



## PROJECT MANUAL & SPECIFICATIONS



# New Construction of NORTHEAST MIDDLE SCHOOL

530 Stevens Street  
Bristol, CT

**State Project No. 017-0088N**

**PHASE I**  
**Volume I of I**

**Construction Documents**  
**April 1, 2024**

QuisenberryArcariMalik



**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201 "The General Conditions of the Contract for Construction", 1997 Edition as amended, and Division 01 General Requirements, are a part of this Section and shall be binding on the Contractor and all Subcontractors who perform this work.

1.2 SUMMARY

- A. This Section includes the following:
1. Project information.
  2. Work covered by Contract Documents.
  3. Phased construction.
  4. Access to site.
  5. Work restrictions.
  6. Specification and drawing conventions.
  7. Miscellaneous provisions.
- B. Related Sections include the following:
1. Division 01 Section "Alternates."
  2. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: New Construction of Northeast Middle School.
1. Project Location: 530 Steven St. Bristol, CT.
- B. Owner: Bristol Board of Education
- C. Architect: The Contract Documents were prepared for Project by Quisenberry Arcari Malik, LLC, Farmington, CT.
- D. Construction Manager: Downes Construction Company / D'Amato Construction Company.
1. Construction Manager for this Project is Project's Constructor. In Divisions 01 through 33 Sections, the terms "Construction Manager" and "Contractor" are synonymous.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

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- A. The Work of Phase I includes, but is not limited to the following:
  - 1. Sitework

#### 1.5 SCHEDULE

- A. The sequence of Work shall be conducted in accordance with the Construction Manager's Construction Schedule.
  - 1. The Construction Schedule is critical to the project. All work is required to be Substantially Complete, with a Certificate of Occupancy obtained, and ready for occupancy by the Owner, on or before the date agreed upon in the CM/Owner Agreement.
  - 2. The final Construction Schedule will be subject to the approval of the Owner, the Architect, and the Construction Manager.
  - 3. The Trade Contractor shall coordinate work with the Construction Manager and other Trade Contractors at the site.

#### 1.6 USE OF PREMISES

- A. Use of Site: Limit use of premises to areas determined by the Construction Manager. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Confine the parking of workmen's and construction vehicles, and the storage of construction materials to a designated staging area determined by the Construction Manager.
  - 2. Owner Occupancy: Allow for Owner occupancy of Project site.
  - 3. Driveways and Entrances: Keep driveways 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 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated.
  - 1. Weekend Hours: Coordinate with Construction Manager.
  - 2. Hours for Utility Shutdowns: Coordinate with Construction Manager.

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- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Construction Manager's written permission.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
  - 1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.
  - 2. Obtain Construction Manager's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted on the property.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

**1.8 SPECIFICATION FORMATS AND CONVENTIONS**

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 48-division format and CSI/CSC's "MasterFormat" numbering system.
  - 1. Section Identification: The Specifications use Section numbers and titles to help crossreferencing 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.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. 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.

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- 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.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
- E. In general, the Specifications will describe the quality of the work and the Drawings, the extent of the work. The Drawings and Specifications are cooperative and supplementary; however, each item of the work is not necessarily mentioned in both the Drawings and the Specifications. All work necessary to complete the project, so described, is to be included in this Contract.
- F. In case of disagreement between the Drawings and Specifications, or within either document itself, the Architect shall interpret the Documents to require the better quality or greater quantity of work for the Owner that can reasonably be construed therefrom. Any work performed by the Contractor without consulting the Architect, when the same requires a decision, shall be performed at the Contractor's risk.
- 1.9 CODES, STANDARDS AND PERMITS
- A. All work under this contract shall conform to all codes and standards in effect as of the date of receipt of Bids which are applicable to this Project. All work shall also conform to specific requirements and interpretations of local authorities having jurisdiction over the Project. These Codes, standards, and authorities are referred to collectively as "the governing codes and authorities" and similar terms throughout the Specifications. Determination of applicable codes and standards and requirements of the authorities having jurisdiction shall be the responsibility of the Contractor; as shall be the analysis of all such codes and standards in regard to their applicability to the Project for the purposes of determining necessary construction to conform to such code requirements, for securing all approvals and permits necessary to proceed with construction, and to obtain all permits necessary for the Owner to occupy the facility for their intended use. In the case of conflicts between the requirements of different codes and standards, the most restrictive or stringent requirements shall be met.
- B. The codes that were used in the design of this Project are as follows:
1. 2022 Connecticut State Building Code (CSBC) including:
    - a. 2021 International Building Code (IBC)
    - b. 2021 International Mechanical Code (IMC)
    - c. 2021 International Plumbing Code (IPC)
    - d. 2021 International Energy Conservation Code (IECC)
    - e. 2020 NFPA 70 National Electrical Code (NEC).
    - f. 2017 ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
  2. 2022 Connecticut Fire Safety Code (CSFSC) including:



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- a. 2020 International Fire Code (IFC), including all referenced standards.
    - b. 2020 NFPA Standard 101 – Life Safety Code.
  3. 2022 Connecticut State Fire Prevention Code.
  4. Current Connecticut Public Health Code.
  5. Current OSHA.
  6. Connecticut General Statutes.
  7. Title II of the Americans with Disabilities Act (ADA) including the 2010 ADA Standards for Accessible Design.
- C. Code Enforcement and Approvals: Secure and pay for the general building permit for the work and conform to all conditions and requirements of the permit and code enforcement authorities.
- D. Identify all permits (other than general building permit) required from authorities having jurisdiction over the Project for the construction and occupancy of the work. Prepare the necessary applications and submit required plans and documents to obtain such permits in a timely manner. Permit fees to be paid by the Subcontractor.
1. Display all permit cards as required by the authorities and deliver legible photocopies of all permits to the Construction Manager and Owner promptly upon their receipt.
  2. Arrange for all inspections, testing and approvals required for all permits. Notify the Owner, Construction Manager and Architect at least three business days in advance, so they may arrange to observe.
  3. Comply with all conditions and provide all notices required by all permits.
  4. Perform and/or arrange for and pay for all testing and inspections required by the governing codes and authorities, other than those provided by the Owner, and notify the Owner, Construction Manager, and Architect of such inspections at least three business days in advance, so they may arrange to observe.
  5. Where inspecting authorities require corrective work in conjunction with applicable codes and authorities, promptly comply with such requirements, except in cases where such requirements clearly exceed the requirements of the Contract Documents, in which case proceed in accordance with the procedures for modifications to the Work established in the Contract Documents.

**1.10 OCCUPATIONAL SAFETY AND HEALTH ACT**

- A. The Contractor and each Subcontractor shall comply with the requirements of the Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, including all standards and regulations which have been promulgated by the Governmental Authorities which administer such Acts. Said requirements, standards and regulations are incorporated herein by reference.
1. In accordance with Connecticut General Statutes Sec. 31-53b, all employees on the Project site must show proof of completing and maintaining the OSHA 10 hour certification requirements in accordance with federal OSHA Training Institute standards.
- B. The Contractor and each Subcontractor shall comply with said regulations, requirements and standards and require and be directly responsible for compliance therewith on the part of his agents, employees material men and Subcontractors; and shall directly receive and be responsible for all citations, assessments, fines or penalties which may be incurred by reason of his agents, employees, material men or Subcontractors failing to so comply.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or added from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates. C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ADD Alternate No. 1: Main Access Road.

END OF SECTION 012300

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SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
  - 1. Division 01 Section "Unit Prices" for administrative requirements for using unit prices.
  - 2. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect, through the Construction Manager, will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions" or similar form prepared by Architect.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect, through the Construction Manager, will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within 10 days after receipt of Proposal Request, submit a quotation to the Architect, estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

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- b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - c. Include costs of labor and supervision directly attributable to the change.
  - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by first submitting a "Request for Information" to the Architect. This request will be responded to by the Architect, wherein the Contractor may submit a Change Order Proposal.
  - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Include costs of labor and supervision directly attributable to the change.
  - 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - 6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

**1.5 ADMINISTRATIVE CHANGE ORDERS**

- A. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.
  - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lowerpriced materials or systems of the same scope and nature as originally indicated.
- B. Unit-Price Adjustment: See Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

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**1.6 CHANGE ORDER PROCEDURES**

- A. On Owner's approval of a Proposal Request, the Architect [Construction Manager] will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or similar form.

**1.7 CONSTRUCTION CHANGE DIRECTIVE**

- A. Construction Change Directive: Architect, through Construction Manager, may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600





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SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
1. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.
  2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  3. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with Continuation Sheets.
    - b. Submittals Schedule.
    - c. Contractor's Construction Schedule.
  2. Submit the Schedule of Values to the Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

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- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section. For major trades with line item values greater than \$25,000, provide a separate line item for units of work within each trade with a value not exceeding \$25,000.
1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of Construction Manager.
    - c. Name of Architect.
    - d. Architect's project number.
    - e. Contractor's name and address.
    - f. Date of submittal.
  2. Submit draft of AIA Document G702 and AIA Document G703 Continuation Sheets.
  3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or Division.
    - b. Description of the Work.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders (numbers) that affect value.
    - g. Dollar value.
      - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
  4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
    - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
    - b. Include the following mandatory line items:
      - 1) Mobilization.
      - 2) Demobilization.
      - 3) Builders Risk Insurance.
      - 4) Bonds.
      - 5) Coordination Drawings.
      - 6) Scheduling.
      - 7) Commissioning.
      - 8) Project record documents.
      - 9) Operation and Maintenance manuals.
      - 10) Field Engineering.

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- 11) Daily Building Cleanup.
  - 12) Safety Program.
  - 13) Full-Time Project Manager.
  - 14) Full-Time Project Superintendent.
  - 15) Field Offices.
  - 16) Dumpsters.
  - 17) Cold Weather Protection.
  - 18) Temporary Heat.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
- a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
- a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

**1.5 APPLICATIONS FOR PAYMENT**

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- 1. Prepare a draft of each Application for Payment and review with the Architect prior to submission of final Application. The draft copy shall be typewritten and include the application number and date.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

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- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
  2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
  2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).

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4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
  5. Products list (preliminary if not final).
  6. Schedule of unit prices.
  7. Submittal schedule (preliminary if not final).
  8. List of Contractor's staff assignments.
  9. List of Contractor's principal consultants.
  10. Copies of building permits.
  11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  12. Initial progress report.
  13. Report of preconstruction conference.
  14. Certificates of insurance and insurance policies.
  15. Performance and payment bonds.
  16. Data needed to acquire Owner's insurance.
  17. OSHA training certificates.
- I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A, "Contractor's Affidavit of Release of Liens." 6. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900



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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. General coordination procedures.
  2. Coordination drawings.
  3. Contractor's use of Architect's REVIT Files.
  4. Requests for Information (RFIs).
  5. Project meetings.
- B. The Contractor and each Subcontractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Subcontractor in each Bid Package.
- C. Related Sections include the following:
1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
  2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services.
  3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.

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- B. Key Personnel Names: Within 10 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Keep list current at all times, resubmit upon update.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: The Construction Manager shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
  4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
  5. No claim for additional compensation or extension of Contract Time will be permitted for conditions resulting from lack of coordination.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Preinstallation conferences.
  6. Progress meetings.
  7. Startup and adjustment of systems.
  8. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.



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1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

**1.6 COORDINATION DRAWINGS**

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

- a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
- b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
- c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- e. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
3. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

- B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

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4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Mechanical and Plumbing Work: Show the following:
    - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Fire-rated enclosures around ductwork.
  6. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other firealarm locations.
    - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
  7. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  8. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
  9. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Division 01 Section "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings (Revit), OR any digital format compatible with submittal format requirement.
  2. File Submittal Format: Submit or post coordination drawing files using 3D Industry Foundation Classes (IFC) format.
  3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    - b. Digital Data Software Program: Drawings are available in Revit 2018.
    - c. Contractor shall execute a data licensing agreement in Agreement form attached at the end of this Section.

**1.7 ADMINISTRATIVE AND SUPERVISORY PERSONNEL**

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

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1.8 REQUESTS FOR INFORMATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI, to the Architect through the Construction Manager, in the form specified.
1. RFIs shall originate with Contractor or Subcontractor. RFIs submitted by entities other than the Construction Manager will be returned with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
1. Project name.
  2. Date.
  3. Name of Subcontractor.
  4. Name of Construction Manager.
  5. Name of Architect.
  6. RFI number, numbered sequentially.
  7. Specification Section number and title and related paragraphs, as appropriate.
  8. Drawing number and detail references, as appropriate.
  9. Field dimensions and conditions, as appropriate.
  10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  11. Contractor's signature.
  12. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs:
1. Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow five working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.

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- f. Requests for interpretation of Architect's actions on submittals.
  - g. Incomplete RFIs or RFIs with numerous errors.
- 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
- 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
- a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within five days if Contractor disagrees with response.
- G. RFI Log: The Construction Manager shall prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log biweekly. Include the following:
  - 1. Project name.
  - 2. Name and address of Construction Manager.
  - 3. Name and address of Architect.
  - 4. RFI number including RFIs that were dropped and not submitted.
  - 5. RFI description.
  - 6. Date the RFI was submitted.
  - 7. Date Architect's response was received.
  - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

## 1.9 PROJECT MEETINGS

- A. General: The Construction Manager will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
  - 1. Attendees: The Construction Manager will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. The Construction Manager will notify Owner and Architect of scheduled meeting dates and times.
  - 2. Agenda: The Construction Manager will prepare the meeting agenda and distribute the agenda to all invited attendees.
  - 3. Minutes: The Construction Manager will record significant discussions and agreements achieved and distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: The Construction Manager will schedule a preconstruction conference before starting construction, at a time convenient to Owner, Construction Manager, and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

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1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Preparation of Record Documents.
    - l. Use of the premises.
    - m. Work restrictions.
    - n. Owner's occupancy requirements.
    - o. Responsibility for temporary facilities and controls.
    - p. Parking availability.
    - q. Office, work, and storage areas.
    - r. Equipment deliveries and priorities.
    - s. First aid.
    - t. Security.
    - u. Progress cleaning.
    - v. Working hours.
  3. Minutes: The Construction Manager will record and distribute meeting minutes.
- C. Preinstallation Conferences: The Construction Manager will conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. The Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility problems.

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- k. Time schedules.
  - l. Weather limitations.
  - m. Manufacturer's written recommendations.
  - n. Warranty requirements.
  - o. Compatibility of materials.
  - p. Acceptability of substrates.
  - q. Temporary facilities and controls.
  - r. Space and access limitations.
  - s. Regulations of authorities having jurisdiction.
  - t. Testing and inspecting requirements.
  - u. Installation procedures.
  - v. Coordination with other work.
  - w. Required performance results.
  - x. Protection of adjacent work.
  - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: The Construction Manager will distribute minutes of the meeting to each party present and to parties who should have been present.
  - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Attend progress meetings at interval determined by the Construction Manager. Dates of meetings may coincide with preparation of payment requests.
- 1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Deliveries.
      - 4) Access.
      - 5) Site utilization.

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- 6) Temporary facilities and controls.
  - 7) Work hours.
  - 8) Hazards and risks.
  - 9) Progress cleaning.
  - 10) Quality and work standards.
  - 11) Status of correction of deficient items.
  - 12) Field observations.
  - 13) RFIs.
  - 14) Status of proposal requests.
  - 15) Pending changes.
  - 16) Status of Change Orders.
  - 17) Pending claims and disputes.
  - 18) Documentation of information for payment requests.
3. Minutes: The Construction Manager will record and distribute the meeting minutes.
  4. Reporting: The Construction Manager will distribute minutes of the meeting to each party present and to parties who should have been present.
    - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Coordination Meetings: Attend Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes.
1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Deliveries.
      - 4) Access.
      - 5) Site utilization.
      - 6) Temporary facilities and controls.

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- 7) Work hours.
- 8) Hazards and risks.
- 9) Progress cleaning.
- 10) Quality and work standards.
  
- 11) Change Orders.

- 3. Reporting: The Construction Manager will record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100



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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Preliminary Construction Schedule.
  2. Contractor's Construction Schedule.
  3. Daily construction reports.
  4. Material location reports.
  5. Field condition reports.
  6. Special reports.
- B. Related Sections include the following:
1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
  2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
  3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
  4. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
  2. Predecessor Activity: An activity that precedes another activity in the network.
  3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

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- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float. D. Event: The starting or ending point of an activity.
  - E. Float: The measure of leeway in starting and completing an activity.
    - 1. Float time belongs to Owner.
    - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
    - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
  - F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
  - G. Major Area: A story of construction, a separate building, or a similar significant construction element.
  - H. Milestone: A key or critical point in time for reference or measurement.
  - I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
  - J. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. PDF electronic file.
  - 2. Two paper copies.
- B. Qualification Data: For scheduling consultant.
- C. Preliminary Network Diagram: Submit two opaque copies, large enough to show entire network for entire construction period. Show logic ties for activities.
  - 1. Include project calendar.
- D. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
  - 1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.
- E. CPM Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number,

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activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

- F. Daily Construction Reports: Submit two copies at weekly intervals, to the Construction Manager.
- G. Material Location Reports: Submit two copies at monthly intervals, to the Construction Manager.
- H. Field Condition Reports: Submit two copies at time of discovery of differing conditions, to the Architect, through the Construction Manager.
- I. Special Reports: Submit two copies at time of unusual event, to the Architect.

#### 1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: The Construction Manager shall conduct a conference at Project site with Architect to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:
1. Review software limitations and content and format for reports. Provide sample of CPM schedule format.
  2. Verify availability of qualified personnel needed to develop and update schedule.
  3. Discuss constraints, including phasing, work stages, and interim milestones.
  4. Review delivery dates for Owner-furnished products.
  5. Review schedule for work of Owner's separate contracts.
  6. Review time required for review of submittals and resubmittals.
  7. Review requirements for tests and inspections by independent testing and inspecting agencies.
  8. Review time required for completion and startup procedures.
  9. Review and finalize list of construction activities to be included in schedule.
  10. Review submittal requirements and procedures.
  11. Review procedures for updating schedule.
  12. Establish mandatory milestone dates and finish dates within each phase.
- C. Review and approval of the Contractor's Construction Schedule is advisory only and does not relieve the Contractor of the responsibility for completing the work within the Contract time.

#### 1.6 COORDINATION

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- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
  - B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
    - 1. Secure time commitments for performing critical elements of the Work from parties involved.
    - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.
  - C. Calendar: Compile a project calendar for use in scheduling. Incorporate all limitations on working days and working hours, including the following:
    - 1. Legal Holidays.
    - 2. Other Holidays observed by the Owner.
    - 3. Other non-working days determined by the Contractor.
    - 4. Optional working days determined by the Contractor.

## **PART 2 - PRODUCTS**

### **2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL**

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 10 days, unless specifically allowed by Architect.
  - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
  - 4. Startup and Testing Time: Include not less than one day for startup and testing.
  - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

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1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Work Restrictions: Show the effect of the following items on the schedule:
  - a. Coordination with existing construction.
  - b. Limitations of continued occupancies.
  - c. Uninterruptible services.
  - d. Partial occupancy before Substantial Completion.
  - e. Use of premises restrictions.
  - f. Provisions for future construction.
  - g. Seasonal variations.
  - h. Environmental control.
6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
  - a. Subcontract awards.
  - b. Submittals.
  - c. Purchases.
  - d. Mockups.
  - e. Fabrication.
  - f. Sample testing.
  - g. Deliveries.
  - h. Installation.
  - i. Tests and inspections.
  - j. Adjusting.
  - k. Curing.
  - l. Startup and placement into final use and operation.
7. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
  - a. Structural completion.
  - b. Permanent space enclosure.
  - c. Completion of mechanical installation.
  - d. Completion of electrical installation.
  - e. Substantial Completion.
8. Other Constraints: Include the following specific activities in each trade in each phase.
  - a. Interface between Contractor and Subcontractor.
  - b. Electrical connections to each piece of equipment.
  - c. Mechanical connections to each piece of equipment.
  - d. Concrete finishing.

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- e. Site work constraints on other activities.
  - D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
  - E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.
  - F. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.
- 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)
- A. General: Prepare network diagrams using AON (activity-on-node) format.
  - B. Preliminary Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
  - C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, timescaled CPM network analysis diagram for the Work.
    - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for commencement of the Work.
      - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
    - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
    - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
    - 4. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.
  - D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
    - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      - a. Preparation and processing of submittals.
      - b. Mobilization and demobilization.
      - c. Purchase of materials.
      - d. Delivery.

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- e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing and commissioning.
  - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
  - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
- 1. Contractor or subcontractor and the Work or activity.
  - 2. Description of activity.
  - 3. Principal events of activity.
  - 4. Immediate preceding and succeeding activities.
  - 5. Early and late start dates.
  - 6. Early and late finish dates.
  - 7. Activity duration in workdays.
  - 8. Total float or slack time.
  - 9. Average size of workforce.
  - 10. Dollar value of activity (coordinated with the Schedule of Values).
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
- 1. Identification of activities that have changed.
  - 2. Changes in early and late start dates.
  - 3. Changes in early and late finish dates.
  - 4. Changes in activity durations in workdays.
  - 5. Changes in the critical path.
  - 6. Changes in total float time.
  - 7. Changes in the Contract Time.
- G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
- 1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
  - 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
  - 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.

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4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
    - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

## 2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions.
  7. Accidents.
  8. Meetings and significant decisions.
  9. Unusual events (refer to special reports).
  10. Stoppages, delays, shortages, and losses.
  11. Meter readings and similar recordings.
  12. Emergency procedures.
  13. Orders and requests of authorities having jurisdiction.
  14. Change Orders received and implemented.
  15. Construction Change Directives received and implemented.
  16. Services connected and disconnected.
  17. Equipment or system tests and startups.
  18. Partial Completions and occupancies.
  19. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## 2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain



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of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

**PART 3 - EXECUTION**

**3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before submission of Application for Payment.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate Actual Completion percentage for each activity.
  4. Evaluate progress of the work jointly with the Owner at the end of each week to show progress and identify conflicts.
- B. Distribution: Distribute two copies each of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200



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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals. B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes, for submitting Coordination Drawings and for use of Architect's REVIT files.
3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule.
4. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
5. Division 01 Section "Closeout Procedures" for submitting warranties.
6. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
8. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
9. Divisions 02 through 33 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's and Construction Manager's responsive action.
- B. Informational Submittals: Written information that does not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

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- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

#### 1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
  2. Initial Submittal: Submit concurrently with preliminary network diagram. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.
  4. Update the submittals schedule periodically as the work progresses. Submit concurrently with each Application for payment.
  5. Utilize a computerized program for tracking submittals. Submit the following reports biweekly:
    - a. Complete list of reviewed submittals.
    - b. Listing of submittals to date.
    - c. Listing of approved submittals.
    - d. Listing of rejected submittals.
    - e. Listing of submittals returned for correction.
    - f. List of outstanding submittals.
  6. At the request of the Architect provide reports capable of being sorted by the following criteria:
    - a. Approved status.
    - b. Subcontractor/Supplier.
    - c. Submission date.
    - d. Number of days late for return.
    - e. Number of days under review.

#### 1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
  2. Date.
  3. Name of Architect.
  4. Name of Construction Manager.

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5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked "Approved" or "Approved as Corrected."
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.
- G. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

**1.6 SUBMITTAL PROCEDURES**

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

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- a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
  - b. Digital Drawing Software Program: The Contract Drawings are available in Revit.
  - c. Contractor shall execute a data licensing agreement in an Agreement form attached at the end of Division 01 Section "Project Management and Coordination."
- B. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  - 1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
  - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  - 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. Initial Review: Allow two weeks for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Subcontractor when a submittal being processed must be delayed for coordination.
  - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  - 3. Resubmittal Review: Allow two weeks for review of each resubmittal.

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- a. Resubmittals will be reviewed no more than two times at the Owner's expense. Resubmittals which fail to comply with Contract requirements will be reviewed at the Contractor's expense.
    - b. The Owner reserves the right to deduct said reimbursement from the Contractor's application for payment on a monthly basis.
  - 4. Concurrent Consultant Review: Submittals may be transmitted simultaneously to Architect and to Architect's consultants, as required. Allow two weeks for review of each submittal. Consultant will return submittal to Architect before being returned to Contractor.
  - E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
    - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
    - 2. Name file with submittal number or other unique identifier, including revision identifier.
      - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., BMS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., BMS-061000.01.A).
    - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
    - 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Architect, containing the following information:
      - a. Project name.
      - b. Date.
      - c. Name and address of Architect.
      - d. Name of Construction Manager.
      - e. Name of Contractor.
      - f. Name of firm or entity that prepared submittal.
      - g. Names of subcontractor, manufacturer, and supplier.
      - h. Category and type of submittal.
      - i. Submittal purpose and description.
      - j. Specification Section number and title.
      - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
      - l. Drawing number and detail references, as appropriate.
      - m. Location(s) where product is to be installed, as appropriate.
      - n. Related physical samples submitted directly.
      - o. Indication of full or partial submittal.
      - p. Transmittal number, numbered consecutively.
      - q. Submittal and transmittal distribution record.
      - r. Other necessary identification.
      - s. Remarks.
    - 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

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- a. Project name.
- b. Number and title of appropriate Specification Section.
- c. Manufacturer name.
- d. Product name.

**1.7 SUBMITTAL REQUIREMENTS**

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
  - a. Manufacturer's written recommendations.
  - b. Manufacturer's product specifications.
  - c. Manufacturer's installation instructions.
  - d. Standard color charts.
  - e. Manufacturer's catalog cuts.
  - f. Wiring diagrams showing factory-installed wiring.
  - g. Printed performance curves.
  - h. Operational range diagrams.
  - i. Mill reports.
  - j. Standard product operation and maintenance manuals.
  - k. Compliance with specified referenced standards.
  - l. Testing by recognized testing agency.
  - m. Application of testing agency labels and seals.
  - n. Notation of coordination requirements.
4. For equipment, include the following in addition to the above, as applicable:
  - a. Wiring diagrams showing factory-installed wiring.
  - b. Printed performance curves.
  - c. Operational range diagrams.
  - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, **unless submittal based on Architect's digital data drawing files is otherwise permitted.**

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
  - a. Dimensions.
  - b. Identification of products.
  - c. Fabrication and installation drawings.



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- d. Roughing-in and setting diagrams.
  - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
  - f. Shopwork manufacturing instructions.
  - g. Templates and patterns.
  - h. Schedules.
  - i. Design calculations.
  - j. Compliance with specified standards.
  - k. Notation of coordination requirements.
  - l. Notation of dimensions established by field measurement.
  - m. Relationship to adjoining construction clearly indicated.
  - n. Seal and signature of professional engineer if specified.
  - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  - 2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of appropriate Specification Section.
  - 3. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
  - 4. Disposition: Maintain sets of approved Samples at Project site, available for qualitycontrol comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  - 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

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6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
- a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
- 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
  - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
  2. Number and name of room or space.
  3. Location within room or space.
  4. Number of Copies: Submit five copies of product schedule or list, unless otherwise indicated. Architect, through Construction Manager, will return four copies.
- a. Mark up and retain one returned copy as a Project Record Document.
- E. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.
- F. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- G. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
  4. Number of Copies: Submit five copies of subcontractor list, unless otherwise indicated. Architect, through Construction Manager, will return four copies.

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- a. Mark up and retain one returned copy as a Project Record Document.
- I. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- J. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- K. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- L. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- M. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- N. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- O. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- P. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- Q. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- R. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- S. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- T. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- U. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- V. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

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- W. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
  2. Date of evaluation.
  3. Time period when report is in effect.
  4. Product and manufacturers' names.
  5. Description of product.
  6. Test procedures and results.
  7. Limitations of use.
- X. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- Y. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- Z. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- AA. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- BB. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
  2. Required substrate tolerances.
  3. Sequence of installation or erection.
  4. Required installation tolerances.
  5. Required adjustments.
  6. Recommendations for cleaning and protection.
- CC. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.

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- 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  - 6. Statement whether conditions, products, and installation will affect warranty.
  - 7. Other required items indicated in individual Specification Sections.
- DD. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- EE. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
- 1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

**1.8 DELEGATED DESIGN**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
- 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit five copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
- 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

**1.9 CONTRACTOR'S REVIEW**

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

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1.10 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

- A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
  - 1. "No Exceptions Taken": The portion of Work covered by the submittal may proceed provided it complies with the Contract Documents.
  - 2. "Make Corrections Noted": The portion of Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal, and with the Contract Documents.
  - 3. "Revise and Resubmit" or "Submit Specified Item": Revise or prepare a new submittal in accordance with notations; resubmit. Do not proceed with that portion of the Work covered by the submittal.
- C. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Construction Manager will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
  - 1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
  - 2. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
  - 3. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

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- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
  2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### 1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.



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- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
  2. Description of test and inspection.
  3. Identification of applicable standards.
  4. Identification of test and inspection methods.
  5. Number of tests and inspections required.
  6. Time schedule or time span for tests and inspections.
  7. Entity responsible for performing tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality-control service.
- D. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspectng.
- E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee

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payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

**1.6 QUALITY ASSURANCE**

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Connecticut and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

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1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Construction Manager.
  2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed by the Construction Manager, unless otherwise indicated.
- K. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated in individual specification sections. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
- L. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups as indicated.
- M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 48.

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1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Payment for these services will be made by the Owner.
  3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

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4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
1. Distribution: Distribute schedule to Owner, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## 1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency and special inspector to conduct special tests and inspections required by the Connecticut State Building Code and by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

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5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
  1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
  2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied

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directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
- D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the organizations responsible for the standards and regulations.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200



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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Sections include the following:
  - 1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
  - 2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
  - 3. Division 01 Section "Execution" for progress cleaning requirements.
  - 4. Division 01 Section "Indoor Air Quality Requirements."
  - 5. Divisions 02 through 33 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

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- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.5 QUALITY ASSURANCE

- A. 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.
- C. Accessible Temporary Egress: Comply with applicable provisions in the 2010 ADA Standards and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. 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.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- C. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

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- 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

### **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 by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. 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: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
  - 1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed

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installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

- F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for demolition operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line and one facsimile line for field office.
  - 1. Provide additional telephone lines for the following:
    - a. Provide a dedicated telephone line for each facsimile machine.
    - b. Provide one telephone line(s) for common use.
  - 2. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Architect's office.
    - e. Engineers' offices.
    - f. Owner's office.
    - g. Principal subcontractors' field and home offices.
  - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
  - 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

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- D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
- Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification sign as indicated in sketch included at the end of this Section.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
- a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.
- F. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- G. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly.
1. Comply with Division 01 Section "Execution" for progress cleaning requirements.
2. Provide sufficient quantity of dumpsters at strategic locations within the Contract limit lines for collection of waste from the work of all Subcontractors.
3. Do not pass materials through open windows, or through window openings when any portion of the window remains in the opening.
- H. Temporary Elevator Use: Use of elevators is not permitted.
- I. Temporary Lifts and Hoists: The Contractor shall provide, operate and maintain in safe operating order facilities for hoisting materials, rubbish, employees and to otherwise carry out the Work. Truck cranes, fork lifts, man lifts and similar devices required for the performance of the Work by each Subcontractor shall be provided by the Subcontractor.
1. Provide temporary lifts and hoists that comply in all respects with the most stringent of all applicable Federal (including OSHA), state and local laws, rules, regulations, codes and ordinances, and provisions of Division 01 of this Specification.
2. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Staging and Scaffolding: Where staging and scaffolding is required, the Contractor shall provide the entire installation.

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1. Staging shall be of approved design, erected and removed by experienced stage builders and shall have all accident prevention devices required by State and local laws.

- K. Existing Stair Usage: Use of Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained.

Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. 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.
  1. Comply with work restrictions specified in Division 01 Section "Summary."
- C. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 31 Section "Site Clearing."
- D. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
  1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
  2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.
- G. 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.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

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- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Temporary Enclosures: The Construction Manager shall provide all temporary enclosures for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.

Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Provide enclosures as required on the exterior or interior side of the building, whether the roof has been installed or not, and whether windows or doors have been installed or not, in order to protect the Work and allow Work to continue in accordance with the requirements of the Specifications. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

- a. Erect and maintain temporary enclosures and temporary heat during the months of November through March.
2. Install tarpaulins securely, with fire-retardant-treated wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
  3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
  4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire-retardant treated material for framing and main sheathing.
  5. Do not use new permanent doors and frames for temporary enclosures until finishing work is begun, and then only if carefully protected from damage. Prior to installation of permanent doors and frames, provide temporary wood or plywood doors with wood frames and proper hardware to make the doors self-closing.
- a. Close and lock all openings accessible from ground level at end of each day=s work to prevent entry of unauthorized persons.
- K. Protection: Protect the Work at all times from damages. Provide all pumps, equipment and enclosures to ensure this protection.
1. Remove all snow and ice as may be required for proper protection and prosecution of the work.
  2. Provide all shoring, bracing and sheeting as required for safety and for proper execution of work.
  3. Protect all work from damage during cold weather. If low temperatures make it impossible to continue operations safely in spite of cold weather precautions, cease work and notify Architect. Repair and/or replacement of all work damaged from frost, freezing or any elements of the weather are the responsibility of the Contractor responsible for temporary protection of the Work.
  4. Should high wind warnings be issued by the U.S. Weather Advisory Bureau, take every precaution to minimize danger to persons, to the Work, and to adjacent properties, including, but not limited to, removing all loose materials, tools and/or equipment from exposed locations, and removing or securing scaffolding or other temporary work.
  5. Protect the building and the site from damage, loss or liability due to theft or vandalism when the work is not in progress at night, weekends, or holidays.

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6. Exercise precaution for the protection of persons and property at all times. Observe the provisions of applicable laws and construction codes. Take additional safety and health measures, or cause such measures to be taken as reasonably necessary. Maintain guards on machinery, equipment and other hazards as set forth in the safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, to the extent that such provisions are not in contravention of applicable laws.
  7. Protect and preserve in operating conditions all utilities traversing the work area. Repair all damages to any utility due to work performed under this Contract, the satisfaction of the Architect at no additional cost to the Owner.
  8. Protect all existing and new finished surfaces against damage from work under this Contract. Restore or replace finishes that are damaged to their original condition, subject to approval by the Architect, and at no additional cost to the Owner.
- L. Roof Protection: The Contractor shall protect all existing roof surfaces to prevent damage from selective demolition and new construction operations. Keep traffic on roof systems to a minimum, and permit traffic only as required to complete the work under this Contract.
1. Repair or replace roofing system components and substrates to their original condition where damaged by operations under this Contract. Comply with Specifications and/or roofing manufacturer's written recommendations for maintaining new and existing roofing warranties, subject to approval by the Architect, and at no additional cost to the Owner.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Prohibit smoking in construction areas.
  2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses. B. Maintenance: Maintain facilities in good operating condition until removal.
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.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. 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



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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 property of Contractor.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

**3.6 PROJECT SIGN**

- A. Provide Project identification sign as indicated in sketch following this Section; one page.

END OF SECTION 015000



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SECTION 015639 – TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SECTION INCLUDES

- A. General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.3 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: For limits placed on Contractor's use of the site.
- B. Section 01 5000 - Temporary Facilities and Controls: For other temporary site fencing.
- C. Section 31 1000 - Site Clearing: For removing existing trees and shrubs.
- D. Section 31 2200 - Grading: Preparation of subsoil that may affect existing plants.

1.4 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site.
  - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
    - a) Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
    - b) Arborist's responsibilities.

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- c) Quality-control program.
- d) Coordination of Work and equipment movement with the locations of protection zones.
- e) Trenching by hand or with air spade within protection zones.
- f) Field quality control.

**1.6 SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
  - 2. Detail fabrication and assembly of protection-zone fencing and signage.
  - 3. Indicate extent of trenching by hand or with air spade within protection zones.
- C. Samples: For each type of the following:
  - 1. Organic Mulch: 1-pint (0.5-L) volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
  - 2. Protection-Zone Fencing: Assembled samples of manufacturer's standard size made from full-size components.
  - 3. Protection-Zone Signage: Full-size samples of each size and text, ready for installation.
- D. Qualification Data: For arborist and tree service firm.
- E. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- F. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- G. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
  - 1. Use sufficiently detailed photographs or video recordings.
  - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- H. Quality-control program.

**1.7 QUALITY ASSURANCE**

- A. Arborist Qualifications: Licensed arborist in jurisdiction where project is located.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this project and that will assign an experienced, qualified arborist to project site during execution of the Work.
- C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work

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without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

- D. Root Pruning Operations: All root pruning operations shall be performed by the Contract Arborist and directed in the field by and ISA Certified Arborist with documented experience in similar SSAT excavation and root pruning.

## 1.8 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
  2. Moving or parking vehicles or equipment.
  3. Foot traffic.
  4. Erection of sheds or structures.
  5. Impoundment of water.
  6. Excavation or other digging unless otherwise indicated.
  7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
1. Type: Wood and bark chips.
  2. Size Range: 3 inches (76 mm) maximum, 1/2-inch (13-mm) minimum.
- B. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements: Previously used materials may be used when approved by Landscape Architect.
1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches (2400 mm) apart.
    - a) Height: 48 inches (1200 mm).
    - b) Color: High-visibility orange, nonfading.
- C. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

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1. Size and Text: 12 inch by 18-inch sign reading “NO ENTRY - TREE PROTECTION ZONE”.
2. Lettering: 3-inch (75-mm) high minimum, black characters on white background.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. All existing trees to remain to be evaluated by a licensed arborist for tree protection, pruning or removal, if necessary, for safety reasons.
- C. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

#### **3.2 PREPARATION**

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches (1372 mm) above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
  1. Apply 4-inch (100-mm) uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches (150 mm) of tree trunks.

#### **3.3 PROTECTION ZONES**

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
  1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Landscape Architect.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Landscape Architect. Install one sign spaced approximately every 50 feet (15 m) on protection-zone fencing, but no fewer than two signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.

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- D. Maintain protection-zone fencing and signage in good condition as acceptable to Landscape Architect and remove when construction operations are complete, and equipment has been removed from the site.
  - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
  - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

### 3.4 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
  - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
  - 2. Cut Ends: Do not paint cut root ends.
  - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
  - 4. Cover exposed roots with burlap and water regularly.
  - 5. Backfill as soon as possible according to requirements in Section 31 2310 ~~31-2323~~.
- B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches (300 mm) outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Site Inspection: Arborist shall probe subsurface soil moisture condition more than 72 hours in advance of start of work. Using a tile probe or similar method, probe subsurface to a 2-to-3-foot depth to determine if sufficient soil moisture exists. If sufficient moisture is not found, immediate coordination with the Construction Manager shall be made to irrigate the proposed work areas. Methodology may be soaker hose, sprinklers, soaker cans with small, drilled holes to release water slowly or other methods. A second follow-up inspection shall be made to determine final sufficiency to begin.
- D. Root Pruning at Utility Trenches: The Contractor shall reveal the structural roots on the side of the trees affected by trenching using compressed air or hand digging. The Contractor shall operate a diamond blade vibratory knife, vibratory plow or rock saw within 2 feet of the proposed trench line to cleanly cut any large structural roots without tearing the root bark. Hand work may be required in some locations. Unless otherwise instructed by the Engineer, root pruning shall be performed to a depth of 2.5 feet only in the vicinity of existing trees. Root pruning shall occur prior to protective fencing and clearing and grubbing.

### 3.5 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

### 3.6 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.
  - 1. Submit details of proposed pruning and repairs.

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2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
  3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 6 inches (150 mm) or smaller in caliper size.
  2. Large Trees: Provide two new tree(s) of 6-inch (150-mm) caliper size for each tree being replaced that measures more than 6 inches (150 mm) in caliper size.
    - a) Species: As selected by Landscape Architect.
  3. Plant and maintain new trees as specified in Section 32 9300.
- C. Soil Aeration: Where directed by Landscape Architect, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch (50-mm) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

**3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639



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SECTION 015713 – TEMPORARY EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

A. Section Includes:

1. Installation of temporary erosion and sedimentation control measures
2. Maintenance of temporary erosion and sedimentation control measures.
3. Monitoring of site condition and installation of supplemental temporary erosion and sedimentation control measures.
4. Sediment removal and disposal
5. Temporary seeding or other surface stabilization measures.
6. Removal of temporary erosion and sedimentation control measures.
7. Monitoring, documentation, and recordkeeping.
8. Installation of permanent erosion control materials.
9. Final cleanup.

- B. Erosion and sediment control techniques include, but are in no way limited to, silt fence, hay bales, drainage structure inserts/filters, mulching with hay/straw, netting/matting, grassing, stone dikes/berms/check-dams, compost blankets and berms, barriers, diversions, traps, basins, and appurtenances which will ensure that erosion and sediment pollution will be either eliminated or maintained within acceptable limits.

- C. The measures specified herein are the minimum requirements which Contractor shall comply to control erosion and siltation throughout execution of the work. Contractor shall provide additional work if necessary to control erosion and siltation throughout the duration of the construction as conditions dictate, or as directed by Engineer.

- D. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

- E. Contractor is responsible for all health and safety.

1.3 SUBMITTALS

- A. Submit material specifications and shop drawings for all materials furnished under this Section.

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- B. Prior to the start of the construction, submit schedule for the construction of required stormwater detention basins, temporary and permanent erosion and sedimentation control measures, clearing and grubbing, grading, structures at watercourses, construction, and paving.
- C. During construction, submit to Engineer schedule changes that affect timing of construction.
- D. Submit copies of all inspection and maintenance report forms.

#### 1.4 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Regulations of Connecticut State Agencies (RCSA)
  - 1. 22a-315-10 through 19, Soil and Water Conservation
- C. Connecticut Department of Energy and Environmental Protection (DEEP)
  - 1. Connecticut Guidelines for Soil Erosion and Sediment Control, DEEP Bulletin 34, State of Connecticut Council on Soil and Water Conservation, 2002.
- D. State of Connecticut Department of Transportation (ConnDOT)
  - 1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

#### 1.5 PERMIT CONDITIONS

- A. Contractor and Subcontractors are bound to comply with any project-related permits obtained by Owner or Engineer for the work of the project. Such permits will affect performance of the work, and Contractor and Subcontractors are bound to comply with requirements of such permit and representations contained in permit application as though Contractor and Subcontractor were the Permittee/permit-holder. Requirements and conditions set forth in Owner or Engineer-obtained project-related permits and permit applications shall be binding on Contractor just as any Specification would be.

#### 1.6 QUALITY CONTROL

- A. Contractor shall be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the erosion of soil or movement of sediment from construction activities to off-site areas via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at the expense of Contractor.
- B. Where additional erosion and sedimentation control measures are required beyond what is indicated on the Drawings or herein, comply with applicable sections of the Connecticut Guidelines for Soil Erosion and Sediment Control, DEEP Bulletin 34, State of Connecticut Council on Soil and Water Conservation, 2002.

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- C. If applicable, comply with applicable provisions of the Connecticut Department of Energy and Environmental Protection (DEEP) General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, (DEEP-WPED-GP-015), latest revision thereof. Conditions of such General Permit, other conditions of approval or authorizations, and associated Stormwater Pollution Control Plan (SWPCP) shall become part of the Contract Documents.
- D. Engineer has the authority to order immediate, additional, temporary control measures to prevent contamination of adjacent streams or other watercourses, or other areas of water impoundment and damage by erosion.
- E. If Engineer observes construction procedures and operations that jeopardize erosion control provisions, Engineer will notify Contractor. If such construction procedures and operations are not corrected promptly, Engineer may suspend the performance of any or all construction until corrections have been made, and such suspension shall not be the basis of any claim by Contractor for additional compensation, nor for an extension of time to complete the Work.
- F. Should construction materials be washed away or otherwise rendered ineffective in the opinion of Engineer during the progression of the Work, Contractor shall replace the installations at no additional cost to the Owner.

**1.7 COORDINATION WITH PERMANENT EROSION CONTROL PROVISIONS**

- A. Coordinate temporary erosion and sedimentation control measures with permanent erosion control features to the extent practical to ensure economical, effective and continuous erosion control throughout construction and post-construction periods.

**PART 2 PRODUCTS**

**2.1 HAY BALES**

- A. Hay bales shall be made of cut hay with forty (40) pounds minimum weight and 120 pounds maximum weight. Bales shall be free of rotten or degraded hay, significant splits or voids. Hay bales shall be held together with a minimum of two bands made of either wire or heavy twine.
- B. Stakes to anchor the bales shall be a minimum of 36 inches long and made of hardwood with a minimum dimension of 1½-inch by 1½-inch normal size. Metal stakes may be used instead of wooden stakes. Metal stakes shall be round, "U," "T," "L," or "C" shaped with a minimum weight of 0.5 pounds per foot.
- C. Replace individual hay bales upon loss of 30% of original mass or volume, whichever is less.

**2.2 SILT FENCE**

- A. Woven Polypropylene geotextile having a minimum weight of 3.1 ounces per square yard conforming to the following:

**1. Mechanical and Physical Properties of Silt Fence Geotextile**

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Weight	ASTM D 3776	oz/yd <sup>2</sup>	5.6
Grab Tensile Strength	ASTM D 4632	Pounds	60

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Grab Elongation (Max percent)	ASTM D 4632	Percent (%)	15–30
Trapezoidal Tear	ASTM D 4533	Pounds	30
Puncture	ASTM D 4833	Pounds	30
Mullen Burst	ASTM D 3786	psi	150–200
Permittivity	ASTM D 4491	Sec <sup>-1</sup>	0.15
Flow Rate	ASTM D 4491	gal/min/ft <sup>2</sup>	15–20
Apparent Opening Size	ASTM D 4751	(U.S. Sieve)	30–35
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70

- B. Silt fence shall be constructed of a minimum thirty-six (36) inch wide continuous woven geotextile. The material shall have a high sediment filtration capacity, high slurry flow and minimum clogging characteristics. Edges of the fabric shall be finished to prevent the outer fibers from pulling away from the geotextile. Geotextile shall be free of defects or flaws that significantly affect its physical and/or filtering properties.
- C. Fabric shall be securely fastened to stakes a minimum of 42 inches long and made of hardwood with a minimum dimension of 1½ inch by 1½ inch normal size such that a 6 to 8 inch length of fabric is unattached at the bottom for anchorage in soil. Metal stakes may be used instead of wooden stakes. Metal stakes shall be round, “U,” “T,” “L,” or “C” shaped with a minimum weight of 0.5 pounds per foot. Stakes shall be spaced not greater than ten feet apart. When required, wire or another type of support shall be constructed between the geotextile fabric and the posts to improve the load carrying capacity of the silt fence.

## 2.3 CATCH BASIN INSERT

- A. Manufactured “bag type” catch basin insert of woven polypropylene geotextile with integral lifting loops or straps conforming to the following:

### 1. Mechanical and Physical Properties of Catch Basin Insert

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength	ASTM D 4632	Pounds	315
Grab Elongation (Max percent)	ASTM D 4632	Percent (%)	30
Trapezoidal Tear	ASTM D 4533	Pounds	40x50 (min)
Puncture	ASTM D 4833	Pounds	135 (min)
Mullen Burst	ASTM D 3786	psi	420 (min)
Permittivity	ASTM D 4491	gal/min/sq ft	0.7
Flow Rate	ASTM D 4491	gal/min/ft <sup>2</sup>	50-200
Apparent Opening Size	ASTM D 4751	(U.S. Sieve)	20-40
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	80 (min)

Note: Catch basin inserts for catch basins with curb openings shall be equipped with integral curb deflector.

## 2.4 STRAW MULCH

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- A. Straw mulch shall be comprised of threshold straw of oats, wheat, barely, or rye that is free from noxious weeds, mold or other objectionable material. Straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment. Straw mulch shall be utilized on all newly graded areas with slopes exceeding 5% to protect areas against washouts and erosion unless other erosion control measures are provided.

**2.5 FILTER BERM COMPOST**

- A. Where establishing vegetation is not planned, compost shall be a decomposed, weed free organic matter source derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. Compost shall possess a moisture content of 30 to 60% and a organic matter content of 25 to 100%. The maximum particle length shall be 6", and 100% passing a 3", 90 to 100% passing a 1", 70% to 100% passing a 3/4", and 30% to 75% passing a 1/4" screen. However, no more than 50% passing a 1/4" screen in high rainfall/flow rate situations.
- B. Where establishing vegetation is planned, compost shall be use a well decomposed, stable, weed free organic matter source derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. Compost shall possess a moisture content of 30 to 60%, a pH of 6.0 to 8.5 and an organic matter content of 25 to 65%. The maximum particle length shall be 6", and 100% passing a 3", 90 to 100% passing a 1", 70% to 100% passing a 3/4", and 30% to 75% passing a 1/4" screen. However, no more than 60% passing a 1/4" in high rainfall/flow rate situations. It shall contain no substances toxic to plants, shall possess no objectionable odors, and shall not resemble the raw material from which it was derived.

**2.6 COMPOST SOIL BLANKET**

- A. Compost soil blankets may be utilized on slopes of up to 2:1.
- B. Slightly scarify slopes and remove large clods, rocks, stumps, roots larger than 2 inches in diameter and debris on slopes, where vegetation is to be established. This soil preparation step may be eliminated where approved by the Landscape Architect/Designer, or where seeding or planting isn't planned. Track (compact) slope using a bulldozer before applying compost.
- C. Apply compost at the following rates:

Compost Application Rates

Annual Rainfall/Flow Rate	Total Precipitation & Rainfall Erosivity Index	Application Rate for Slopes to be Vegetated (Note 1)	Application Rate for Slopes not being Unvegetated
Low	1"-25" & 20-90	1/2"-3/4"	1"-1 1/2"
Average	26"-50" & 91-200	3/4"-1"	1 1/2"-2"
High	51" and above, & 201 and above	1"-2"	2"-4"

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- D. Lower application rates indicated for slopes to be vegetated should only be used in conjunction with seeding, and for compost blankets applied during the prescribed planting season for the particular region.
- E. Compost shall be uniformly applied using an approved spreader unit, including bulldozers, side discharge manure spreaders, etc. Track (compact) the compost layer using a bulldozer or other appropriate equipment. (This step may be eliminated where impractical or where deemed unnecessary by the Landscape Architect/Designer.) Alternatively, apply compost using a pneumatic (blower) unit, or other unit that propels the product directly at the soil surface, thereby preventing water from moving between the soil-compost interface. Thorough watering may be used to improve settling of the compost. Apply compost layer approximately 3 feet (90 cm) over the top of the slope, or overlap it into existing vegetation.
- F. On highly unstable soils, use compost in conjunction with appropriate structural measures.
- G. Dry or hydraulic seeding may be completed following compost application, as required, or during the compost application itself, where a pneumatic unit is used to apply the compost.

## 2.7 STONE CHECK DAM

- A. Stone shall be graded as follows:

Gradation of Stone for Check Dam (ConnDOT M.01.01 Grading No. 3)

Sieve	Percent Passing by Weight
2 1/2"	100
2"	90–100
1 1/2"	35–70
1	0–15
1/2"	0–5

Stone shall be sound, tough, durable, angular, not subject to disintegration, on exposure to water, or weathering, be chemically stable and shall be suitable in all other respects for the purpose intended.

- B. Geotextile may be used under the stone to provide a stable foundation and to facilitate removal of the stone.

## 2.8 EROSION CONTROL SEED MIXTURE

### Erosion Control Seed

Species (Note 1)	Application Rate, Pounds Per Acre	Application rate, Pounds Per 1,000 sf	Optimum Seed Depth, inches (Note 2)	Optimum Seeding Dates (Note 3)
Annual ryegrass <i>Lolium multiflorum</i>	40	1.00	0.5	3/1–6/15 and 8/1–10/15
Perennial ryegrass <i>Lolium perenne</i>	40	1.00	0.5	3/15–7/1 and 8/1–10/15
Winter Rye <i>Secale cereale</i>	120	3.00	1.00	4/5–7/1 and 8/15–10/15

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Oats <i>Avena sativa</i>	86	2	1	3/1–6/15 and 8/1–9/15
Winter Wheat <i>Triticum aestivum</i>	120	3	1	4/15–7/1 and 8/15–10/15
Millet <i>Echinochloa crusgalli</i>	20	.5	1	5/15–7/15
Sudangrass <i>Sorghum sudanese</i>	30	.7	1	5/15–8/1
Buckwheat <i>Fagopyrum esculentum</i>	15	.4	1	4/1–9/15
Weeping lovegrass <i>Eragostis cymbula</i>	5	.2	.25	6/1–7/1
ConnDOT All Purpose Mix	150	3.4	.5	3/1–6/15 and 8/1–10/15

Notes:

1 – Listed species may be used in combinations to obtain a broader time spectrum. If used in combinations, reduce each species planting rate by 20% of that listed

2 – Seed at twice the indicated depth for sandy soils.

3 – May be planted throughout summer if soil moisture is adequate or can be irrigated. Fall seeding may be extended 15 days in the coastal towns

## 2.9 EROSION CONTROL MATTING

- A. Temporary Erosion Control Blanket shall be 1) Curlex® Excelsior Blanket, as manufactured by American Excelsior Company, 2) ERO-MAT® V75S(FD), as manufactured by Verdyol Plant Research, Ltd., or 3) Landlok® S2 RD, as manufactured by SI® Geosolutions, or 4) approved equal.
- B. Degradable Erosion Control Fabric Netting shall be Landlok® 407 GR, as manufactured by 1) SI® Geosolutions, or 2) GeoJute® as manufactured by Belton Industries, Inc., or 3) BioNet® S150BN™ Double Net Straw Blanket, as manufactured by North American Green, or 4) approved equal.
- C. Long-Term and Non-degradable Turf Reinforcement Mats shall be 1) Pyramat®, as manufactured by SI® Geosolutions, or 2) Recyclex® Turf Reinforcement Matting, as manufactured by American Excelsior Company, or 3) Vmax3 C350™, as manufactured by North American Green, or 4) approved equal.
- D. Erosion control matting shall be secured with staples or an alternative attachment device such as geotextile pins or plastic pegs as recommended by the manufacturer. The Contractor shall submit a sample of the alternative attachment device for the Engineer's approval prior to installation.

## PART 3 EXECUTION

### 3.1 GENERAL

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TEMPORARY EROSION AND SEDIMENTATION  
CONTROLS

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- A. Install erosion and sedimentation control measures as shown on the Drawings prior to any site disturbance.
- B. No work shall be started until erosion control schedules and installation have been accepted by Engineer.
- C. Engineer has the authority to control the surface area of each material exposed by construction operations and to direct Contractor to immediately provide permanent or temporary pollution control measures to prevent contamination of adjacent watercourses or other areas of water impoundment. Every effort shall be made by Contractor to prevent erosion on the site and abutting properties or areas.
- D. Contractor shall construct all permanent erosion and sediment control features at the earliest practical time as outlined in the accepted schedule. Temporary erosion and sediment control measures shall be used to correct conditions that develop during construction, which were unforeseen, but are needed prior to installation of permanent control features, or that are needed temporarily to control erosion or sedimentation which develops during construction operations.
- E. Contractor shall limit as necessary the surface area of the earth material exposed to sufficiently maintain and protect the slopes to prevent pollution. Where erosion is likely to be a problem, clearing and grubbing operations shall be scheduled and performed so that grading operations and permanent erosion and sediment control features can follow immediately thereafter, if conditions permit; otherwise, temporary control measures will be required between successive construction stages.
- F. Erosion control measures shall be maintained by Contractor, and he shall remove such installations only upon completion of the work and the site is stabilized or when authorized to do so by Engineer.
- G. Contractor shall operate all equipment and perform all construction operations so as to minimize pollution. Contractor shall cease any of his operations, which will increase pollution during rainstorms.
- H. Failure by Contractor to control erosion, pollution, and siltation shall be cause for the Engineer to employ outside assistance to provide the necessary corrective measures. The cost of such assistance, including engineering costs, will be charged to Contractor and appropriate deductions made to Contractor's payment.

**3.2 HAY BALES**

- A. Hay bales shall be positioned as indicated on the Drawings and/or as necessary to prevent off site movement of sediment produced by, or as a result of, construction activities, or as direct by the Engineer.
- B. Hay bales shall be utilized on all catch basins and drainage facilities on the Project Site to prevent the entry of sediments or other debris. Maintain such protection throughout execution of the work until such drainage facilities have been abandoned/removed.
- C. Bales shall be placed lengthwise with ends of adjacent bales tightly abutting one another to form a continuous barrier. Bales shall be entrenched to a depth of 4 inches and backfilled, with the backfill placed toward the potential source of runoff and sediment. All bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms. Each bale



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shall be anchored with a minimum of two stakes, driving the first stake in each bale towards the previously laid bale to drive the bales together. Stakes must be driven a minimum of 18 inches into the ground. Loose hay shall be inserted between bales as required to prevent water from escaping between the bales.

### 3.3 GEOTEXTILE SILT FENCE

- A. Install a filter fabric silt fence prior to construction and remove after full surface restoration has been achieved. Install silt fence as indicated on the Drawings and/or as necessary to prevent off site movement of sediment produced by, or as a result of, construction activities.
- B. Install as follows:
  - 1. Hand shovel excavate a small trench a minimum of six inches wide by six inches deep on the upslope side of the desired fence line location.
  - 2. Unroll the siltation fence system, position the post in the back of the trench (downhill side), and hammer the post at least 12 inches into the original ground.
  - 3. Fabric rolls shall be spliced at posts. The fabric shall be overlapped six inches, folded over and securely fastened to posts.
  - 4. Lay the bottom 6 inches of the fabric into the trench to prevent undermining by storm water run-off.
  - 5. Backfill the trench and compact. Compaction is necessary to prevent the run-off from eroding the backfill.
  - 6. For slope and swale installations, extend the ends of the trench sufficiently up slope such that the bottom end of the fence will be higher than the top of the lowest portion of the fence.

### 3.4 CATCH BASIN INLET SEDIMENT CONTROL

- A. Install catch basin inlet sediment control devices in each exiting catch basin as long as it remains in use in accordance with manufacturer's guidelines at the locations shown on the Drawings.
- B. A catch basin sediment filter shall be installed and changed/cleaned per the manufacturer's recommendations, or as directed by the **(Insert Name)**, during construction.
- C. New catch basins shall have a filter installed immediately upon completion of construction. In addition, a hay bale, or similar, barrier shall be installed around the new basin and maintained in place until binder is placed or disturbed areas draining to it are stabilized.
- D. Catch basins with curb openings shall have filter fabric covering the opening and the edges of the fabric shall be secured. A filter boom shall also be placed over the opening.

### 3.5 TEMPORARY SEDIMENT BASINS

- A. Temporary sedimentation basins shall be employed as required during construction. Sedimentation shall be periodically removed from the basins and from behind erosion and sedimentation control devices. The Contractor shall direct all possible site runoff to the temporary sedimentation basins.

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- B. The temporary sedimentation basins shall be maintained from the start of construction until construction of the permanent detention basins is completed and perimeter areas are stabilized.

### 3.6 TEMPORARY MULCHING

- A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 30 calendar days of the completion of rough grading or where final grading has been completed but seeding is not anticipated for 20 days.

- 1. Straw/Hay Mulch

- Exposure Period: 6 months

- Application Method: By hand or machine

- Application Rate: 110 lbs/1,000 square feet.

- 2. Bark Chips/Shredded Bark

- Exposure Period: Less than one year

- Application Method: By hand or machine

- Application Rate: 6 cubic yards /1,000 square feet.

### 3.7 TEMPORARY EROSION CONTROL MATS

- A. Erosion control mats shall be furnished, installed, maintained, and later removed in ditches or swales, on embankment slopes, and excavation slopes at the locations shown on the Drawings in accordance with the manufacturer's recommendations.
- B. All areas shall be smooth graded and compacted. Remove all rocks, dirt clods, vegetation and other obstructions that may cause damage to the mats.
- C. Unroll mats parallel to the direction of water flow and lay flat against the ground. Overlap roll ends 1–2 feet with upslope mat on the top to prevent uplift of mat end by water flow. Overlay adjacent edges of mat by six inches. Extend mat 2–3 feet above the crest of steep slopes and anchor by excavating a 6-inch-deep trench, and secure end of mat in trench, backfill and compact. Secure mat to the ground using staples or pins furnished by manufacturer of mat.
- D. When no longer required, as determined by the Engineer, temporary erosion control mats shall become the property of the Contractor and be removed and properly disposed.
- E. Ground disturbances, including holes and depressions caused by the installation and removal of the temporary erosion control blanket shall be backfilled and repaired.

### 3.8 INSPECTIONS AND MAINTENANCE

- A. Contractor is responsible to maintain the sediment and erosion control features at all times throughout the project duration and until the completion certification and approval has been issued.
- B. Regular erosion and sediment control system inspections shall be conducted by Contractor throughout the project duration. At a minimum, Contractor shall conduct daily inspections and

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maintain erosion control systems in good operating condition. Report the results of the inspection and the recommended maintenance and/or repair requirements to Engineer.

- C. Additional inspections may be required and/or directed prior to, or immediately following, a storm event >0.1 inches. Repairs shall be made as necessary.
- D. In the event that the sedimentation and erosion control measures employed by Contractor prove to be inadequate as determined by the Engineer, Contractor shall adjust operations to the extent necessary to prevent erosion and sediment transport.
- E. Surface water shall be pumped to maintain excavations free of water. Comply with applicable requirements of the Connecticut Department of Environmental Protection, specifically those requirements related to the management of stormwater and dewatering wastewaters associated with construction activities.
- F. Hay bales and/or silt fences.
  - 1. Remove accumulated sediment once it builds up to one-half of the height of the bale or fabric.
  - 2. Replace damaged or degraded bales as necessary or when directed by the Engineer.
  - 3. Replace damaged fabric, or patch with a 2-ft minimum overlap. Overlaps may only be made at fence posts.
  - 4. Make other repairs as necessary to ensure that the bales/fence is filtering all runoff.
- G. Erosion Control Mats shall be inspected at least once a week. Areas where the mat has become dislodged from the soil surface or become torn shall be re-graded and re-seeded as necessary and the mat re-installed. When repetitive failures occur at the same location review conditions and modify erosion control measures to reduce failure rate. Temporary erosion control blanket damaged during the progress of work or resulting from the Contractor's vehicles, equipment, or operations shall be repaired or replaced at the expense of the Contractor.
- H. Clean catch basin inlet sediment control devices in accordance with manufacturer's guidelines.
- I. Any catch basins that collect sediment as a result of Contractor's work shall be thoroughly cleaned out by Contractor.

END OF SECTION 015713



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SECTION 015714 – TEMPORARY DUST CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SECTION INCLUDES

- A. Furnishing and spreading water, calcium chloride, and/or mulch on the subgrade, or in other areas of a Project Site or associated off-site areas, for the purpose of controlling dust emissions.
- B. The requirements set forth in this section of the specifications apply to all phases and areas of construction.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Regulations of Connecticut State Agencies (RCSA)
  - 1. RCSA Section 22a-174-1 through 43, Abatement of Air Pollution.
- C. ASTM International (ASTM)
  - 1. ASTM D98, Standard Specification for Calcium Chloride.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Only water, calcium chloride, and mulch are approved for dust control. No asphalt or petroleum-based products may be utilized for dust control.
- B. Water used shall be clean, non-polluted water obtained from sources approved by Engineer.
- C. Calcium chloride, ASTM D98. Calcium chloride in pellet form and flake form shall be acceptable.
  - 1. Calcium chloride shall be packaged in moisture proof bags or in airtight drums with the manufacturer, name of product, net weight, and percentage of calcium chloride guaranteed by the manufacturer legibly marked on each container.
  - 2. Engineer may reject calcium chloride failing to meet the requirements of the aforementioned specifications or which has become caked or sticky in shipment.
- D. Mulch

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1. Straw mulch: Threshold straw of oats, wheat, barely, or rye that is free from noxious weeds, mold or other objectionable material. Straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer.
2. Wood chips: Processed tree trimmings free of trash or other physical contaminants such as metal and plastic.

**PART 3 EXECUTION**

**3.1 GENERAL**

- A. Dust control shall be the responsibility of Contractor and dust control operations shall meet the requirements of the State of Connecticut Department of Environmental Protection.
- B. Construction sequencing shall be organized and conducted in a manner to leave existing pavement or ground coverings in place until just prior to earth excavation for the purpose of minimizing the migration of dust beyond the Project Limits into the surrounding area.
- C. Engineer reserves the right to conduct active dust monitoring using visual methods and may utilize particulate measurement equipment during the course of the work. If the amount of fugitive dust and/or particulate generated during the work is deemed unacceptable in the Engineer's judgment or exceeds baseline Project Site conditions at Engineer's monitoring locations, Engineer may require Contractor to stop work and implement corrective measures. No claim for delay will be considered for work stoppage based upon the results of Engineer's active dust monitoring results.
- D. Stockpiled materials from which particle have the potential of becoming airborne shall be securely covered with a temporary waterproof covering made of polyethylene, polypropylene, hypalon, or approved equal. The covers must be in place at all times when work with the stockpiles is not occurring.
- E. Subcontractor shall sweep all adjacent roads and neighboring parking lots and driveways that are impacted by the work. Whenever dirt is tracked from the site it shall be cleaned as necessary to prevent it from becoming a nuisance or hazard. At a minimum, adjacent streets shall be swept once per week.

**3.2 WATER**

- A. The application of water shall be under the control of Engineer at all times. It shall be applied only at the locations, and at such times, and in the amount as may be directed by Engineer. Quantities of water wasted or applied without authorization will not be paid for.
- B. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding or pollution.
- C. Contractor shall have available and maintain in an operable condition at all times, sufficient equipment for the purpose of applying water for dust control.
- D. Watering equipment shall consist of pipelines, tanks, tank trucks, distributors, pumps, meters, hose or other devices, approved by Engineer, which are capable of applying a uniform spread of water over the surface. A suitable device for a positive shut-off and for regulating the flow of water shall be located so as to permit positive operator control.
- E. Applications of water for dust suppression include, but are not necessarily limited to, the following:

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1. Demolition activities, material handling, material processing, and loading.
2. Earthwork.
3. Open excavation faces and dust-prone areas of the work.
4. Temporary access roads and roadway surfaces within and around the Project Site.

**3.3 CALCIUM CHLORIDE**

- A. Calcium chloride shall be applied only at the locations, at such times and in the amount as may be directed by the Engineer and only in areas that will not be adversely affected by the application.
- B. Calcium chloride shall be uniformly applied at the rate of one and one-half (1½) pounds per square yard (lb/yd<sup>2</sup>) or at any other rate as directed by Engineer. Application shall be by means of a mechanical spreader, or other approved methods. The number and frequency of applications shall be to Engineer's satisfaction.

**3.4 MULCH FOR DUST CONTROL**

- A. Coordinate the use of mulch for dust control with erosion and sedimentation control measures.
- B. Straw mulch shall be applied at a rate of 100 pounds per 1,000 square feet (100 lb/1,000 ft<sup>2</sup>).
- C. Wood chips or wood mulch shall be applied at such a rate as to form a layer one (1) inch thick.

**3.5 OTHER DUST CONTROL MEASURES**

- A. A temporary seed mixture may be spread in lieu of, or in addition to mulch over areas where the suspension of grading work in disturbed areas is expected to be more than 30 calendar days and as directed by Engineer.

END OF SECTION 015714





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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
1. Division 01 Section "References" for applicable industry standards for products specified.
  2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
  3. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise.
    - a. Products salvaged or recycled from other projects are not considered new products.
    - b. Products manufactured and stored for more than one year prior to the start date of this project are not considered new products.
  3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

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1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
- C. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification, or for purposes of evaluating "or equal" products.

#### 1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
  2. Form: Tabulate information for each product under the following column headings:
    - a. Specification Section number and title.
    - b. Generic name used in the Contract Documents.
    - c. Proprietary name, model number, and similar designations.
    - d. Manufacturer's name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
    - g. Projected delivery date or time span of delivery period.
    - h. Identification of items that require early submittal approval for scheduled delivery date.
  3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
    - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
  4. Completed List: Within 90 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
  5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

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- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

- a. Statement indicating why specified material or product cannot be provided.
- b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
- j. Cost information, including a proposal of change, if any, in the Contract Sum.
- k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
- l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor, through Construction Manager, of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

- a. Form of Acceptance: Change Order.
- b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will

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notify Contractor, through Construction Manager, of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
- b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

- 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
- 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions. B. Delivery and Handling:

- 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
- 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
- 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected. C. Storage:

- 1. Store products to allow for inspection and measurement of quantity or counting of units.
- 2. Store materials in a manner that will not endanger Project structure.
- 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- 4. Store cementitious products and materials on elevated platforms.
- 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
- 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
- 7. Protect stored products from damage and liquids from freezing.

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8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
  3. Refer to Divisions 02 through 34 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

## 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. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. 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.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
  6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

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7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Products:

- a. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed equal product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

2. Manufacturers:

- a. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed equal manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

3. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.

4. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.

5. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

- a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

6. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

- a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
- b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

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- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution 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:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Substitution request is fully documented and properly submitted.
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution 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:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - b. Requested substitution does not require extensive revisions to the Contract Documents.
  - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - d. Substitution request is fully documented and properly submitted.
  - e. Requested substitution will not adversely affect Contractor's construction schedule.
  - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - g. Requested substitution is compatible with other portions of the Work.
  - h. Requested substitution has been coordinated with other portions of the Work.
  - i. Requested substitution provides specified warranty.
  - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

**2.3 COMPARABLE PRODUCTS**

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A. Conditions: 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000



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SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

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. General installation of products.
  4. Coordination of Owner-installed products.
  5. Progress cleaning.
  6. Starting and adjusting.
  7. Protection of installed construction.
  8. Correction of the Work.
- B. Related Sections include the following:
1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  2. Division 01 Section "Submittal Procedures" for submitting surveys.
  3. Division 01 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 01 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.

1.3 INFORMATIONAL SUBMITTALS

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

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- C. Certified Surveys: Submit two copies signed by land surveyor.
- D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

**1.4 QUALITY ASSURANCE**

Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in the State of Connecticut 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 sitework, 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.
- C. Examination and Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

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4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
- D. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
  2. List of detrimental conditions, including substrates.
  3. List of unacceptable installation tolerances.
  4. Recommended corrections.

### 3.2 PREPARATION

Existing Utility Information: Furnish information to Owner 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. 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.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. 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 Architect. Include a detailed description of problem encountered, together with recommendations for changing 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 Architect and Construction Manager 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.

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- 5. Notify Architect and Construction Manager 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.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. 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.
- E. 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 Architect and Construction Manager.

#### 3.4 FIELD ENGINEERING

Identification: Owner will identify existing benchmarks, control points, and property corners.

- B. 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 Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. 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.
- D. 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 sitework.

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- E. Final Property Survey: Prepare a final property survey, as required by the City of Bristol and the State of Connecticut, showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
  2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

**3.5 INSTALLATION**

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  4. Maintain minimum headroom clearance of 7'-6" in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  2. Allow for building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with

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integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
  - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  - 2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

### 3.7 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. Dispose of materials lawfully.
  - 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.
- 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.

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- 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 in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. 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.
- H. 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 at Substantial Completion.
- I. 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.
- J. 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.

**3.8 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 01 Section "Quality Requirements."

**3.9 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.

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- C. Provide protection of all new finished flooring in accordance with Division 09 flooring Sections. Provide the same protection for all existing finished flooring to remain. Protect flooring for duration of construction period and throughout subsequent phases including but not limited to FF&E and Technology installation.

**3.10 CORRECTION OF THE WORK**

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 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 017300



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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
1. Salvaging nonhazardous demolition and construction waste.
  2. Recycling nonhazardous demolition and construction waste.
  3. Disposing of nonhazardous demolition and construction waste.
- B. Related Sections include the following:
1. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction, and location of waste containers at Project site.
  2. Division 01 Section "Sustainable Design Requirements."
  3. Division 01 Section "Indoor Air Quality Requirements."
  4. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.
  5. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

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- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- 1.4 REQUIREMENTS FOR CONSTRUCTION WASTE MANAGEMENT
- A. The Contractor shall prepare and submit a Construction Waste Management Plan to the Owner and Architect for approval. The CWM Plan shall outline the provisions to be implemented by the Contractor and Subcontractors to recycle and salvage demolition and construction waste generated during the project. The end-of-project recycling rate shall equal, at minimum, 50% (by weight) with a target of at least 75%, of the total waste from construction and miscellaneous demolition.
- B. Upon approval of the CWM Plan by the Owner and Architect, it shall be implemented by the Contractor and Subcontractors throughout the duration of the project, and documented in accordance with the Submittal Requirements below.
- C. The Construction Waste Management Plan shall include, but not be limited to, the following components:
1. Listing of Targeted Materials: The contractor shall develop a list of the waste materials from the Project that will be targeted for reuse, salvage, or recycling. The following materials, at minimum, shall be accounted for (materials that will not be recycled shall be indicated as such):
    - a. Cardboard, paper, packaging
    - b. Clean dimensional wood, palette wood
    - c. Beverage containers
    - d. Concrete and/or Concrete Masonry Units (CMU)
    - e. Metals from banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
    - f. Drywall
    - g. Carpet and pad
    - h. Paint
    - i. Rigid Foam
    - j. Glass
    - k. Plastics
  2. Landfill Information: The contractor shall provide the name and location of the landfill(s) where trash will be disposed of.
  3. Recycling or Salvaging Facilities: The contractor shall provide the names and locations of the recycling or salvaging facilities where waste materials will be delivered.
  4. Sorting Method: The contractor shall provide a description of the proposed means of sorting and transporting the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site for off-site sorting). Waste haulers using off-site sorting operations shall provide a written description of the sorting process used, and their method for calculating project-specific recycling rates.
  5. Packaging Waste: The contractor shall note whether suppliers will eliminate or take back packaging for major materials delivered to the site.

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- 6. Implementation and Supervision: The contractor shall include provisions in the Construction Waste Management Plan for addressing conditions in the field that do not adhere to the CWM Plan, including provisions to rectify non-compliant conditions.
  - 7. Additional Information: The contractor shall include any additional information deemed relevant to describe the scope and intent of the CWM Plan to the Owner and Architect.
  - D. Construction Waste Management and recycling requirements shall be incorporated into all Subcontractor's contracts.

**1.5 SUBMITTALS**

- A. Waste Management Plan: Submit 3 copies of plan within 30 days of date established for the Notice to Proceed.
- B. Calculations and supporting documentation to demonstrate end-of-project recycling rates meeting the requirements for Construction Waste Management above. The process for recording and assembling documentation shall be as follows:

- 1. Record and document the total weight (in tons) of all demolition and construction waste materials sent to the landfill. Monthly Waste Management Reporting Forms shall be used as the basis for determining the total amount of waste landfilled for the project. The monthly reporting forms shall specify:

- a. the number of dumpsters or other containers sent to the landfill for that month;
- b. the volume (in cubic yards) of each dumpster or container sent to the landfill for that month;
- c. the type of waste contained in each dumpster or container; and
- d. the weight of the waste in each dumpster or container. If the weight of the waste is not directly measured for each dumpster or container, the following Solid Waste Conversion Factors shall be used to convert the volume of waste to weight:

Solid Weight Conversion Factors:

Mixed Waste	350 lbs/cubic yard
Wood	300 lbs/cubic yard
Cardboard	100 lbs/cubic yard
Gypsum Wallboard	500 lbs/cubic yard
Rubble	1,400 lbs/cubic yard

- 2. Record and document the total weight (in tons) of all demolition and construction waste materials recycled or salvaged. Monthly Waste Management Reporting Forms shall be used as the basis for determining the total amount of waste recycled or salvaged for the project. The monthly reporting forms shall specify:

- a. the number of dumpsters or other containers of recycled or salvaged materials for that month;
- b. the volume (in cubic yards) of each dumpster or container of recycled or salvaged materials for that month;
- c. the type of recycled or salvaged material contained in each dumpster or container; and

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- d. the weight of the recycled or salvaged material in each dumpster or container. If the weight of the material is not directly measured for each dumpster or container, the Solid Waste Conversion Factors listed for landfill waste (see above) shall be used, where applicable, to convert the volume of material to weight. For materials not contained in the Solid Waste Conversion Factors (e.g., metals, glass), the Contractor shall propose a conversion factor for review by the Owner and Architect.
  - 3. Calculate the end-of-project recycling rate percentage by dividing the recycled and salvaged waste (in tons) by the total waste generated (recycled, salvaged, and landfilled waste – also in tons), and multiplying by 100.
  - C. CTHPB Submittal: Letter template for Credit 6d, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
  - D. Qualification Data: For Waste Management Coordinator.
  - E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- 1.6 QUALITY ASSURANCE
- A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council. Waste management coordinator may also serve as LEED coordinator.
  - B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
  - C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
  - D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
    - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
    - 2. Review requirements for documenting quantities of each type of waste and its disposition.
    - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
    - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
    - 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

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- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
1. Total quantity of waste.
  2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
  3. Total cost of disposal (with no waste management).
  4. Revenue from salvaged materials.
  5. Revenue from recycled materials.
  6. Savings in hauling and tipping fees by donating materials.
  7. Savings in hauling and tipping fees that are avoided.
  8. Handling and transportation costs. Include cost of collection containers for each type of waste.
  9. Net additional cost or net savings from waste management plan.
- E. Forms: Prepare waste management plan on forms included at end of Part 3.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION**

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3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect, Owner, and Construction Manager. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - 1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - 2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.

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5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE A.

Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
  - a. Comply with requirements in Division 32 Section "Plants" for use of clean sawdust as organic mulch.

- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

- B. Burning: Do not burn waste materials.

- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419





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**SECTION 017700 - CLOSEOUT PROCEDURES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

**1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Substantial Completion procedures.
  2. Final completion procedures.
  3. Warranties.
  4. Final cleaning.
  5. Repair of the Work.
- B. Related Sections include the following:
1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
  2. Division 01 Section "Execution" for progress cleaning of Project site.
  3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  5. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
  6. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

**1.4 CLOSEOUT SUBMITTALS**

- A. Certificates of Release: From authorities having jurisdiction.

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B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

**1.6 SUBSTANTIAL COMPLETION PROCEDURES**

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of 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. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
6. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
7. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.
  - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
8. Submit test/adjust/balance records.
9. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

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- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
  6. Advise Owner of changeover in heat and other utilities.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect 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 Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection 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.

**1.7 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 01 Section "Payment Procedures."
  2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. 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. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or

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will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

**1.8 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.
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 Architect.
- d. Name of Construction Manager.
- e. Name of Contractor.
- f. Page number.

**1.9 SUBMITTAL OF PROJECT WARRANTIES**

- A. 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 by separate agreement with Contractor.

1. Manufacturers' warranties shall not commence until date of Substantial Completion or until all aspects of the commissioning of the respective system are complete and accepted by the Commissioning Authority and Owner, whichever date is later.

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

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

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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.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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. HEPA vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
  - j. 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.
  - k. Remove labels that are not permanent.
  - l. 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.

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- 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - n. Replace parts subject to unusual operating conditions.
  - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - q. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - r. 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.
  - s. 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.

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

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. Emergency manuals.
  3. Operation manuals for systems, subsystems, and equipment.
  4. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.
- B. Related Sections include the following:
1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
  3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
  4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work 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 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Architect will comment on whether content of operations and maintenance submittals are acceptable.

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2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect, through Construction Manager, will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

## 1.5 COORDINATION

- A. Where operation and maintenance documentation includes 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. 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.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.



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- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
  - D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
  - E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

**2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS**

- 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 in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name, address, and telephone number of Contractor.
  - 6. Name and address of Architect.
  - 7. Name and address of Construction Manager.
  - 8. 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, indexed to the content of the volume, and cross-referenced to Specification 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.
  - 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.

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- 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. Crossreference 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 subject matter of contents. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent 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 binder tabs on drawings and bind with 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 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
  1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:

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1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

## 2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections 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. License requirements including inspection and renewal dates.
- 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. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

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- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.
- 2.5 PRODUCT MAINTENANCE MANUAL
- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL
- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

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- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- D. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training videotape, if available.
- E. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- F. **Spare Parts List and Source Information:** Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
- H. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

### **PART 3 - EXECUTION**

#### **3.1 MANUAL PREPARATION**

- A. **Operation and Maintenance Documentation Directory:** Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

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- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. 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.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. 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.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

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SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

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.
  3. Demonstration and training video recordings.
- B. Related Sections include the following:
1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
  2. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and 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. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructors and videographer.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

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A. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:
  - a. Name of Project.
  - b. Name and address of videographer.
  - c. Name of Architect.
  - d. Name of Construction Manager.
  - e. Name of Contractor.
  - f. Date of video recording.
2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.5 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 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  1. Inspect and discuss locations and other facilities required for instruction.
  2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  3. Review required content of instruction.
  4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

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



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- 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 Architect.

## **PART 2 - PRODUCTS**

### **2.1 INSTRUCTION PROGRAM**

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
  - 1. Building envelope including aluminum framing systems, sealants, and roofing systems.
  - 2. Motorized doors, including overhead coiling doors.
  - 3. Equipment, including residential appliances.
  - 4. Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.
  - 5. Intrusion detection systems.
  - 6. Heat generation, including boilers, feedwater equipment, pumps, and water distribution piping.
  - 7. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
  - 8. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
  - 9. HVAC instrumentation and controls.
  - 10. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
  - 11. Packaged engine generators, including transfer switches.
  - 12. Lighting equipment and controls.
  - 13. Communication systems, including intercommunication, voice and data equipment.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:

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- a. Emergency manuals.
  - b. Operations manuals.
  - c. Maintenance manuals.
  - d. Project Record Documents.
  - e. Identification systems.
  - f. Warranties and bonds.
  - g. Maintenance service agreements and similar continuing commitments.
3. 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.
4. 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.
5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. 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

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- e. Procedures for preventive maintenance.
- f. Procedures for routine maintenance.
- g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

### **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. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- C. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

#### **3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS**

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

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1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
  1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercialgrade graphic label.
  2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
  3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
  4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
  1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
  1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while, or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

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SECTION 018113 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain Connecticut High Performance Building Standard Guidelines (CTHPB) prerequisites and credits needed for Project to comply with the CTHPB Standard.
1. The Owner requires the Contractor to implement practices and procedures to meet the Project's environmental goals, which include compliance with the CTHPB standard. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in related sections of the contract documents, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the stated CTHPB Performance Criteria.
  2. Other CTHPB prerequisites and credits needed to comply with the CTHPB Standard depend on material selections and may not be specifically identified as CTHPB requirements. Compliance with requirements needed to comply with CTHPB Standard prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
  3. Additional CTHPB Standard prerequisites and credits needed to achieve CTHPB compliance depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
  4. A copy of the CTHPB Standard checklist is attached at the end of this Section for information only.
- B. Related Sections:
1. Divisions 01 through 33 Sections for CTHPB requirements specific to the work of each of these Sections. Requirements may or may not include reference to CTHPB.
  2. Division 01 Section "Construction Waste Management and Disposal."
  3. Division 01 Section "Indoor Air Quality Requirements."

1.3 DEFINITIONS

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- A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSCFSC-accredited certification body.
  - B. CTHPB: Connecticut High Performance Building Standard.
  - C. Rapidly Renewable Materials: Materials made from plants that are typically harvested within a 10-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.
  - D. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
  - E. Regionally Extracted and Manufactured Materials: Regionally manufactured materials made from raw materials that are extracted, harvested, or recovered within a radius of 500 miles from Project site.
  - F. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
    - 1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
    - 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
    - 3. The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).

**1.4 REFERENCE STANDARDS AND REGULATORY REQUIREMENTS**

- A. Rule 1168 – "Adhesive and Sealant Applications", effective date of July 1, 2005 and Rule Amendment date of January 7, 2005: South Coast Air Quality Management District (SCAQMD), State of California, [www.aqmd.gov](http://www.aqmd.gov).
- B. Green Seal Standard for Commercial Adhesives GS-36, requirements in effect October 19, 2000.
- C. "Green Seal Standard for Architectural Coating" (GS-11), plus "Green Seal Standard for AntiCorrosive Paints" (GC-03).
- D. Rule 1113 - "Architectural Coatings", amended 7/9/04: South Coast Air Quality Management District (SCAQMD), State of California, [www.aqmd.gov](http://www.aqmd.gov).

**1.5 SUBMITTALS**

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- A. General: Submit additional CTHPB submittals required by other Specification Sections.
- B. CTHPB submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated CTHPB requirements.
- C. Detailed Submittal Requirements: The items below define the information and documents to be provided for each type of CTHPB Submittal.
1. CTHPB Compliance Documentation: Information to be supplied for this form (blank copy provided as Attachment A to this Section) shall include some or all of the following items, as identified in each specification section:
- a) Product name and manufacturer
  - b) Cost breakdowns for the materials included in the contractor or sub-contractor's scope of work. Cost reporting shall include:
    - i. The total cost for the contractor's work.
    - ii. Itemized material costs (excluding the contractor's labor, equipment, overhead and profit).
  - c) The percentages (by weight) of pre-consumer and post-consumer recycled content in the supplied product(s).
  - d) The percentages (by weight) of regional material content in the supplied product.
  - e) The percentage (by weight) of rapidly renewable content in the supplied products.
  - f) The percentage of FSC certified wood content in the supplied products. Calculate percentage by weight, volume and cost. Use whichever provides the highest percentage of FSC content.
  - g) The percentage (by weight) of salvaged content in the supplied products
  - h) If applicable, indication that product has been certified as low-VOC by SCS – Indoor Advantage Gold or the GREENGUARD Certification Program.
2. CRF Back-Up Documentation: These documents are used to validate the information provided on the CRF (except cost data). For each material listed on the CRF, provide documentation to certify the material's Sustainable Building attributes, as applicable:
- a) Recycled content: Provide published product literature or letter of certification on the manufacturer's letterhead certifying the amounts of post-consumer and/or postindustrial content. For concrete, provide concrete mix designs and volumes to verify the percentage of recycled material included, by weight and by cost.
  - b) Regional manufacturing (within 500 mile radius): Provide published product literature or letter of certification on the manufacturer's letterhead indicating the city/state where the manufacturing plant is located and the direct distance in miles from the project site.
  - c) Regional raw materials (within 500 mile radius):
    - i. Provide published product literature or letter of certification on the manufacturer's letterhead indicating the city/state from which each of the raw materials in the product were extracted, harvested or recovered, and the direct distance in miles from the project site.
    - ii. If only some of the raw materials for a particular product or assembly originate within a 500 mile radius of the subproject site, provide the percentage (by weight) that these materials comprise in the complete product.

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d) FSC Certified Wood:

i. Provide vendor invoices for each FSC wood product or assembly. Invoices shall include chain-of-custody certificate numbers and itemized costs for all certified products. ii. For assemblies, provide the percentage (by cost and by weight) of the assembly that is FSC-certified wood.

e) Rapidly renewable resources: Provide published product literature or letter of certification on the manufacturer's letterhead indicating the rapidly renewable content in the installed product.

f) VOC content: Provide manufacturer's published product literature or stated in a letter of certification on the manufacturer's letterhead that the product has been certified as low-VOC by either SCS – Indoor Advantage Gold or the GREENGUARD certification program.

D. CTHPB Action Plans: Provide preliminary submittals within 30 days of date established for the Notice to Proceed indicating how the following requirements will be met:

1. Construction Waste Management: Waste management plan complying with Division 01 Section "Construction Waste Management and Disposal."
2. Recycled Content: List of proposed materials with recycled content. Indicate cost, postconsumer recycled content, and pre-consumer recycled content for each product having recycled content.
3. Local or Regional Content: List of proposed regionally manufactured materials and regionally extracted and manufactured materials.
4. Certified Wood Products: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
5. Construction indoor-air-quality management plan – During Construction.
6. Construction indoor-air-quality management plan - Before Occupancy

E. CTHPB Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with CTHPB action plans for the following:

1. Construction Waste Management: Waste reduction progress reports complying with Division 01 Section "Construction Waste Management and Disposal."
2. Recycled Content.
3. Local or Regional Content: Regionally manufactured materials and regionally extracted and manufactured materials.
4. Certified wood products.

F. Additional CTHPB Documentation Submittals:

1. Construction Activity Pollution Prevention: Provide supporting documentation of erosion and sedimentation control measures on site with:
  - a. Photographs
  - b. Maintenance Logs
  - c. Meeting Minutes
  - d. Field Sketches and Shop Submittals



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2. Reduce Outdoor Light Pollution: Product data for interior and exterior lighting fixtures that stop direct-beam illumination from leaving the building site.
3. Reduce Potable Water Use: Product data for plumbing fixtures indicating water consumption.
4. CIAQ Plan – During Construction:
  - a. Construction indoor-air-quality management plan.
  - b. Product data for temporary filtration media.
  - c. Product data for filtration media used during occupancy.
  - d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
5. CIAQ Plan – Before Occupancy:
  - a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
  - b. Product data for filtration media used during flush-out and during occupancy.
  - c. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.

## PART 2 - PRODUCTS

### 2.1 RECYCLED CONTENT OF MATERIALS

- A. Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of cost of materials used for Project.
  1. Cost of recycled content of an item shall be determined by adding the percentage (by weight) of post-consumer recycled content and one-half the percentage (by weight) of pre-consumer recycled content and multiplying by cost of the item.
  2. Do not include plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.
  3. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims" 16 CFR 260.7 (e).

### 2.2 REGIONAL MATERIALS

- A. Provide a minimum of 20 percent of building materials (by cost) that are regionally extracted and manufactured materials.

### 2.3 CERTIFIED WOOD

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- A. Provide a minimum of 50 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:

- a. Rough carpentry.
- b. Miscellaneous carpentry.
- c. Heavy timber construction.
- d. Finish carpentry.
- e. Architectural woodwork.
- f. Wood paneling.
- g. Wood veneer wall covering.
- h. Wood flooring.
- i. Wood cabinets.

**2.4 LOW-EMITTING MATERIALS REQUIREMENTS**

- A. The following materials shall be certified as low-VOC products by either the Scientific Certification Systems – Indoor Advantage Gold system or GREENGUARD Certification Program:

1. Adhesives and Sealants used in the interior of the building
2. Acoustic Ceiling Tiles and Wall Panels
3. Interior Paints
4. Wall Coverings
5. Carpet Systems and Associated Adhesives
6. Composite and Solid Wood Flooring
7. Resilient Flooring and Associated Adhesives

- B. All composite wood and agrifiber products used within the shell of the building shall meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

**PART 3 - EXECUTION**

**3.1 REFRIGERANT REMOVAL**

- A. Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in Division 23 Sections.

**3.2 CONSTRUCTION WASTE MANAGEMENT**

- A. Comply with Division 01 Section "Construction Waste Management and Disposal."

**3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT**

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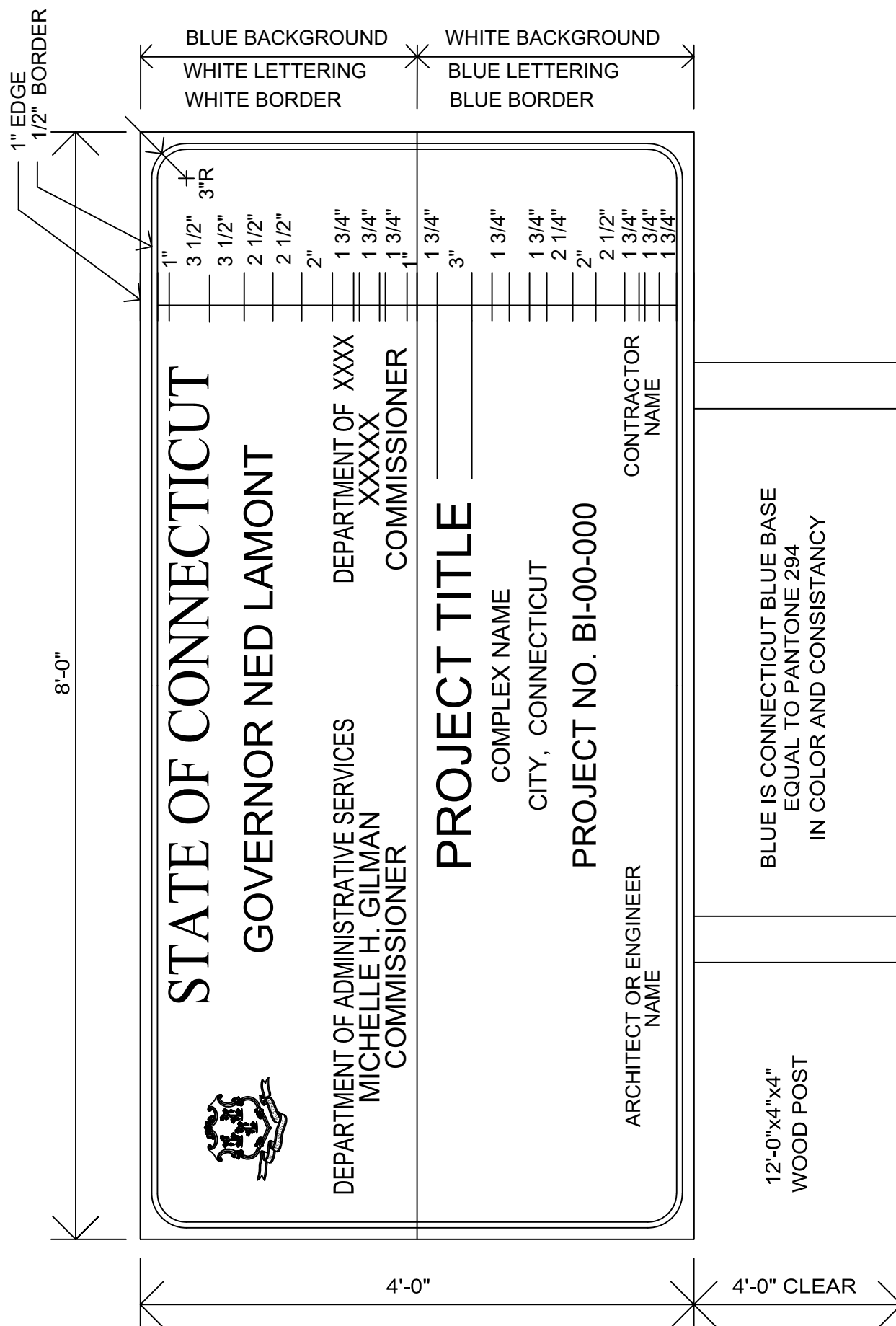
- A. Comply with requirements in Division 01 Sections "Indoor Air Quality Requirements" and "Construction Indoor Air Quality (IAQ) Program."

3.4 FORMS

- A. The following Form referenced in this Section, is attached:
  - 1. CTHPB Compliance Documentation.

END OF SECTION 018113









**DOWN TO EARTH  
CONSULTING, LLC**  
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**GEOTECHNICAL ENGINEERING REPORT  
NORTHEAST MIDDLE SCHOOL  
530 STEVENS STREET  
BRISTOL, CONNECTICUT**

**Prepared for:**

Alfred Benesch and Company  
120 Hebron Avenue – 2<sup>nd</sup> Floor  
Glastonbury, Connecticut 06033

**Prepared by:**

Down To Earth Consulting, LLC  
27 Siemon Company Drive #363W  
Watertown, Connecticut 06795

File No. 0015-036.00  
February 2024

Down To Earth Consulting, LLC  
27 Siemon Company Drive #363W, Watertown, CT 06795  
(203) 683-4155

NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
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**DOWN TO EARTH  
CONSULTING, LLC**  
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

February 5, 2024  
File No. 0015-036.00

Mr. Ryan Scrittorale, P.E.  
Alfred Benesch and Company  
120 Hebron Avenue – 2<sup>nd</sup> Floor  
Glastonbury, Connecticut 06033

Via email: [rscriitorale@benesch.com](mailto:rscriitorale@benesch.com)

Re: Geotechnical Engineering Report  
Proposed Northeast Middle School Building  
530 Stevens Street  
Bristol, Connecticut

Down To Earth Consulting, LLC (DTE) is pleased to submit this geotechnical engineering report to Alfred Benesch and Company (Client) for the proposed school building at 530 Stevens Street in Bristol, Connecticut (Site). We appreciate this opportunity to work with you. Please call if you have any questions.

Sincerely,

Down To Earth Consulting, LLC



Thomas J. Orszulak, P.E.  
Project Manager



Raymond P. Janeiro, P.E.  
Reviewer/Principal



**NEW CONSTRUCTION OF:  
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Proposed Northeast Middle School  
Bristol, Connecticut  
File No. 0015-036.00 – February 5, 2024  
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APPENDIX 1 – FIGURES

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## 1.0 INTRODUCTION

Down To Earth Consulting, LLC (DTE) completed a subsurface exploration program and geotechnical engineering evaluation for the proposed school building at 530 Stevens Street in Bristol, Connecticut. Our geotechnical engineering services included: reviewing project plans, observing test borings, characterizing subsurface conditions within the project limits, performing geotechnical engineering analyses, and providing geotechnical design and construction recommendations for the project. Refer to Figure 1 (in Appendix 1) for the approximate Site location.

Our services were performed in accordance with our December 12, 2024, *Subconsultant Services Agreement*, which was based in part on the drawing entitled, *Boring Plan, Northeast Middle School, 530 Stevens Street, Bristol, CT*, prepared by QA+M Architecture, dated September 20, 2023. We were also provided with a *Grading and Drainage Plan, New Construction of Northeast Middle School, 532 Stevens Street, Bristol, CT*, prepared by the Client, revision dated January 12, 2024.

Elevations (El.) stated in this report are in feet and based on the topographic information provided in the referenced drawings. Our recommendations are based on allowable stress design methods and the 2021 International Building Code with 2022 Connecticut Supplements (Building Code).

## 2.0 BACKGROUND

The 23.8-acre Site is located at 230 Stevens Street in Bristol, Connecticut and is generally bordered by residential parcels. The proposed school building area generally consists of athletic fields adjacent to the existing Northeast Middle School Building. Existing grades in the area of proposed improvements typically slope from approximately El. 415 at the eastern portion of the Site to approximately El. 400 at the southeastern portion of the Site.

The project consists of constructing an approximate 80,000-square-foot school building with associated parking and athletic fields. It is our understanding that the proposed one- to two-story building will be constructed slab-on-grade (i.e., no basement level) with a finished-floor elevation of El. 412.5. Paved parking, access-ways, and utilities are proposed immediately surrounding the proposed building. Foundation and slab loads were not available at the time this report was prepared.

## 3.0 SUBSURFACE DATA

### 3.1 GENERAL SITE GEOLOGY

Published surficial and bedrock geological map data (1:24,000 scale, *Surficial Geologic Map of the Bristol Quadrangle, Howard E. Simpson, 1961* and *Bedrock Geological Map of Connecticut, John Rodgers, 1985*) was reviewed. The surficial material within the Site area is mapped as a variable mixture of gravel, sand, silt and clay intermixed with cobbles and boulders (Ground-moraine Deposits). The underlying bedrock is classified as red-brown, coarse- to fine-grained arkose (New Haven Formation).



### 3.2 TEST BORINGS

DTE observed and logged twenty test borings drilled by our subcontractor, General Borings, Inc. on December 13, 2023 through January 12, 2024. Seventeen borings (identified as B-1 through B-17) were drilled within the proposed building footprint and three borings (I-1 through I-3) were drilled in proposed stormwater detention basins. Test boring locations are depicted on Figure 2 (Appendix 1) and the logs are included in Appendix 2. Borings were survey-located in the field by the Client.

The borings were drilled to explore the soil and groundwater conditions in the proposed improvements area. Hollow-stem auger drilling methods were used to advance borings to depths of approximately 9.5 to 21 feet below existing grades (approximate El. 400 to 380). The borings were advanced until encountering equipment refusal in natural soil deposits.

Representative soil samples were obtained for soil classification by split barrel sampling procedures in general accordance with ASTM D-1586. The split-spoon sampling procedure utilizes a standard 2-inch O.D. split-barrel sampler that is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the middle 12-inches of a normal 24-inch penetration is recorded as the Standard Penetration Resistance Value (N). The blows (i.e., "N-Value") are indicated on the boring logs at their depth of occurrence and provide an indication of the relative consistency of the material.

Groundwater levels were measured using a weighted tape in open drill holes and/or inferred from wet soil samples during drilling. Boring B-4 was also completed as a temporary monitoring well.

## 4.0 SUBSURFACE CONDITIONS

### 4.1 SUBSURFACE PROFILE

Based on the subsurface explorations completed at the Site, the subsurface profile generally consists of Fill overlying Gravelly Sand Deposits. The following is a more detailed description of the subsurface materials encountered at the Site:

#### 4.1.1 Fill

A layer of uncontrolled Fill was encountered at most boring locations (except for B-3, B-6, B-7, B-8, and B-17) and generally consisted of loose to medium, brown/dark brown, fine to coarse sand with "little" to "some" amounts of fine to coarse gravel (10 to 35%) and "trace" to "some" amounts of silt (0 to 35%). Trace amounts of root matter and decomposed wood fragments (0 to 5%) were also observed in the Fill. The Fill layer typically ranged between 2 and 5 feet thick. In isolated locations (i.e., B-9, B-14, B-15, and B-16) the Fill layer extended to a depth of approximately 7 to 8 feet below grade (El. 405+/- to 401+/-). The thickness, character, and consistency of the Fill will vary between exploration locations.

#### 4.1.2 Gravelly Sand

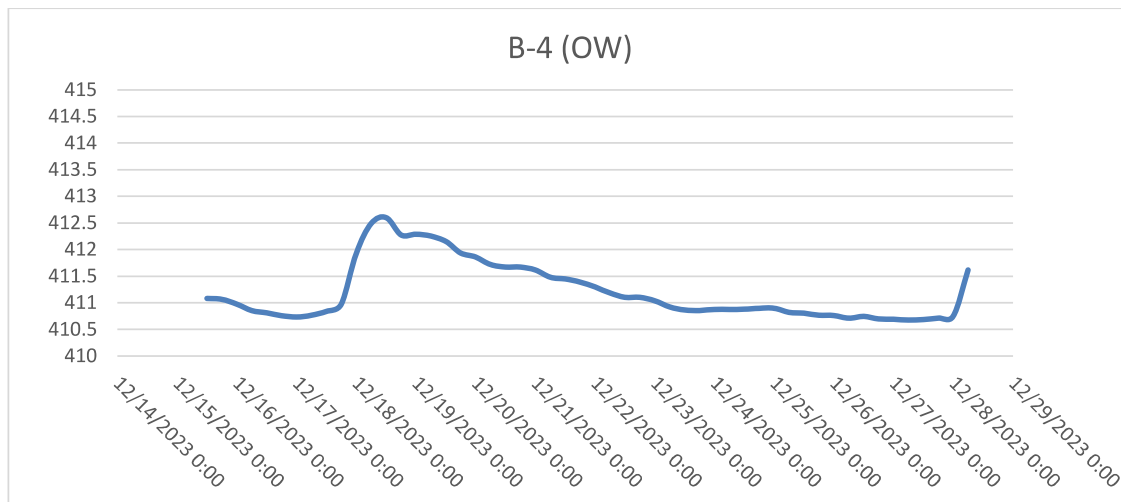
Gravelly Sand deposits were encountered below the Fill and extended to a depth of approximately 9.5 to 21 feet below existing grades (approximate El. 400+/- to 380+/-). The Gravelly Sand



deposits generally consisted of dense to very dense, red-brown, fine to coarse sand with varying amounts of gravel and silt. In many instances, the presence of cobbles and boulders were inferred by observed “rig chatter” during drilling and split spoon sampler refusals.

#### 4.2 GROUNDWATER

Groundwater was observed at depths ranging from about 1 to 9.5 feet below grade (approximate El. 410 to 396) within the limits of the subsurface explorations. Groundwater levels measured in each of the boreholes may not have had sufficient time to stabilize and should be considered approximate. Boring B-4 was completed as a temporary groundwater monitoring well to collect stabilized groundwater readings. Groundwater readings were collected every six hours using an electronic piezometer between December 15, 2023, and December 28, 2023. The documented readings are plotted on the following graph:



Groundwater levels will vary depending on factors such as temperature, season, precipitation, construction activity, and other conditions, which may be different from those at the time of these measurements.

### 5.0 GEOTECHNICAL RECOMMENDATIONS

We offer the following geotechnical design recommendations based on the subsurface conditions encountered at the Site, available project information, and the proposed construction.

#### 5.1 FOUNDATIONS

##### 5.1.1 Foundation Type and Bearing Strata

We recommend supporting the proposed building on conventional, shallow spread footings. The footings should bear on undisturbed, natural Gravelly Sand or on Structural Fill (hereinafter specified as Compacted Granular Fill (CGF)) over undisturbed Gravelly Sand. Existing Fill and



soils with appreciable organic content are not considered suitable bearing materials and must be excavated from the foundation areas during site preparation. Based on the available subsurface information, a finished floor elevation of El. 412.5, and typical foundation embedment depths, we estimate that 2 to 3 feet (to possibly 7 feet in the Boring B-14, B-15, and B-16 areas) of over-excavation and replacement with CGF may be required. Actual bottom of unsuitable bearing soil elevations will vary across the site and must be verified during construction excavation by a DTE representative.

When CGF is used beneath the footings (e.g., in backfill areas), we recommend that it be placed one foot beyond the edge of the footings and at a one horizontal to one vertical slope away and down from the bottom outside edge of the footings. Crushed Stone can be used in place of CGF as it is easier to achieve compaction requirements.

#### 5.1.2 Footing Levels and Sizes

Exterior footings (and footings in unheated areas) should be constructed at a minimum frost depth of 42-inches below proposed site grades. Interior footings, in heated areas, should be constructed at a minimum depth of 24-inches below proposed top of slab-on-grade level. We recommend a minimum footing width of column and strip footings of 3 feet and 2 feet, respectively.

#### 5.1.3 Allowable Bearing Pressures and Estimated Settlement

We recommend a maximum allowable design bearing pressure of five kips per square foot (5 ksf) for footings bearing on the recommended bearing materials. Based on the recommended bearing strata and anticipated loads, we anticipate that footings will undergo less than 1 inch of total settlement and the maximum differential settlement should not exceed 0.5 inches.

Settlements will occur as the loads are applied and are expected to be complete at the end of construction.

DTE should be provided with the final foundation loads and geometries once they are available to confirm the above recommended bearing capacity and settlement estimates.

#### 5.1.4 Drainage

We recommend installing an exterior perimeter footing drain at the proposed building. These drains will help prevent infiltrated surface water from building up behind foundation walls and facilitate surface drainage.

Drains should consist of 6-inch diameter perforated PVC pipe, surrounded by 6-inches of Crushed Stone, wrapped in non-woven filter fabric. Footing drain inverts should be set flush with or up to 6-inches above bottom of footing levels. Cleanouts should be installed in the direction of flow at the beginning of piping runs and consist of 45-degree elbows (90-degree elbows should not be allowed). The drains should be gravity drained to a Site drainage system as recommended by the Client.



## 5.2 SLABS

### 5.2.1 Subgrade

We recommend placing concrete floor slabs over a minimum eight-inch-thick base course layer of compacted Sand and Gravel or six-inch layer of compacted Crushed Stone placed on the surface of undisturbed, suitable, natural soils, or on CGF over natural soils.

The base course layer may also be placed on inorganic Site soils that have been improved with surface densification under the observation of a qualified Geotechnical Engineer. This procedure consists of removing all surficial organic and debris materials and compacting the surface with a minimum of four passes with a vibratory drum roller having a minimum dynamic force of 5,000 lbs. per foot of drum width. Areas exhibiting instability shall receive additional compaction and/or be over-excavated and replaced with CGF, as recommended by the Geotechnical Engineer.

Existing Fill improvement will require careful observation by an experienced Geotechnical Engineer. Surface densification will improve loose zones and/or collapse potential of voids in the top 2 to 4 feet of Fill. It will not prevent organics or other deleterious materials (wood, etc.) from decaying and potentially causing slab settlements. Periodic slab resurfacing and repair may be required if there are slab settlements.

If project stakeholders are not willing to accept some risk associated with potential slab settlement and cracking, the proposed slabs should be constructed over CGF over prepared, natural soil deposits.

The design subgrade modulus for the recommended subgrade and base course is 200 pounds per cubic inch (pci).

### 5.2.2 Drainage and Damp-Proofing

Groundwater levels could potentially be above the proposed at-grade slab floor elevations from normal seasonal groundwater fluctuations. We recommend using a “relieved” slab design with an underdrain system. The underdrain system should consist of a network of perforated PVC pipes that should consist of 4-inch minimum diameter perforated PVC pipe, surrounded by 6-inches of Crushed Stone, and wrapped in non-woven filter fabric. Drain inverts should be level or pitched up to 0.25%, embedded at a minimum depth of 12-inches below bottom of slab, and nominally spaced 20 feet-on-center.

Slab damp-proofing should be installed between the slab and base course and consist of not less than 6-mil polyethylene with joints lapped at least 6-inches.

## 5.3 RETAINING WALLS

### 5.3.1 Backfill and Drainage

We recommend backfilling earth retaining structures with compacted Sand and Gravel and installing footing drains. The drains should consist of 4-inch-diameter perforated PVC pipe, surrounded by 4-inches of Crushed Stone, wrapped in non-woven filter fabric. Footing drain





inverts should be set flush with or up to 6-inches above bottom of footing level. The drains should be gravity drained to daylight or to the site drainage system.

#### 5.3.2 Lateral Earth Pressures

Walls that are free to rotate at the top and are not braced should be designed to resist an equivalent active static horizontal fluid earth pressure equal to 35 pcf (based on  $\phi' = 34^\circ$ ,  $c = 0$ ,  $K_a = 0.28$ ,  $\delta = 17^\circ$ , and  $\gamma = 125$  pcf). Braced retaining walls (e.g., loading docks) should be designed to resist an equivalent at-rest static horizontal fluid earth pressure equal to 56 pcf (based on  $\phi' = 34^\circ$ ,  $c = 0$ ,  $K_o = 0.45$ , and  $\gamma = 125$  pcf). This assumes no unbalanced hydrostatic pressures, seismic forces, or surcharges from traffic loads. We recommend using a minimum traffic surcharge load of 250 psf.

Due to the limited expected wall movement and depth of footings, we do not recommend the use of passive earth pressures against the base of walls. Based on an assumed Seismic Design Category "C" (or higher), no seismic design forces need be applied to retaining walls.

#### 5.3.3 Coefficient of Friction

We recommend a maximum coefficient of friction of 0.45 between foundations and the recommending bearing strata.

### 5.4 SEISMIC DESIGN

Based on the standard penetration test results, visual soil classification, and design peak ground acceleration at this locale, the site soils are not susceptible to liquefaction.

We recommend using the following design parameters as defined by the Building Code and, where applicable, the 2021 International Building Code (IBC):

- Site Class: C (Section 1613.5 of the IBC)
- MCE spectral response accelerations:  $S_s = 0.188g$  and  $S_1 = 0.054g$  (Building Code Appendix N)

### 5.5 PAVEMENT DESIGN

The pavement section (i.e., combined thickness of asphalt, base course, and subbase materials) should be placed on the surface of non-organic suitable improved Fill (prepared under the observation of the Geotechnical Engineer (see Section 5.2.1), undisturbed suitable natural soils, or on CGF over these materials.

Based on available project information, a 20-year design life, and that subgrades are prepared in accordance with Section 5.2, we recommend the following minimum flexible pavement sections:

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<u>ITEM</u>	<u>MINIMUM THICKNESS (in.)</u>	<u>CTDOT SPECIFICATION (FORM 818)</u>
Pavement Wearing Course	1.5	HMA S0.375 Superpave
Pavement Binder Course	2 (Standard Duty) 3.5 (Heavy Duty)	HMA S0.5 Superpave
Base Course	6 (Standard Duty) 8 (Heavy Duty)	Processed Aggregate Base (M.05.01)
Subbase Course	8	M.02.02 Subbase (M.02.06, Grading B)

Pavement maintenance (e.g., crack sealing) will be required throughout the design life of the pavement, and it should be assumed by project stakeholders that pavement performance will deteriorate over time resulting from frost heave. To mitigate risks associated with frost heave, a minimum pavement section thickness (i.e., combined thickness of asphalt and non-frost susceptible base and subbase) thickness of 42-inches would be required, which would result in significant costs.

## **6.0 MATERIALS RECOMMENDATIONS**

### **6.1 ON-SITE MATERIALS**

Based on our visual soil classifications, some of the site soils that do not contain organic material may be reusable as CGF or Sand and Gravel (if the material gradation conforms to the recommendations in Section 6.0), or Common Fill. The elevated fines content (i.e., soil particles passing the No. 200 sieve) of some Site soils could make them difficult to place and compact. Success in using these materials will depend on their moisture content and prevailing weather conditions when they are excavated, placed, and compacted.

### **6.2 COMPACTED GRANULAR FILL**

Compacted Granular Fill (CGF) for use as structural fill shall consist of inorganic soil free of clay, loam, ice and snow, tree stumps, roots, and other organic matter; graded within the following limits:

Sieve Size	Percent finer by weight
4-inches	100%
No. 10	30 - 100
No. 40	10 - 90
No. 200	0 - 15

### **6.3 SAND AND GRAVEL**

Sand and Gravel for use as slab and retaining wall backfill shall consist of hard, durable sand and gravel; free of ice, clay, shale, roots, sod, rubbish, and other organic matter; graded within the following limits:



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Sieve Size	Percent finer by weight
2-inches	100%
1/2-inch	50 - 85
No. 4	40 - 75
No. 40	10 - 35
No. 200	0 - 5

#### 6.4 CRUSHED STONE

Crushed Stone for use around drains or below foundations and slabs shall consist of sound, tough, durable, rock that is graded within the following:

Sieve Size	Percent finer by weight
5/8-inches	100%
1/2-inch	85 - 100
3/8 inch	15 - 45
No. 4	0 - 15
No. 8	0 - 5

#### 6.5 COMMON FILL

Common Fill may be used for general site grading, and other areas as appropriate, or as directed by the Geotechnical Engineer or his/her representative. The material should not be used beneath sensitive structures. Common Fill should conform to the following gradation requirements:

Sieve Size	Percent finer by weight
6-inches	100%
No. 200	0 - 25

#### 6.6 MATERIAL PLACEMENT AND COMPACTION

CGF and Sand and Gravel should be placed in loose lifts not exceeding 8 inches in depth and compacted to at least 95 percent of its maximum dry density, and within 2% of optimum moisture content, as determined by ASTM D1557, Method C (Modified Proctor).

Common Fill should also be placed in loose lifts not exceeding 8 inches in depth and compacted to at least 92 percent of its maximum dry density.

Crushed Stone is considered to be “self-compacting” and would negate the need to run laboratory proctor testing and have field density testing of in-place lifts. The Crushed Stone should be plate compacted to “chink up” the working surface in lifts. We recommend placing Crushed Stone in maximum 12-inch lifts and compacting the lifts with a minimum of four passes with a vibratory plate compactor weighing a minimum of 1,000 pounds and with a minimum centrifugal force of 10,000 pounds.

Extra care should be used when compacting adjacent to walls. Hand-operated rollers or plate compactors weighing not more than 250 pounds should be used within a lateral distance of 5 feet



of walls. Where walls are buried on both sides, backfill and compaction should proceed on both sides of the wall so that the difference in top of fill on either side of the wall does not exceed 2 feet.

#### **6.7 GEOTEXTILE FABRIC**

Geotextile fabric placed around crushed stone pipe bedding or used as a separation fabric for crushed stone and soil material should meet the following criteria:

<u>Property</u>	<u>Criteria</u>	<u>Test Method</u>
Grab Strength	min. 120lbs	ASTM D4632
Static (CBR) Puncture	min. 310lbs	ASTM D6241
Trapezoid Tear	min. 50lbs	ASTM D4533
Apparent Opening Size	No. 70 (max.) U.S. Sieve Size	ASTM D4751

Fabric should be needle-punched non-woven material. Seams should be overlapped a minimum of six inches. During stone placement, the stone drop height should not exceed three feet and equipment traffic should be kept off the fabric until at least 6 to 12 inches of material is placed.

### **7.0 CONSTRUCTION RECOMMENDATIONS**

Geotechnical construction considerations include: removal of unsuitable bearing materials below proposed foundations and floor slabs levels; foundation subgrade preparation; fill material placement and compaction; reuse of excavated materials; and temporary groundwater control.

#### **7.1 REMOVAL OF BURIED STRUCTURES AND UTILITIES**

All existing substructures and utilities within the proposed building area must be removed in their entirety prior to construction of new foundations. Disturbed materials must be removed down to the level of firm, natural soil and the resulting excavations must be backfilled with CGF to achieve required subgrades. Backfill materials placed in the building area should be placed in accordance with Section 6.0.

#### **7.2 SUBGRADE PREPARATION**

Excavation to subgrade elevations for shallow foundation and slab construction should be performed using a smooth-edged bucket to minimize possible disturbance to the subgrade. Soil subgrades should be proof-compacted prior to CGF or concrete placement under the observation of a qualified Geotechnical Engineer with at least four (4) passes of a smooth-drum vibratory roller (minimum 8,000 pounds, minimum centrifugal force of 12,500 pounds) or, where approved by the Geotechnical Engineer, a vibratory plate compactor with a minimum of 2,500 pounds of centrifugal force. Any soft or loose zones identified during proof-rolling should be excavated and replaced with CGF, as necessary, and as recommended by the Geotechnical Engineer.

Final excavations should not be made until the areas are ready for CGF or concrete placement. The base of footing and slab excavations should be free of water, frost, ice, organic material, and loose soils prior to placing CGF and concrete.



To help protect foundation subgrades in wet weather conditions, consideration should be given to placing either a 4-inch (minimum) Crushed Stone layer or a 2-inch-thick layer of lean concrete over building subgrades.

### **7.3 TEMPORARY EXCAVATIONS**

The site soils are classified as OSHA Class “C” soil and can be cut at a maximum one vertical to one and a half horizontal (1V:1.5H) slope up to a maximum excavation depth of 20 feet. These maximum slope and excavation depths assume no surcharge load (i.e., stockpiles, construction equipment, etc.) at the top of the excavations or groundwater seepage.

If excavations cannot be sloped in accordance with OSHA requirements, a temporary excavation support system will be required. The system should be chosen and installed by the contractor and designed by a Professional Engineer registered in the State of Connecticut.

### **7.4 TEMPORARY GROUNDWATER CONTROL**

Some foundation excavations will require excavation below the groundwater table. We expect that temporary groundwater/storm water control can largely be accomplished by means of shallow trenches and sumps and grading the excavation to low points. The construction dewatering system means and methods should be chosen by the contractor and designed by a Professional Engineer registered in the State of Connecticut. This should include providing a discharge water management plan that avoids endangering public health and nearby property and meets applicable local, state, and environmental regulations.

## **8.0 REVIEW OF FINAL DESIGN, PLANS, AND SPECIFICATIONS**

When project plans are finalized, and specifications are available, they should be provided to DTE for review of conformance with our geotechnical recommendations. If any changes are made to the proposed building location or our assumptions of finished floor elevations, the recommendations provided in this report will need to be verified by DTE for applicability.

## **9.0 CONSTRUCTION QUALITY CONTROL**

We further recommend that DTE be retained during earthwork construction to observe excavation to footing subgrade, subgrade preparation, and fill placement and compaction in accordance with Connecticut Building Code requirements. The geotechnical engineer in the field should observe the work for compliance with the recommendations in this report, identify changes in subsurface conditions from those observed in the explorations should they become apparent, and assist in the development of design changes should subsurface conditions differ from those anticipated prior to the start of construction.

## **10.0 CLOSURE**

We trust the information presented herein is sufficient for your use to progress design of the proposed school building. We have enjoyed working with you on this project and look forward to our continued involvement. Please do not hesitate to call us if you have any questions.

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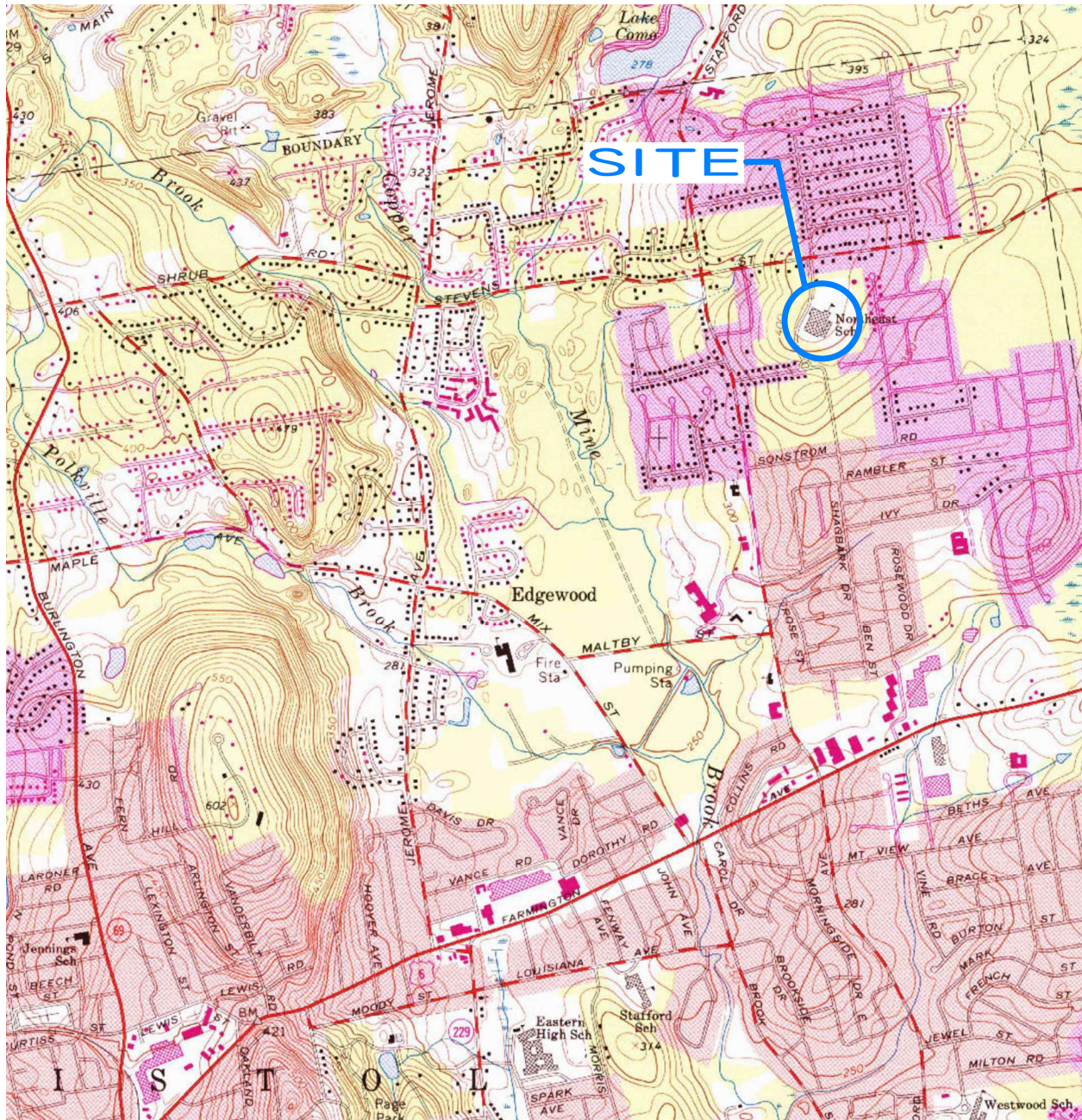
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This report is subject to the limitations included in Appendix 3.





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**DOWN TO EARTH  
CONSULTING, LLC**  
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

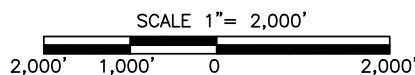
27 SIMON COMPANY DRIVE #363W  
WATERTOWN, CONNECTICUT 06795



QUADRANGLE LOCATION

**AREA PLAN  
NORTHEAST MIDDLE SCHOOL  
530 STEVENS STREET  
BRISTOL, CONNECTICUT**

REFERENCE:  
USGS TOPOGRAPHIC QUADRANGLE: BRISTOL, CT



PROJECT NO. 0015-036.00

DATE: 1/26/2024

FIGURE NO. 1

DRAWN BY: MF

REVIEWED BY: RPJ



NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
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MATCH LINE SHEET C2.4

MATCH LINE SHEET C2.3

NOTES:  
1) BASE MAP DEVELOPED FROM AN ELECTRONIC  
COMPANY, ENTITLED "GRADING & DRAINAGE PL  
BRISTOL, CT". DRAWING NO.: C-2.0. DATED: JA  
2) BORINGS WERE COMPLETED BY GENERAL B  
EARTH CONSULTING, LLC.  
3) THE LOCATIONS OF THE EXPLORATIONS WEF  
COMPANY.

QAM 2210

April 1, 2024 – Phase 1 CDs

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GEOTECHNICAL REPORT

TEST BC  
BY OTH  
TEST BC  
BY DOW

SCALE 1"=100'

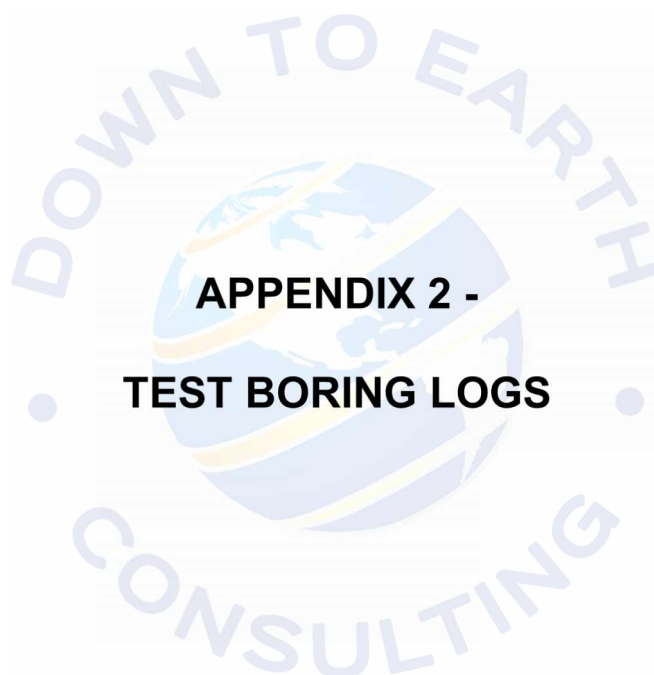
DOWN TO EARTH  
CONSULTING, LLC

PROJECT

NORTHEAST MIDDLE SCHOOL  
530 STEVENS STREET  
BRISTOL, CONNECTICUT


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STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>I-1</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>							
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>406.0</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/19/2023</u>      Date End <u>12/19/2023</u></p>									
<p>Hammer Type: <u>Lever Operated Safety Hammer</u>      <b>Groundwater Readings (from ground surface)</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Sampler Size: <u>1-3/8" I.D. Split Spoon</u></td> <td style="width: 10%;">Date <u>12/19/23</u></td> <td style="width: 10%;">Time <u>-</u></td> <td style="width: 10%;">Depth (ft) <u>1</u></td> <td style="width: 10%;">Elev. <u>405+/-</u></td> <td style="width: 40%;">Stabilization Time <u>1 hour</u></td> </tr> </table> <p>Type Drill Rig: <u>Case Mounted Mobile B-53</u></p> <p>Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u></p>			Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date <u>12/19/23</u>	Time <u>-</u>	Depth (ft) <u>1</u>	Elev. <u>405+/-</u>	Stabilization Time <u>1 hour</u>	
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date <u>12/19/23</u>	Time <u>-</u>	Depth (ft) <u>1</u>	Elev. <u>405+/-</u>	Stabilization Time <u>1 hour</u>				
<b>D E P T H</b>	<b>Casing Blows (ft)</b>	<b>SAMPLE INFORMATION</b>						<b>SAMPLE DESCRIPTION</b>	<b>STRATA</b>
		<b>Type &amp; No.</b>	<b>REC/PEN (inches)</b>	<b>DEPTH (feet)</b>	<b>BLOWS PER 6 INCHES</b>	<b>Core Time (min./ft)</b>			
1		S-1	7/24	0 to 2	6-15-21-8			Medium dense, dark brown, fine to coarse SAND, some Silt, trace (-) Roots	4"+/- Topsoil FILL
2									
3		S-2	18/24	2 to 4	10-10-19-18			Medium dense, red-brown, fine to medium SAND, some Silt, little fine to coarse fragmented Gravel	
4									
5		S-3	18/24	4 to 6	18-25-32-41			Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt	GRAVELLY SAND
6									
7		S-4	4/5	6 to 6.4	50/5"			Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt	
8								END OF EXPLORATION AT 6.4 FEET BELOW GROUND SURFACE	
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SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.


**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>I-2</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>																		
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>405.2</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/19/2023</u>      Date End <u>12/19/2023</u></p>																				
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		Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)														
1		S-1	10/24	0 to 2	3-3-2-1		Loose, dark brown, fine to medium SAND and SILT, trace (-) Roots					4" +/- Topsoil FILL								
2																				
3		S-2	9/24	2 to 3.4	17-11-14-5		Medium dense, red-brown, fine to coarse SAND, some Silt, little fine to coarse fragmented Gravel					GRAVELLY SAND								
4																				
5																				
6		S-3	11/11	5 to 5.9	14-50/5"		Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt													
7							END OF EXPLORATION AT 5.9 FEET BELOW GROUND SURFACE													
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0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

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D E P T H	Casing Blows (ft)	SAMPLE INFORMATION					SAMPLE DESCRIPTION					STRATA
		Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)						
1		S-1	17/24	0 to 2	2-9-25-26		Dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt					6" +/- Topsoil FILL
2							Medium dense, red-brown, fine to coarse SAND, little Silt, little fine to coarse Gravel					SAND
3		S-2	12/24	2 to 4	11-10-12-6							
4												
5		S-3	10/24	4 to 6	10-45-28-56							
6							Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt					SAND
7		S-4	12/24	6 to 8	50-39-31-30		Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt					
8							END OF EXPLORATION AT 8 FEET BELOW GROUND SURFACE					
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**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
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3) Cobbles and/or boulders were inferred based on observed auger chatter from about 2 to 4 feet below grade.


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1		S-1    13/13    0 to 1.1    3-5-50/1"	Loose to very dense, dark brown to red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt		9"+/- Topsoil FILL															
2																				
3					GRAVELLY SAND															
4		S-2    16/16    3 to 4.3    6-36-50/4"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt																	
5																				
6		S-3    20/24    5 to 7    15-29-36-34	Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt																	
7																				
8																				
9																				
10																				
11		S-4    8/8    10 to 10.7    60-50/2"	Very dense, red-brown, fine to coarse SAND, trace fine Gravel, trace Silt																	
12																				
13					END OF EXPLORATION AT 16.5 FEET BELOW GROUND SURFACE															
14																				
15																				
16		S-5    3/3    15 to 15.3    50/3"	Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt																	
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18																				
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0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	<div style="display: flex; justify-content: space-between;"> <div> 1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. </div> <div> 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number. </div> </div>

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2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Cobbles and/or boulders were inferred based on intermittent auger chatter from about 3 to 16.5 feet.  
4) Auger refusal encountered at about 16.5 feet below grade on inferred boulder.


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Type Drill Rig: <u>Case Mounted Mobile B-53</u>	12/13/23	-	2	410+/-	End of Drilling															
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<p><b>D E P T H</b></p>	<p><b>Casing Blows (ft)</b></p>	<p><b>SAMPLE INFORMATION</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;"><b>Type &amp; No.</b></td> <td style="width: 10%; text-align: center;"><b>REC/PEN (inches)</b></td> <td style="width: 10%; text-align: center;"><b>DEPTH (feet)</b></td> <td style="width: 10%; text-align: center;"><b>BLOWS PER 6 INCHES</b></td> <td style="width: 10%; text-align: center;"><b>Core Time (min./ft)</b></td> </tr> </table>	<b>Type &amp; No.</b>	<b>REC/PEN (inches)</b>	<b>DEPTH (feet)</b>	<b>BLOWS PER 6 INCHES</b>	<b>Core Time (min./ft)</b>	<p><b>SAMPLE DESCRIPTION</b></p>	<p><b>STRATA</b></p>											
<b>Type &amp; No.</b>	<b>REC/PEN (inches)</b>	<b>DEPTH (feet)</b>	<b>BLOWS PER 6 INCHES</b>	<b>Core Time (min./ft)</b>																
1		S-1    8/21    0 to 1.8    3-5-23-50/3"	Medium dense, dark brown, fine to coarse SAND, little fine to coarse Gravel, little Silt	9"+/- Topsoil FILL																
2																				
3																				
4																				
5																				
6		S-2    20/24    5 to 7    23-29-33-47	Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt																	
7																				
8																				
9																				
10																				
11		S-3    0/24    10 to 12    19-39-48-51	Very dense, No Recovery																	
12																				
13																				
14																				
15																				
16		S-4    6/6    15 to 15.5    69/6"	Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt																	
17																				
18																				
19																				
20																				
21		S-5    10/13    20 to 21.1    35-48-50/1"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt																	
22			END OF EXPLORATION AT 21.1 FEET BELOW GROUND SURFACE																	
23																				
24																				
25																				
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39																				
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SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.

**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-3</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>												
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>407.8</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/14/2023</u>      Date End <u>12/14/2023</u></p>														
<p>Hammer Type: <u>Lever Operated Safety Hammer</u>      <b>Groundwater Readings (from ground surface)</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Sampler Size: <u>1-3/8" I.D. Split Spoon</u></td> <td style="width: 12.5%;">Date</td> <td style="width: 12.5%;">Time</td> <td style="width: 12.5%;">Depth (ft)</td> <td style="width: 12.5%;">Elev.</td> <td style="width: 25%;">Stabilization Time</td> </tr> <tr> <td>Type Drill Rig: <u>Case Mounted Mobile B-53</u></td> <td>12/14/23</td> <td>-</td> <td>3</td> <td>405+/-</td> <td>End of Drilling</td> </tr> </table> <p>Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u></p>			Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time	Type Drill Rig: <u>Case Mounted Mobile B-53</u>	12/14/23	-	3	405+/-	End of Drilling
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time									
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<p><b>D E P T H</b></p>	<p><b>Casing Blows (ft)</b></p>	<p><b>SAMPLE INFORMATION</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%;">Type &amp; No.</th> <th style="width: 10%;">REC/PEN (inches)</th> <th style="width: 10%;">DEPTH (feet)</th> <th style="width: 10%;">BLOWS PER 6 INCHES</th> <th style="width: 10%;">Core Time (min./ft)</th> </tr> </table>	Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)	<p><b>SAMPLE DESCRIPTION</b></p>	<p><b>STRATA</b></p>					
Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)										
1		S-1    13/24    0 to 2    2-9-19-27	Medium dense, dark brown to brown, fine to coarse SAND, some Silt, little fine to coarse Gravel	7"+/- Topsoil										
2														
3		S-2    20/24    2 to 4    25-29-17-16	Dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt											
4														
5														
6		S-3    9/9    5 to 5.8    29-50/3"	Very dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt											
7				GRAVELLY SAND										
8														
9														
10														
11		S-4    6/10    10 to 10.8    28-50/4"	Very dense, brown, fine to coarse SAND, some fine Gravel, trace Silt											
12														
13														
14														
15														
16		S-5    6/6    15 to 15.5    66/6"	Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt											
17														
18														
19														
20														
21		S-6    4/4    20 to 20.3    50/4"	Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt											
22			END OF EXPLORATION AT 20.3 FEET BELOW GROUND SURFACE											
23														
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<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">SPT N-Values</th> <th style="width: 20%;">SPT N-Values</th> <th style="width: 20%;">Proportions</th> <th colspan="2" style="width: 40%;">SYMBOL KEY</th> </tr> <tr> <td>0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense</td> <td>0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard</td> <td>Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%</td> <td>1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test.</td> <td>7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.</td> </tr> </table>					SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY		0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test.	7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.
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0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test.	7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.										
<p><b>FIELD NOTES:</b> 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.</p> <p>2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.</p> <p>3) Boring relocated approximately 9 feet southwest due to utility conflict.</p>														


**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-4</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>										
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>411.7</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/13/2023</u>      Date End <u>12/13/2023</u></p>												
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<p><b>D E P T H</b></p>	<p><b>Casing Blows (ft)</b></p>	<p><b>SAMPLE INFORMATION</b></p>	<p><b>SAMPLE DESCRIPTION</b></p>	<p><b>STRATA</b></p>								
		<p>Type &amp; No.</p> <p>REC/PEN (inches)</p> <p>DEPTH (feet)</p> <p>BLOWS PER 6 INCHES</p> <p>Core Time (min./ft)</p>										
1		S-1 15/24 0 to 2 3-5-23-33	Medium dense, dark brown to red-brown, fine to coarse SAND, little Silt, little fine to coarse Gravel	9"+/- Topsoil FILL								
2												
3		S-2 17/17 2 to 3.4 35-44-50/5"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt									
4												
5												
6		S-3 16/16 5 to 6.3 27-32-50/4"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt									
7												
8												
9		S-4 0/1 8 to 8.1 50/1"	Very dense, No Recovery									
10												
11		S-5 10/10 10 to 10.8 49-50/4"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt									
12				GRAVELLY SAND								
13												
14												
15												
16		S-6 24/24 15 to 17 27-24-28-28	Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt									
17												
18												
19												
20												
21		S-7 9/9 20 to 20.8 52-50/3"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt									
22			END OF EXPLORATION AT 20.8 FEET BELOW GROUND SURFACE									
23												
24												
25												
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SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Cobbles and/or boulders were inferred based on observed auger chatter from about 3 to 10 feet below grade.  
4) Boring completed as temporary monitoring well.

**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**


 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-5</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>																								
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>412.0</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/14/2023</u>      Date End <u>12/14/2023</u></p>																										
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		<b>Type &amp; No.</b>	<b>REC/PEN (inches)</b>	<b>DEPTH (feet)</b>	<b>BLOWS PER 6 INCHES</b>	<b>Core Time (min./ft)</b>																				
1		S-1	16/24	0 to 2	3-5-23-37		Medium dense, dark brown to brown, fine to coarse SAND, some Silt, little fine to coarse Gravel	9"+/- Topsoil FILL																		
2																										
3		S-2	17/17	2 to 3.4	35-49-50/5"		Medium dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt																			
4																										
5																										
6		S-3	19/19	5 to 6.6	51-47-51-50/1"		Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt																			
7																										
8																										
9																										
10																										
11		S-4	9/9	10 to 10.8	42-50/3"		Very dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt	GRAVELLY SAND																		
12																										
13																										
14																										
15																										
16		S-5	8/11	15 to 15.9	33-50/5"		Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt																			
17																										
18																										
19																										
20																										
21		S-6	12/12	20 to 21	31-55/6"		Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt																			
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<b>SPT N-Values</b>	<b>SPT N-Values</b>	<b>Proportions</b>	<b>SYMBOL KEY</b>	
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**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.





**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-6</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>												
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>411.3</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/14/2023</u>      Date End <u>12/14/2023</u></p>														
<p>Hammer Type: <u>Lever Operated Safety Hammer</u>      <b>Groundwater Readings (from ground surface)</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Sampler Size: <u>1-3/8" I.D. Split Spoon</u></td> <td style="width: 10%;">Date</td> <td style="width: 10%;">Time</td> <td style="width: 10%;">Depth (ft)</td> <td style="width: 10%;">Elev.</td> <td style="width: 40%;">Stabilization Time</td> </tr> <tr> <td>Type Drill Rig: <u>Case Mounted Mobile B-53</u></td> <td>12/14/23</td> <td>-</td> <td>3</td> <td>408+/-</td> <td>End of Drilling</td> </tr> </table> <p>Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u></p>			Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time	Type Drill Rig: <u>Case Mounted Mobile B-53</u>	12/14/23	-	3	408+/-	End of Drilling
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time									
Type Drill Rig: <u>Case Mounted Mobile B-53</u>	12/14/23	-	3	408+/-	End of Drilling									
<p><b>D E P T H</b></p>	<p><b>Casing Blows (ft)</b></p>	<p><b>SAMPLE INFORMATION</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;"><b>Type &amp; No.</b></td> <td style="width: 10%; text-align: center;"><b>REC/PEN (inches)</b></td> <td style="width: 10%; text-align: center;"><b>DEPTH (feet)</b></td> <td style="width: 10%; text-align: center;"><b>BLOWS PER 6 INCHES</b></td> <td style="width: 10%; text-align: center;"><b>Core Time (min./ft)</b></td> </tr> </table>	<b>Type &amp; No.</b>	<b>REC/PEN (inches)</b>	<b>DEPTH (feet)</b>	<b>BLOWS PER 6 INCHES</b>	<b>Core Time (min./ft)</b>	<p><b>SAMPLE DESCRIPTION</b></p>	<p><b>STRATA</b></p>					
<b>Type &amp; No.</b>	<b>REC/PEN (inches)</b>	<b>DEPTH (feet)</b>	<b>BLOWS PER 6 INCHES</b>	<b>Core Time (min./ft)</b>										
1		S-1    14/24    0 to 2    3-9-18-24	Medium dense, dark brown to brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt	7"+/- Topsoil										
2														
3		S-2    8/24    2 to 3.4    12-25-20-14	Dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt											
4														
5														
6		S-3    10/14    5 to 6.2    25-39-50/2"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt	GRAVELLY SAND										
7														
8														
9														
10														
11		S-4    13/24    10 to 12    46-41-44-43	Very dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt											
12														
13														
14														
15														
16		S-5    9/9    15 to 15.8    47-50/3"	Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt											
17														
18														
19														
20														
21		S-6    5/5    20 to 20.3    50/4"	Very dense, red-brown, fine to medium SAND, little Silt, trace fine Gravel											
22			END OF EXPLORATION AT 20.3 FEET BELOW GROUND SURFACE											
23														
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SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.

 <b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small>		<b>PROJECT</b>				BORING NO. <u>B-7</u>		
		PROPOSED NORTHEAST MIDDLE SCHOOL				SHEET <u>1</u> of <u>1</u>		
		530 STEVENS STREET				FILE NO. <u>0015-036.00</u>		
		BRISTOL, CONNECTICUT				CHKD. BY <u>RPJ</u>		
Boring Co. <u>General Borings, Inc.</u>		Boring Location <u>See Boring Location Plan</u>		Ground Surface El. <u>411.1</u>		Datum <u>Not Available</u>		
Driller <u>Jim Casson</u>		Ground Surface El. <u>411.1</u>		Date Start <u>12/14/2023</u>		Date End <u>12/14/2023</u>		
Logged By <u>Mateusz Fekieta</u>		Date Start <u>12/14/2023</u>		Date End <u>12/14/2023</u>				
Hammer Type: <u>Lever Operated Safety Hammer</u>				Groundwater Readings (from ground surface)				
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>				Date	Time	Depth (ft)	Elev.	
Type Drill Rig: <u>Case Mounted Mobile B-53</u>				12/14/23	-	2.5	409+/-	
Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u>								
DEPTH (ft)	Casing Blows (ft)	SAMPLE INFORMATION					SAMPLE DESCRIPTION	STRATA
		Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)		
1		S-1	10/24	0 to 2	2-14-14-20		Medium dense, dark brown to brown, fine to coarse SAND, little Silt, little fine to coarse Gravel	9"+/- Topsoil
2								
3		S-2	20/24	2 to 3.4	25-24-27-35		Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt	
4								
5								
6		S-3	0/4	5 to 5.3	55/4"		Very dense, No Recovery	
7								
8								
9								
10								
11		S-4	1/2	10 to 10.2	50/2"		Very dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt	
12								
13								
14								
15								
16								
17								
18								
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SPT N-Values		SPT N-Values		Proportions		SYMBOL KEY		
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense		0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard		Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%		1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test, 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.		
FIELD NOTES: 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual. 2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors. 3) Cobbles and/or boulders were inferred based on intermittent auger chatter from about 5 to 14.5 feet below grade. 4) Auger refusal encountered at about 14.5 feet below grade on inferred boulder.								

 <b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small>		<b>PROJECT</b>		BORING NO. <u>B-8</u>				
		PROPOSED NORTHEAST MIDDLE SCHOOL		SHEET <u>1</u> of <u>1</u>				
		530 STEVENS STREET		FILE NO. <u>0015-036.00</u>				
		BRISTOL, CONNECTICUT		CHKD. BY <u>RPJ</u>				
Boring Co. <u>General Borings, Inc.</u>		Boring Location <u>See Boring Location Plan</u>						
Driller <u>Jim Casson</u>		Ground Surface El. <u>411.3</u>		Datum <u>Not Available</u>				
Logged By <u>Mateusz Fekieta</u>		Date Start <u>12/14/2023</u>		Date End <u>12/14/2023</u>				
Hammer Type: <u>Lever Operated Safety Hammer</u>		Groundwater Readings (from ground surface)						
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>		Date	Time	Depth (ft)	Elev.	Stabilization Time		
Type Drill Rig: <u>Case Mounted Mobile B-53</u>		12/14/23	-	4.5	407+/-	End of Drilling		
Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u>								
DEPTH (ft)	Casing Blows (ft)	SAMPLE INFORMATION					SAMPLE DESCRIPTION	STRATA
		Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)		
1		S-1	19/21	0 to 2	5-9-15-21		Medium dense, dark brown to brown, fine to coarse SAND, little fine to coarse Gravel, little Silt	9"+/- Topsoil           GRAVELLY SAND
2								
3		S-2	19/24	2 to 4	22-28-36-30		Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt	
4								
5								
6		S-3	6/8	5 to 5.7	18-50/2"		Very dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt	
7								
8								
9								
10								
11		S-4	6/6	10 to 10.5	50/6"		Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt	END OF EXPLORATION AT 10.5 FEET BELOW GROUND SURFACE
12								
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15								
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36								
37								
38								
39								
40								
SPT N-Values		SPT N-Values		Proportions		SYMBOL KEY		
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense		0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard		Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%		1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.		
FIELD NOTES: 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual. 2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.								


**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-9</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>												
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>411.2</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/14/2023</u>      Date End <u>12/15/2023</u></p>														
<p>Hammer Type: <u>Lever Operated Safety Hammer</u>      <b>Groundwater Readings (from ground surface)</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Sampler Size: <u>1-3/8" I.D. Split Spoon</u></td> <td style="width: 12.5%;">Date</td> <td style="width: 12.5%;">Time</td> <td style="width: 12.5%;">Depth (ft)</td> <td style="width: 12.5%;">Elev.</td> <td style="width: 25%;">Stabilization Time</td> </tr> <tr> <td>Type Drill Rig: <u>Case Mounted Mobile B-53</u></td> <td>12/14/23</td> <td>-</td> <td>3</td> <td>408+/-</td> <td>End of Drilling</td> </tr> </table> <p>Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u></p>			Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time	Type Drill Rig: <u>Case Mounted Mobile B-53</u>	12/14/23	-	3	408+/-	End of Drilling
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time									
Type Drill Rig: <u>Case Mounted Mobile B-53</u>	12/14/23	-	3	408+/-	End of Drilling									
<p><b>D E P T H</b></p>	<p><b>Casing Blows (ft)</b></p>	<p><b>SAMPLE INFORMATION</b></p> <p>Type &amp; No.   REC/PEN (inches)   DEPTH (feet)   BLOWS PER 6 INCHES   Core Time (min./ft)</p>	<p><b>SAMPLE DESCRIPTION</b></p>	<p><b>STRATA</b></p>										
1		S-1   20/24   0 to 2   2-12-17-17	Medium dense, dark brown, fine to coarse SAND, some Silt, little fine to coarse Gravel	9"+/- Topsoil FILL										
2														
3		S-2   10/24   2 to 3.4   26-28-24-25	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, some Silt	POSSIBLE FILL										
4														
5														
6		S-3   5/24   5 to 7   11-18-34-35	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, trace Roots	GRAVELLY SAND										
7														
8														
9														
10														
11		S-4   8/16   10 to 12   14-45-50/4"	Very dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt											
12														
13														
14														
15														
16		S-5   6/8   15 to 15.7   36-50/2"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt											
17														
18														
19														
20														
21		S-6   9/10   20 to 20.8   30-50/4"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt											
22			END OF EXPLORATION AT 20.8 FEET BELOW GROUND SURFACE											
23														
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25														
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31														
32														
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34														
35														
36														
37														
38														
39														
40														

SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Auger refusal encountered at about 4.5 feet below grade on inferred boulder. Boring relocated 6 feet south and advanced to 5 feet below grade prior to collecting subsequent sample.


**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-10</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>												
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>411.3</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Ray Janeiro, P.E.</u>      Date Start <u>1/12/2024</u>      Date End <u>1/12/2024</u></p>														
<p>Hammer Type: <u>Lever Operated Safety Hammer</u>      <b>Groundwater Readings (from ground surface)</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Sampler Size: <u>1-3/8" I.D. Split Spoon</u></td> <td style="width: 10%;">Date</td> <td style="width: 10%;">Time</td> <td style="width: 10%;">Depth (ft)</td> <td style="width: 10%;">Elev.</td> <td style="width: 10%;">Stabilization Time</td> </tr> <tr> <td>Type Drill Rig: <u>Track Mounted D-50</u></td> <td>1/12/24</td> <td>-</td> <td>7</td> <td>404+/-</td> <td>End of Drilling</td> </tr> </table> <p>Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u></p>			Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time	Type Drill Rig: <u>Track Mounted D-50</u>	1/12/24	-	7	404+/-	End of Drilling
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time									
Type Drill Rig: <u>Track Mounted D-50</u>	1/12/24	-	7	404+/-	End of Drilling									
<p><b>D E P T H</b></p>	<p><b>Casing Blows (ft)</b></p>	<p><b>SAMPLE INFORMATION</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%;">Type &amp; No.</th> <th style="width: 10%;">REC/PEN (inches)</th> <th style="width: 10%;">DEPTH (feet)</th> <th style="width: 10%;">BLOWS PER 6 INCHES</th> <th style="width: 10%;">Core Time (min./ft)</th> </tr> </table>	Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)	<p><b>SAMPLE DESCRIPTION</b></p>	<p><b>STRATA</b></p>					
Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)										
1		S-1    16/24    0 to 2    1-7-34-35	Dense, dark brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, with fractured cobble fragments	8" +/- Topsoil  FILL										
2														
3		S-2    14/24    2 to 4    43-29-22-16	Very dense, dark red-brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt, trace (-) Roots											
4														
5				GRAVELLY SAND										
6		S-3    0/18    5 to 6.5    11-39-60	Very dense, No Recovery											
7														
8		S-4    15/22    7 to 8.8    34-45-42-50/4"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, wet											
9														
10														
11		S-5    16/24    10 to 12    33-29-38-42	Very dense, red-brown, fine to coarse SAND, some Silt, little fine Gravel											
12														
13														
14														
15				END OF EXPLORATION AT 19 FEET BELOW GROUND SURFACE										
16		S-6    10/11    15 to 15.9    26-50/5"	Very dense, red-brown, fine to coarse SAND, little Silt, little fine Gravel											
17														
18														
19														
20														
21														
22														
23														
24														
25				END OF EXPLORATION AT 19 FEET BELOW GROUND SURFACE										
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0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Cobbles and/or boulders were inferred based on intermittent auger chatter from about 3 to 9 feet below grade.  
4) Auger refusal encountered at about 19 feet below grade on inferred boulder.


**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-11</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>						
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>411.3</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/14/2023</u>      Date End <u>12/14/2023</u></p>								
<p>Hammer Type: <u>Lever Operated Safety Hammer</u>      <b>Groundwater Readings (from ground surface)</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Sampler Size: <u>1-3/8" I.D. Split Spoon</u></td> <td style="width: 10%;">Date <u>12/14/23</u></td> <td style="width: 10%;">Time <u>-</u></td> <td style="width: 10%;">Depth (ft) <u>2.5</u></td> <td style="width: 10%;">Elev. <u>409+/-</u></td> <td style="width: 40%;">Stabilization Time <u>End of Drilling</u></td> </tr> </table> <p>Type Drill Rig: <u>Case Mounted Mobile B-53</u></p> <p>Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u></p>			Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date <u>12/14/23</u>	Time <u>-</u>	Depth (ft) <u>2.5</u>	Elev. <u>409+/-</u>	Stabilization Time <u>End of Drilling</u>
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<p><b>D E P T H</b></p>	<p><b>Casing Blows (ft)</b></p>	<p><b>SAMPLE INFORMATION</b></p>	<p><b>SAMPLE DESCRIPTION</b></p>	<p><b>STRATA</b></p>				
1		S-1    14/14    0 to 1.2    3-5-50/2"	Very dense, dark brown, fine to coarse SAND, some fine to coarse Gravel, little Silt	9"+/- Topsoil FILL				
2								
3		S-2    13/13    2 to 3.1    12-31-50/1"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt					
4								
5								
6		S-3    6/24    5 to 7    16-29-34-31	Very dense, red-brown, fine to coarse GRAVEL and fine to coarse SAND, trace Silt	GRAVELLY SAND				
7								
8								
9								
10			END OF EXPLORATION AT 8.5 FEET BELOW GROUND SURFACE					
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SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Cobbles and/or boulders were inferred based on observed auger chatter from about 5 to 8.5 feet below grade.  
4) Auger refusal encountered at about 8.5 feet below grade on inferred boulder.


**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-12</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>												
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>409.3</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/14/2023</u>      Date End <u>12/19/2023</u></p>														
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1		S-1    16/24    0 to 2    1-2-17-17	Medium dense, dark brown to red-brown, fine to coarse SAND, some Silt, little fine to coarse Gravel, trace (-) Roots		9" +/- Topsoil FILL									
2														
3		S-2    18/24    2 to 4    9-10-19-18	Medium dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt		GRAVELLY SAND									
4														
5														
6		S-3    11/24    5 to 5.7    7-18-15-17	Dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt											
7														
8														
9														
10														
11		S-4    16/20    10 to 12    21-34-42-50/2"	Very dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt											
12														
13														
14														
15														
16		S-5    0/3    15 to 15.3    50/3"	Very dense, No Recovery											
17														
18														
19														
20														
21		S-6    0/3    20 to 20.3    50/3"	Very dense, No Recovery											
22			END OF EXPLORATION AT 20.3 FEET BELOW GROUND SURFACE											
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<b>SPT N-Values</b>	<b>SPT N-Values</b>	<b>Proportions</b>	<b>SYMBOL KEY</b>
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.

**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**


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<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>410.3</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Ray Janeiro, P.E.</u>      Date Start <u>1/12/2024</u>      Date End <u>1/12/2024</u></p>														
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Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time									
Type Drill Rig: <u>Track Mounted D-50</u>	1/12/24	-	4	406+/-	End of Drilling									
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1		S-1    14/24    0 to 2    2-4-4-4	Loose, dark brown, fine to coarse SAND and SILT, little fine to coarse Gravel, trace (-) Roots	8"+/- Topsoil FILL										
2														
3		S-2    6/11    2 to 2.9    9-50/5"	Loose to very dense, dark brown, fine to coarse SAND and SILT, with fractured cobble fragments at sample tip	BOULDER										
4														
5				GRAVELLY SAND										
6		S-3    9/24    5 to 7    14-12-14-26	Medium dense, red-brown fine to coarse SAND, little fine Gravel, little Silt											
7														
8		S-4    12/18    7 to 8.5    32-49-50	Very dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt											
9				END OF EXPLORATION AT 9.5 FEET BELOW GROUND SURFACE										
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SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Auger refusal encountered on inferred boulder at about 4 feet below grade, Boring relocated about 10 feet west and advanced to 5 feet below grade prior to collecting subsequent sample.  
4) Cobbles and/or boulders were inferred based on intermittent auger chatter from about 8 to 9 feet below grade.  
5) Auger refusal encountered at about 9.5 feet below grade on inferred boulder.




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Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time									
Type Drill Rig: <u>Track Mounted D-50</u>	1/12/24	-	6.5	404+/-	1 hour									
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Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)										
1		S-1    18/22    0 to 1.8    2-3-9-50/4"	Medium dense, dark brown, fine to coarse SAND, some Silt, some fine Gravel, trace (-) Roots, moist	FILL										
2														
3														
4		S-2    12/24    3 to 5    13-4-5-22	Loose, dark brown, fine to coarse SAND and SILT, some fine to coarse Gravel, with decomposed wood at sample tip, wet											
5				GRAVELLY SAND										
6		S-3    12/24    5 to 7    13-12-9-10	Medium dense, dark brown, fine to coarse SAND, some fine to coarse Gravel, some Silt, little decomposed Wood fragments											
7														
8														
9				GRAVELLY SAND										
10		S-4    18/24    9 to 11    27-37-40-59	Very dense, red-brown, fine to coarse SAND, some fine Gravel, little Silt											
11														
12														
13				GRAVELLY SAND										
14														
15														
16		S-5    9/11    15 to 15.9    27-50/5"	Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt											
17			END OF EXPLORATION AT 15.9 FEET BELOW GROUND SURFACE											
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**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Cobbles and/or boulders were inferred based on observed auger chatter from about 2 to 3 and 12 to 13 feet below grade.  
4) Driller notes increased drilling resistance at about 8 feet below grade.


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Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time									
Type Drill Rig: <u>Case Mounted Mobile B-53</u>	12/19/23	-	9.5	399.5+/-	2 hours									
<p><b>D E P T H</b></p>	<p><b>Casing Blows (ft)</b></p>	<p><b>SAMPLE INFORMATION</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%;">Type &amp; No.</th> <th style="width: 10%;">REC/PEN (inches)</th> <th style="width: 10%;">DEPTH (feet)</th> <th style="width: 10%;">BLOWS PER 6 INCHES</th> <th style="width: 10%;">Core Time (min./ft)</th> </tr> </table>	Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)	<p><b>SAMPLE DESCRIPTION</b></p>	<p><b>STRATA</b></p>					
Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)										
1		S-1    18/24    0 to 2    2-5-8-10	Medium dense, dark brown, fine to coarse SAND, some Silt, little fine Gravel, trace (-) Roots	+/-9" Topsoil  FILL										
2														
3	S-2    10/20    2 to 3.8    4-6-30-50/2"	Dense, dark brown, fine to coarse SAND, some fine Gravel, some Silt, wet												
4														
5														
6	S-3    18/24    5 to 5.7    9-8-10-12	Medium dense, dark brown/gray, fine to medium SAND, some Silt, trace Roots, trace Organic Debris	BURIED TOPSOIL/SUBSOIL											
7														
8														
9	S-4    4/24    8 to 10    28-18-21-23	Dense, red-brown, COBBLE fragments	GRAVELLY SAND											
10														
11	S-5    14/22    10 to 11.8    16-33-41-50/4"	Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt												
12														
13														
14														
15														
16	S-6    15/22    15 to 16.8    42-39-45-50/4"	Very dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt	END OF EXPLORATION AT 16.8 FEET BELOW GROUND SURFACE											
17														
18														
19														
20														
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SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.

**NEW CONSTRUCTION OF:  
NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small>		<b>PROJECT</b>				BORING NO. <u>B-16</u>	
		PROPOSED NORTHEAST MIDDLE SCHOOL				SHEET <u>1</u> of <u>1</u>	
		530 STEVENS STREET				FILE NO. <u>0015-036.00</u>	
		BRISTOL, CONNECTICUT				CHKD. BY <u>RPJ</u>	

Boring Co. <u>General Borings, Inc.</u>	Boring Location <u>See Boring Location Plan</u>
Driller <u>Jim Casson</u>	Ground Surface El. <u>407.6</u> Datum <u>Not Available</u>
Logged By <u>Ray Janeiro, P.E.</u>	Date Start <u>1/12/2024</u> Date End <u>1/12/2024</u>


Hammer Type: <u>Lever Operated Safety Hammer</u>	<b>Groundwater Readings (from ground surface)</b>				
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date	Time	Depth (ft)	Elev.	Stabilization Time
Type Drill Rig: <u>Track Mounted D-50</u>	1/12/24	-	9	399+/-	End of Drilling
Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u>					

D E P T H	Casing Blows (ft)	SAMPLE INFORMATION					SAMPLE DESCRIPTION	STRATA
		Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)		
1		S-1	22/24	0 to 2	2-7-11-8		Medium dense, dark red-brown, fine to coarse SAND and SILT, little fine Gravel, trace (-) Roots, with organic debris at sample tip	8"+/- Topsoil  FILL
2								
3		S-2	14/24	2 to 4	9-12-15-18			
4							Medium dense, dark brown, fine to coarse SAND, some Silt, some fine Gravel, trace (-) Roots, with fractured cobble fragments at sample tip	
5								
6		S-3	10/24	5 to 7	9-7-8-24		Medium dense, dark brown, fine to coarse SAND and SILT, little fine to coarse Gravel, trace decomposed Wood fragments, moist	GRAVELLY SAND
7								
8		S-4	2/24	7 to 9	17-17-18-14		Dense, brown, fractured COBBLE fragments	
9								
10								
11		S-5	9/10	10 to 10.8	45-50/4"		Very dense, red-brown, fine to coarse SAND, some fine Gravel, little Silt, wet	
12								
13								
14								
15								
16		S-6	18/23	15 to 16.9	27-30-40-50/5"		Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, wet	END OF EXPLORATION AT 16.9 FEET BELOW GROUND SURFACE
17								
18								
19								
20								
21								
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SPT N-Values	SPT N-Values	Proportions	SYMBOL KEY
0 to 4 - Very Loose 5 to 10 - Loose 11 to 30 - Medium Dense 31 to 50 - Dense Over 50 - Very Dense	0 to 2 - Very Soft 3 to 4 - Soft 5 to 8 - Medium Stiff 9 to 15 - Stiff 16 to 30 - Very Stiff Over 30 - Hard	Trace = 0 to 10% Little = 10 to 20% Some = 20 to 35% And = 35 to 50%	1. S denotes split-barrel sampler. 2. ST denotes 3-inch O.D. undisturbed sample. 3. UO denotes 3-inch Osterberg undisturbed sample. 4. PEN denotes penetration length of sampler. 5. REC denotes recovered length of sample. 6. SPT denotes Standard Penetration Test. 7. WH denotes weight of hammer 8. WR denotes weight of rods 9. PP denotes Pocket Penetrometer. 10. FVST denotes field vane shear test. 11. RQD denotes Rock Quality Designation. 12. C denotes core run number.

**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Driller notes increased drilling resistance at about 7 feet below grade.  
4) Cobbles and/or boulders were inferred based on observed auger chatter from about 14 to 15 feet below grade.

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NORTHEAST MIDDLE SCHOOL  
BRISTOL, CT  
STATE PROJECT NO. 017-0088N**

 <p><b>DOWN TO EARTH CONSULTING, LLC</b> <small>GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING</small></p>	<p><b>PROJECT</b></p> <p>PROPOSED NORTHEAST MIDDLE SCHOOL</p> <p>530 STEVENS STREET</p> <p>BRISTOL, CONNECTICUT</p>	<p>BORING NO. <u>B-17</u></p> <p>SHEET <u>1</u> of <u>1</u></p> <p>FILE NO. <u>0015-036.00</u></p> <p>CHKD. BY <u>RPJ</u></p>										
<p>Boring Co. <u>General Borings, Inc.</u>      Boring Location <u>See Boring Location Plan</u></p> <p>Driller <u>Jim Casson</u>      Ground Surface El. <u>401.0</u>      Datum <u>Not Available</u></p> <p>Logged By <u>Mateusz Fekieta</u>      Date Start <u>12/19/2023</u>      Date End <u>12/19/2023</u></p>												
<p>Hammer Type: <u>Lever Operated Safety Hammer</u>      <b>Groundwater Readings (from ground surface)</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Sampler Size: <u>1-3/8" I.D. Split Spoon</u></td> <td style="width: 15%;">Date <u>12/19/23</u></td> <td style="width: 15%;">Time <u>-</u></td> <td style="width: 15%;">Depth (ft) <u>5</u></td> <td style="width: 15%;">Elev. <u>396+/-</u></td> <td style="width: 20%;">Stabilization Time <u>End of Drilling</u></td> </tr> </table> <p>Type Drill Rig: <u>Case Mounted Mobile B-53</u></p> <p>Drilling Method: <u>3.25-inch I.D. Hollow-Stem Augers</u></p>			Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date <u>12/19/23</u>	Time <u>-</u>	Depth (ft) <u>5</u>	Elev. <u>396+/-</u>	Stabilization Time <u>End of Drilling</u>				
Sampler Size: <u>1-3/8" I.D. Split Spoon</u>	Date <u>12/19/23</u>	Time <u>-</u>	Depth (ft) <u>5</u>	Elev. <u>396+/-</u>	Stabilization Time <u>End of Drilling</u>							
D E P T H	Casing Blows (ft)	<b>SAMPLE INFORMATION</b>					<b>SAMPLE DESCRIPTION</b>					<b>STRATA</b>
		Type & No.	REC/PEN (inches)	DEPTH (feet)	BLOWS PER 6 INCHES	Core Time (min./ft)						
1		S-1	5/24	0 to 2	1-7-15-14		Medium dense, dark brown, fine to coarse SAND, some Silt, little fine Gravel					9"+/- Topsoil/ Forest Debris
2							Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt					
3		S-2	6/9	2 to 2.8	27-50/3"							
4												
5												
6		S-3	10/22	5 to 6.8	8-12-27-50/4"		Dense, red-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt					GRAVELLY SAND
7												
8												
9												
10												
11		S-4	17/17	10 to 11.4	45-47-50/5"		Very dense, red-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt					
12												
13												
14												
15												
16		S-5	10/10	15 to 15.8	55-50/4"		Very dense, red-brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt					
17												
18												
19												
20												
21		S-6	3/4	20 to 20.3	50/4"		Very dense, red-brown, COBBLE fragments					
22							END OF EXPLORATION AT 20.3 FEET BELOW GROUND SURFACE					
23												
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**FIELD NOTES:** 1) Stratification lines represent approximate boundaries between soil types, transitions may be gradual.  
2) Water level readings have been made at times and under conditions stated, fluctuations may occur due to other factors.  
3) Auger refusal encountered on inferred boulder at about 3 feet below grade. Boring relocated about 3 feet northwest and advanced to 5 feet below grade prior to collecting subsequent sample.



## **LIMITATIONS**

### Explorations

1. The analyses and recommendations submitted in this report are based in part upon the data obtained from subsurface explorations by Down To Earth Consulting, LLC (DTE) and others. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.
3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, tidal, temperature, and other factors occurring since the time measurements were made.

### Review

4. In the event that any changes in the nature, design or location of the proposed building are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by DTE. It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

### Construction

5. It is recommended that this firm be retained to provide soil engineering services during construction of the earthworks and foundation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

### Use of Report

6. This report has been prepared for the exclusive use of Alfred Benesch and Company for specific application to the project noted in this geotechnical report in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.
7. This soil and foundation engineering report has been prepared for this project by DTE. This report is for design purposes only and is not sufficient to prepare an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to design considerations only.
8. This report may contain comparative cost estimates for the purpose of evaluating alternative foundation schemes. These estimates may also involve approximate quantity evaluations. It should be noted that quantity estimates may not be accurate enough for construction bids. Since DTE has no control over labor and materials cost and design, the estimates of construction costs have been made on the basis of experience. DTE does not guarantee the accuracy of cost estimates as compared to contractor's bids for construction costs.

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SECTION 023219 EXPLORATORY EXCAVATIONS

PART 1 GENERAL

1.1 The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

A. Section Includes:

1. Excavation of test pits where it may be necessary to locate or examine soils, groundwater, drains, pipes, rock, utilities, subsurface structures, or any other obstacles or subsurface conditions.
2. Stockpiling, management, and disposal of surplus or unsuitable material.
3. Backfilling and compacting of test pits with suitable material.

B. Exploratory excavations shall be conducted where shown on the Drawings, where directed or approved by Engineer, and as Contractor may deem necessary to locate or examine subsurface conditions as part of his work.

C. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

D. Contractor is responsible for all health and safety.

1.3 PAYMENT

A. Exploratory excavation work conducted by Contractor for his use shall be considered incidental work and shall be included in Contractor's base price for the project. Contractor shall be responsible for any required backfilling with suitable materials, disposal of unsuitable excavated materials, and restoration of the excavation area.

1.4 REFERENCES

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

B. United States Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

1.5 SAFETY

A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.

B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint

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as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.

- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

#### 1.6 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Utility Mark-out
  - 1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).
  - 2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.
  - 3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.
- C. Utility Coordination
  - 1. Inform all utility owners of the necessity of test pit work. Provide reasonable advance notice to allow for coordination.
  - 2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.
  - 3. If so desired by the respective utility owners, all or part of the work under this Section may be accomplished by their crews and/or supervised by them.
- D. Utility Protection
  - 1. Safeguard and protect from damage any utility to remain in service. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.



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2. Where utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.
3. When uncharted or incorrectly charted piping or utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

**E. Retaining Structures**

1. Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utilities, paving, light standards, piping or conduit. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

**1.7 SEQUENCING**

- A. If test pits are required during the work to evaluate unforeseen conditions, notify Engineer as soon as the need for such work is known.
- B. Notify Engineer and/or utility companies of any conflicts or other conditions observed which may require design revisions, relocations, and/or adjustment. No work shall be started within areas where conflicts or other conditions are observed which require design revisions, relocations, and/or adjustment until authorized by Engineer.

**PART 2 PRODUCTS – NOT USED**

**2.1 SOILS**

- A. Refer to Section 31 2310 – Earthwork.

**PART 3 EXECUTION**

**3.1 EXCAVATION**

- A. Test pit excavation and backfill shall comply with applicable provisions of earthwork and excavation as indicated in other applicable Specification Sections.
- B. Excavation of test pits shall be accomplished by such means as are required to ensure that underground utilities or structures which may be encountered are not damaged.
- C. Contractor shall measure and record the size, configuration, exact horizontal and vertical location of all utilities, pipes or other conditions/obstacles encountered.
- D. Contractor shall be solely responsible for any damages incurred during excavation operations. Any such damages shall be repaired or replaced by Contractor to the satisfaction of the facility owner/operator, responsible/administering agency, and/or Engineer. Whether repair and/or replacement is Conducted by Contractor or must be conducted by owner/operator or responsible/administering agency, any and all costs thereof, including those costs associated with planning, coordination and owner/operator or responsible/administering agency personnel, shall be borne by Contractor.
- E. Where an existing pavement has been removed for test pit excavation, the surface shall be restored in accordance with the Drawings and Specifications. In all other areas, the surface of

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test pit areas shall be backfilled and the surface restored to a condition equal to original, unless otherwise indicated by Engineer.

END OF SECTION 023219

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SECTION 024113 – UTILITY DEMOLITION AND ABANDONMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. Section includes:
1. Termination of utility services.
  2. Demolition or abandonment of drainage, sewer, and water pipe
  3. Demolition or abandonment of miscellaneous below-grade utilities and related facilities including but not necessarily limited to electric and communications ducts, steam lines, and gas lines.
  4. Demolition or abandonment of manholes, catch basins, vaults, and similar utility structures.
  5. Demolition or abandonment of above-grade utilities and related facilities including but not necessarily limited to electric, telephone, cable systems, and data communications.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut.
1. State of Connecticut Solid Waste Management Regulations, Sections 22a-209 including any amendments thereto.
  2. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.
- D. ASTM International (ASTM)
1. ASTM C33 – Standard Specification for Concrete Aggregates.
  2. ASTM C55 – Standard Specification for Concrete Building Brick.
  3. ASTM C91 – Standard Specification for Masonry Cement.
  4. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

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5. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
6. ASTM C 150 – Standard Specification for Portland Cement.
7. ASTM C230 – Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
8. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
9. ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
10. ASTM C476 – Standard Specification for Grout for Masonry.
11. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

#### 1.4 SAFETY

- A. Conduct the work of this Section in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.
- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

#### 1.5 SUBMITTALS

- A. Abandonment procedures required by the owner of each utility prior to performing the work of utility termination/cutting/capping/plugging.
- B. Material specifications and shop drawings for all materials and equipment furnished under this section, prior to performing the work of utility abandonment.
- C. Schedule indicating the timing of termination for each utility.
- D. Copies of permits, licenses, approvals, insurance, or bonds associated with termination of utility service.
- E. Copies of utility termination letters confirming termination of service from each utility owner/operator.
- F. Quality Control Submittals (prior to commencement of work)
  1. Schedule of demolition activities.

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2. Methods of demolition, including sequence and equipment proposed for same.
- G. Contract Closeout Submittals (prior to authorization of final payment):
  1. As-built drawings showing locations of all terminated/cut/capped/plugged utilities and service disconnections at or before project close-out.

## 1.6 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Utility Mark-out
  1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).
  2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.
  3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.
- C. Utility Coordination
  1. Inform all utility owners of the necessity of test pit work. Provide reasonable advance notice to allow for coordination.
  2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.
  3. If so desired by the respective utility owners, all or part of the work under this Section may be accomplished by their crews and/or supervised by them.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Comply with the material specifications required by the owner of each utility. Where such material specifications may conflict with this Specification, utility owner's requirements shall prevail.
- B. Gravel Borrow: Conform to applicable Specifications.
- C. Sand: ASTM C33.
- D. Portland Cement: ASTM C150, Type II.
- E. Masonry Cement: ASTM C91.
- F. Mortar Aggregate: ASTM C144, standard masonry type, clean, dry, free of deleterious materials.
- G. Concrete: Design of mix in accordance with ASTM C94; ASTM C150, Type II Portland Cement, washed and graded sand, and aggregate with maximum size of 1-inch; or pre-packaged concrete mix with maximum aggregate size of 1-inch, ASTM C387. Minimum 28-day compressive strength of 4,000 psi.

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- H. Masonry Mix: Washed and graded mason sand, lime, and Portland Cement, ASTM C270; or pre-packaged, dry, sand/lime/cement mortar mixture, ASTM C387. Minimum 28-day compressive strength of 1,800 psi (Type S).
- I. Grout: Bagged, pre-mixed formulations of non-shrink grout shall meet the requirements of ASTM C1107, Grade B or site mixed, ASTM C476.
  - 1. Unconfined compressive strength: 7,500 psi at 28 days.
  - 2. Grout shall be non-metallic, non-gaseous, and non-shrink when tested in accordance with ASTM C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees F to 90 degrees F.
  - 3. Mix Design: Obtain prior written approval of Engineer for any proposed mix design. Mix design shall include the proportions of hydraulic cement, potable water, fine aggregates, expansive agent, and any other necessary additive or admixture.
  - 4. Grout shall be mixed to a flowable consistency as determined by ASTM C230. All bagged material shall be clearly marked with the manufacturer's name, date of production, batch number, and written instructions for proper mixing, placement and curing of the product.
  - 5. Contractor may formulate and design a grout mix for use on the project in lieu of using a pre-bagged product.
- J. Water: Potable.
- K. Solid Concrete Masonry Unit: ASTM C55, sized per pipe diameter to minimize requirements for cutting.

### **PART 3 EXECUTION**

#### **3.1 GENERAL**

- A. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.
- B. Existing utilities at the Project Site have not been clearly defined as to location, size, and as-built condition, and all utility information shown on the Drawings or described herein must be considered approximate.
- C. Primary structures and other site features are shown on the Drawings; other smaller structures and features not shown on the Drawings may exist and shall be demolished as part of the work of this Section at no additional cost.
- D. Contractor shall have sole responsibility for verification of actual field conditions. Contractor shall bear full responsibility for obtaining information regarding the location, layout, and as-built configuration of existing site improvements, including aspects of such improvements which are not readily visible, including but not necessarily limited to above-ground and underground utilities, utility structures, their connections, and other above- and below-grade construction that may affect, or be affected by, the work of this Section.
- E. Utility services to buildings outside the limits of work shall be maintained and all resulting costs or charges shall be the responsibility of Contractor.

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- F. Although surficial features such as manholes, catch basins, valves and junction boxes may be visible and/or shown on the Drawings, Contractor is required to perform exploratory excavations as he deems appropriate to ascertain the location and nature of all subsurface utilities components which are to be terminated, abandoned, or demolished, or otherwise affected by the work.
- G. Provide all required coordination with owners of the various utilities serving, or present at, the Project Site as required to complete termination, demolition and abandonment work.
- H. Prior to physically cutting, disconnecting, demolishing or abandoning any facility, verify that service has been terminated and no active connections remain.
- I. Coordinate as required for permanent termination of service, temporary termination of service, relocation of facilities, abandonment of facilities, demolition of facilities, cutting, capping, plugging, and bracing.
- J. Comply at all times with the procedures for terminations of utility services as required by the owner of each utility.
- K. When utilities are encountered that are not indicated on the Drawings, notify Engineer before proceeding with the work.

### 3.2 PROTECTION OF UTILITIES

- A. Locate and identify existing utilities that are to remain and protect them from damage. Provide protection as required such as marking, blocking, bracing, stabilizing, supporting, and retaining.
- B. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.
- C. When uncharted or incorrectly charted utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.
- D. Utilities to remain which are damaged by Contractor shall be repaired/replaced to the satisfaction of the utility owner at Contractor's expense.
- E. Retaining Structures
  - 1. Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utilities, paving, light standards, piping or conduit. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

### 3.3 UTILITY TERMINATION

- A. Termination: Where "Terminate" is indicated, permanently terminate utility service as indicated on the Drawings in accordance with each utility owner's specific requirements, or coordinate with the utility owner in those cases where the utility owner will perform termination.
- B. Coordinate and secure required permits, licenses, approvals, insurance, or bonds associated with termination of service.
- C. Coordinate inspections by utility company personnel, or if privately-owned, coordinate inspections by qualified, authorized personnel on behalf of the utility owner.

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- D. Provide completed and executed utility termination forms as required by each utility owner's requirements.
- E. Secure any required utility termination letters from each utility which confirm that service has been terminated and no active connections remain.
- F. Termination Procedure
  - 1. Water
    - a. Do not impact any water pipe that may be constructed of asbestos-containing materials unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein.
    - b. Cut and cap water pipe as indicated on the Drawings or in accordance with the water utilities' requirements. Do not leave "dead-end" pipe runs.
    - c. Provide restraining blocks at all capped ends.
  - 2. Electrical and Communications
    - a. Remove conductors to nearest structure unless otherwise indicated. Plug openings in structures per the details or in accordance with the utilities' requirements.
    - b. Cut and cap conduits at each end. Caps shall match conduit type.
    - c. Direct-Bury Cable: Comply with the cable owner's requirements.
    - d. Secure termination documentation.
  - 3. Gas
    - a. Comply with gas company requirements.
  - 4. Steam
    - a. Prior to impacting any steam pipe, confirm that no asbestos-containing materials are present, or confirm that all asbestos-containing materials have been properly abated.
    - b. Provide concrete plug at open ends.

**3.4 UTILITY ABANDONMENT**

- A. Abandonment: Where "Abandon" or "Abandon in-place" is indicated, terminate utility service, cut, cap and otherwise separate the facility from portions to remain and implement abandonment procedure as defined herein.
- B. Sewer and Drainage Systems
  - 1. Less than 6 inches in diameter: Provide 6-inch concrete plug at open ends on either side of the length to be abandoned as indicated on the Drawings.



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2. Greater than 6 inches in diameter: Fill abandoned section with grout/flow-fill and provide 6-inch concrete plugs on either side of the length to be abandoned as indicated on the Drawings.
  - a. Where the filling of pipe is called-for, submit plan of proposed procedure to the owner of such utility and Engineer for approval.
  - b. Filling of pipe shall be with pressure (pumping) methods.
3. Where the filling of pipe or conduit is called-for, Contractor shall submit a plan of his proposed procedure to the owner of such utility and Engineer for approval.
4. All structures which are to be abandoned in-place shall have their tops or roof slabs removed and floor slabs broken so as to permit the free passage of water.
5. Unless otherwise indicated, structures which are to be abandoned in-place may be demolished such that only that portion of the structure from finished grade to a point five feet below finished grade are removed.

**C. Water Pipe**

1. Do not impact any water pipe that may be constructed of asbestos-containing materials unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein.
2. Cut and cap water pipe on either side of the length to be abandoned as indicated on the Drawings.
3. Provide restraining blocks at all capped ends of water pipe to remain in service.

**D. Electrical and Communications**

1. Remove conductors to nearest structure unless otherwise indicated.
2. Cut and cap conduits on either side of the length to be abandoned as indicated on the Drawings. Caps shall match conduit type.

**E. Gas**

1. Comply with gas company requirements.

**F. Steam**

1. Prior to impacting any steam pipe, confirm that no asbestos-containing materials are present, or confirm that all asbestos-containing materials have been properly abated.
2. Provide concrete plug on either side of the length to be abandoned as indicated on the Drawings.

**G. Utility Structures**

1. Comply with utility owner's requirements.
2. All structures which are to be abandoned in-place shall have their tops or roof slabs removed and floor slabs broken so as to permit the free passage of water.
3. Unless otherwise indicated, structures which are to be abandoned in-place may be demolished such that only that portion of the structure from finished grade to a point five feet below finished grade are removed.

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4. Backfill to match adjacent grade and restore surface area to match adjacent grade unless otherwise indicated.

### 3.5 UTILITY DEMOLITION

- A. Where "Remove," "Demolish," or "R&D" is indicated on the Drawings, such facility or structure shall be completely removed and disposed-of, after termination.
- B. Subsurface Utilities: Demolition shall include complete removal of the utility system and any associated concrete encasement, catch basins and related structures; sanitary sewerage manholes, pumps, and related facilities; valves, backflow devices, vents, reducers, couplings, meters, hydrants, fittings, thrust blocks, anchors; vaults, pull boxes, splice boxes, and handholes; or other ancillary components of the utility located within the limits to be demolished. The plugging or capping of utilities at the limit of demolition shall be as indicated on the Drawings. Where no plugging or capping is shown, comply with the requirements for utility termination at the limit of demolition.
- C. Above-grade Utilities: Demolition shall include complete removal of the utility system and any associated utility poles, guys, wires, transformers, light standards, utility and light pole foundations, supports and ancillary equipment.
- D. Do not demolish any utility until termination and plugging/capping has been completed and verified.
- E. Prior to the demolition of any lighting system, verify that power supplies which may be shared with other lighting systems outside the Project Limits have been segregated.
- F. Asbestos-Containing Materials
  1. Do not impact any asbestos-insulated utility where "Remove" or "Demolish" is indicated on the Drawings until all asbestos-containing materials have been properly abated and verification of same has been either
    - a. Completed and verified by qualified personnel; or
    - b. If asbestos abatement specifications are part of the contract documents the work has been completed by Contractor's qualified personnel or subcontractor in accordance with the requirements contained therein.
  2. Do not impact any asbestos-containing pipe where "Remove" or "Demolish" is indicated on the Drawings unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein. If asbestos abatement specifications are not part of the contract documents coordinate with Owner's abatement contractor for completion of the work.

### 3.6 MATERIAL DISPOSITION

- A. Salvage of Utility Materials
  1. If requested by the utility owner, frames and covers of manholes and catch basins to be demolished or abandoned shall remain the property of the utility owner. They shall be removed and transported to a designated storage area by Contractor.
  2. Notify the utility owner at least 24 hours before salvaged materials are transport so that the exact place and time for delivery can be arranged.

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3. Other utility materials which are to be salvaged or reused are indicated on the Drawings.

**B. Disposal of Utility Materials**

1. The loading of utility demolition materials for disposal shall be performed in a manner that prevents materials and activities from generating excessive dust and ensure minimum interference with roads, sidewalks and streets both onsite and offsite.
2. Transport of all materials off-site shall be in accordance with applicable Department of Transportation Regulations. All utility demolition materials leaving the site shall become the property of Contractor.
3. Disposal of utility demolition materials shall be conducted in accordance with all applicable regulations and occur only at facilities approved/licensed or permitted by the Connecticut Department of Energy and Environmental Protection.
4. Disposal of Demolition Materials: All materials resulting from utility demolition shall be removed from the Project Site by Contractor for disposal, reuse, salvage or recycling. Disposal shall be conducted in accordance with all applicable regulations.

**3.7 FILL AND BACKFILL**

- A. Backfill excavations from utility work in accordance with Specification Section 31 2310 – Earthwork.
- B. Backfill excavations from utility work in accordance with applicable Specification Sections.

**3.8 DOCUMENTATION**

**A. Field Identification**

1. Physically mark the location of each subsurface utility termination with a surveyor's stake, with such stake identifying the utility type and depth below grade. Where the use of stakes at a utility termination location may be inappropriate, Contractor shall provide staking at an adjacent location(s) and include appropriate offset dimensions or other suitable demarcation.

**B. As-Built Drawings**

1. Provide as-built documentation for each utility termination, including location, depth, and method and material of construction for termination. Such as-built documentation shall be noted on the appropriate Drawings.
2. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relieve Contractor from satisfying the requirements of local permitting authorities.
3. As work progresses, record the following on two (2) sets of Drawings:
4. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.
5. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
6. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.

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7. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.
8. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

**3.9 CLEAN UP**

- A. Contractor shall remove all debris, residuals, and materials at the conclusion of utility termination, demolition, and abandonment activities.

END OF SECTION 024113

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**SECTION 024123 SITE DEMOLITION**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

**1.2 SUMMARY**

- A. Section includes:
  - 1. General Site Demolition.
  - 2. Demolition of site structures, retaining walls, signage, light standards, foundations and appurtenances, pavement, curbing, and similar site improvements.
  - 3. Filling of voids and excavations resulting from site demolition.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

**1.3 REFERENCES**

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut.
  - 1. State of Connecticut Solid Waste Management Regulations, Section 22a-209 including any amendments thereto.

**1.4 DEFINITIONS**

- A. Demolition: Any operation including the dismantling or wrecking of a structure, assembly, appurtenance, or any portion thereof, including major and minor components, parts, and systems. Demolition shall be inclusive of the removal, handing, processing, segregation, loading, and proper off-site disposition of materials. Demolition shall be interpreted as complete and total removal unless otherwise indicated. The term Remove shall be synonymous with Demolition.
- B. Bulky Waste: Land clearing debris and non-contaminated or hazardous waste material resulting directly from demolition activities other than Clean Fill, including such materials as tree stumps, tree tops, concrete, wood, brick, plaster, roofing materials, wallboard, metals, carpeting, insulation, furniture, and furnishings. Bulky Waste shall include Construction and Demolition Debris and Construction and Demolition Waste.

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**1.5 SAFETY**

- A. Conduct the work of this Section in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.
- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

**1.6 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Utility Mark-out
  - 1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).
  - 2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.
  - 3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.
- C. Utility Coordination
  - 1. Inform all utility owners of the necessity of test pit work. Provide reasonable advance notice to allow for coordination.
  - 2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.
  - 3. If so desired by the respective utility owners, all or part of the work under this Section may be accomplished by their crews and/or supervised by them.

**1.7 REGULATORY REQUIREMENTS**

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- A. Comply with all applicable federal, state, and local safety and health requirements regarding all aspects of the work. Do not proceed until all permits or other approvals are secured.
- B. Contractor is bound to comply with any project-related permits or approval obtained by Owner, including all requirements of such permit and representations contained in permit application as though Contractor were the permittee. Requirements and conditions set forth in Owner-obtained project-related permits and permit applications shall be binding on Contractor just as any Specification would be.
- C. Do not close or obstruct roadways, sidewalks, hydrants, or other infrastructure without permits or authorization from local municipal authorities or other authorities having jurisdiction.

**PART 2 PRODUCTS – NOT USED**

**PART 3 EXECUTION**

**3.1 IDENTIFICATION OF EXISTING FEATURES**

- A. Prior to commencing construction activities, Contractor shall identify and delineate those areas or specific improvements that are not to be disturbed. Areas or specific improvements within the Limits of Work/Contract Limits and general work areas which are not to be disturbed shall be clearly marked or fenced. Monuments and markers shall be protected before construction operations commence. Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting designated areas, specific improvements, monuments, and markers at the Project Site.

**3.2 PROTECTION OF EXISTING FEATURES**

**A. General**

- 1. All areas or specific improvements, including but not limited to vegetation, utilities, poles, wires, fences, curbs, monuments/property-line markers, and other structures, which must be preserved in place without being temporarily or permanently relocated shall be carefully supported and otherwise protected from damage by Contractor.
- 2. As excavation/demolition work approaches underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.

**B. Pavements**

- 1. On paved surfaces to remain, Contractor shall not use or operate heavy equipment, other power-operated equipment, or store tools, equipment, or materials which may mar, cut, or otherwise damage such surfaces. If there is no alternative to the operation of heavy equipment, other power-operated equipment, or storage of tools, equipment, or materials on paved surfaces to remain, Contractor shall take all measures necessary to protect such surfaces.
- 2. All surfaces, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of construction operations. Such restoration shall meet the approval of Engineer and may include repair or complete replacement at Contractor's expense.

**C. Planted Areas**

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1. All planted areas, including lawn/turf areas and landscaped areas, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of construction operations.

**D. Utilities**

1. Locate and identify existing utilities that are to remain and protect them from damage. Provide protection as required such as marking, blocking, bracing, stabilizing, supporting, and retaining.
2. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.
3. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.
4. Where known utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.
5. When uncharted or incorrectly charted utilities are encountered, stop work and notify Engineer. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

- E. Retaining Structures:** Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utility systems, paving, or other improvements. Contractor assumes responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

**3.3 SITE DEMOLITION**

- A.** Conduct site demolition as shown on the Drawings.
- B.** Conduct site demolition operations in a manner that will prevent damage to adjacent structures, utilities, pavements and other facilities to remain.
- C.** Remove from the site and properly dispose of all materials resulting from site demolition operations.

**3.4 DUST CONTROL**

- A.** Implement fugitive dust suppression to prevent unacceptable levels of dust resulting from site demolition operations or other activities required by the Contract Documents. It shall be the Contractor's responsibility to supervise fugitive dust control measures and to monitor airborne particulate matter. Comply with applicable provisions of Section 01 5714 – Temporary Dust Control.

**3.5 REPLACEMENT**

- A.** In case of damage, Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. When the Owner does not wish to make the repairs themselves, all damage shall be repaired by Contractor, or, if not promptly done by him, Engineer may have the repairs made at the expense of Contractor.



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- B. Contractor shall patch, repair and/or replace all adjacent materials and surfaces damaged through the prosecution of work at no expense to Owner. All repair and replacement work shall match the existing in-kind. Final acceptance of said work shall be at the sole judgment of Owner.

END OF SECTION 024123



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SECTION 033200 – SITE CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes
  - 1. Site cast-in-place concrete, including but not necessarily limited to, sidewalks, ramps, driveways, curbing, pads, bases, retaining walls, and thrust blocks.
  - 2. All facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the Work shown on the Drawings and as specified herein.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM)
  - 1. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  - 2. ASTM A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
  - 3. ASTM A767 – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
  - 4. ASTM A775 – Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
  - 5. ASTM A996 – Standard Specification for Rail-Steel and Axle-Steel Deformed Bars or Concrete Reinforcement.
  - 6. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

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7. ASTM C29 – Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
8. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
9. ASTM C33 – Standard Specification for Concrete Aggregates.
10. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
11. ASTM C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
12. ASTM C70 – Standard Test Method for Surface Moisture in Fine Aggregate.
13. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
14. ASTM C117 – Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
15. ASTM C127 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
16. ASTM C128 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
17. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
18. ASTM C138 – Standard Test Method for Density (“Unit Weight”), Yield, and Air Content (Gravimetric) of Concrete.
19. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
20. ASTM C150 – Standard Specification for Portland Cement.
21. ASTM C156 – Standard Test Method for Water Retention by Concrete Curing Materials.
22. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
23. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
24. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
25. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
26. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
27. ASTM C233 – Standard Test Method for Air-Entraining Admixtures for Concrete.
28. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

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- 29.ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- 30.ASTM C311 – Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
- 31.ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
- 32.ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
- 33.ASTM C566 – Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying.
- 34.ASTM C595 – Standard Specification for Blended Hydraulic Cements.
- 35.ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 36.ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- 37.ASTM C685 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
- 38.ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
- 39.ASTM C803 – Standard Test Method for Penetration Resistance of Hardened Concrete.
- 40.ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
- 41.ASTM C979 – Standard Specification for Pigments for Integrally Colored Concrete.
- 42.ASTM C989 – Ground Granulated Blast-Furnace Slag for Use in Concrete Mortars.
- 43.ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
- 44.ASTM A1078 – Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement.
- 45.ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- 46.ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- 47.ASTM D2628 – Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
- 48.ASTM D4397 – Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
- 49.ASTM D5249 – Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.

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- 50. ASTM D5893 – Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
- 51. ASTM E329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- D. Concrete Reinforcing Steel Institute (CRSI).
  - 1. CRSI Manual of Standard Practice, latest edition.
- E. State of Connecticut
  - 1. 2016 Connecticut State Building Code, including all Amendments, Supplements, and Errata.
- F. American Concrete Institute (ACI)
  - 1. ACI 224R – Control of Cracking on Concrete Structures.
  - 2. ACI 224.3R – Joints in Concrete Construction.
  - 3. ACI 301 – Specifications for Structural Concrete.
  - 4. ACI 302.1R – Guide for Concrete Floor or Slab Construction.
  - 5. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete.
  - 6. ACI 305R – Guide to Hot Weather Concreting.
  - 7. ACI 306R – Guide to Cold Weather Concreting.
  - 8. ACI 308R – Guide to Curing Concrete.
- G. American Welding Society (AWS).
  - 1. AWS A5.1/A5.1M (2004; Errata 2004) Carbon Steel Electrodes for Shielded Metal Arc Welding.
  - 2. AWS D1.4/D1.4M (2005; Errata 2005) Structural Welding Code – Reinforcing Steel.

#### 1.4 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section “Sustainable Design Requirements” and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

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4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

**1.5 SUBMITTALS**

- A. For each type of specially furnished concrete provide a description of methods and the sequence of placement.
- B. Manufacturer's catalog data for the following items shall include printed instructions for admixtures, bonding agents, epoxy-resin adhesive binders, waterstops, and liquid chemical hardeners:
  1. Concrete Aggregates.
  2. Portland Cement.
  3. Ready-Mix Concrete.
  4. Form Facing Materials.
  5. Reinforcement Materials.
  6. Joint Materials.
  7. Water-Vapor Barrier Subgrade Cover.
  8. Bonding Materials.
  9. Finish Materials.
  10. Concrete Curing Materials.
  11. Form release agent.
  12. Concrete coloring additive.
  13. Elastomeric joint sealant.
  14. Preformed joint filler
- C. Submit samples of the following:

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1. Preformed joint filler.
2. Manufacturer's color charts showing full range of colors available.
3. Cured samples of elastomeric joint sealants in the color(s) selected.

**D. Design Data**

1. Mix Design data for each class of Ready-Mix Concrete shall be submitted at least 15 calendar days prior to start of specified work.
2. Mix Design data for each type of integrally-colored concrete mix called-for shall be submitted at least 15 calendar days prior to start of specified work.

**E. Test Reports**

1. Submit test reports for all testing conducted under this Section.

**F. Certificates**

1. Submit certificates for the following:
  - a. Concrete Design Mixes.
  - b. Concrete Aggregates.
  - c. Welding Procedures. Welding Procedures shall be in accordance with AWS D1.4/D1.4M. Certificates for Welder Qualifications shall be in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.
  - d. Mill certificates for Steel Bar.
2. Certificates for concrete shall contain project name, title/number, date, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer, brand name of manufactured materials, material name, values as specified for each material, and test results.

**G. Manufacturer's Instructions**

1. Installation instructions shall indicate the manufacturer's recommended method and sequence of installation for the following items:
  - a. Admixtures
  - b. Bonding Materials
  - c. Waterstops
  - d. Liquid Chemical Hardener

**1.6 QUALITY ASSURANCE**

- A. Dimensions, locations, and details of equipment pads, anchors, supports, and similar features indicated on the Drawings are approximate. Manufacturer's approved shop drawings of



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equipment to be supported, anchored, or contained thereby shall be consulted for exact location, size and details.

- B. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.
- C. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- D. Welder qualifications: Welder qualifications shall be verified in accordance with AWS D1.4/D1.4M or under an equivalent qualification test approved in advance. Welders shall be permitted to do only the type of welding for which each is specifically qualified.
- E. Concrete testing: Concrete testing shall be performed by an approved Testing Agency/Testing Laboratory experienced in sampling and testing of concrete. Testing Agency/Testing Laboratory shall meet the requirements of ASTM E329.

#### 1.7 MOCKUPS

- A. Where mockups are called-for, comply with the following:
  - 1. At location on the Project Site selected by Engineer, place and finish 100 square foot mockup section for examination. Mockup to be constructed by the installer who will actually perform the work for the Project.
  - 2. For accurate color, the quantity of concrete mixed to produce the sample should not be less than 3 cubic yards (or not less than 1/3 the capacity of the mixing drum on the ready-mix truck) and should always be in full cubic yard increments. Excess material shall be discarded according to local regulations.
  - 3. For colored concrete, record the amount of integral colorant, dry colorant, or chemical stain needed per square foot of application to establish coverage rates for the work.
  - 4. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control construction, and expansion joints in sample panels.
  - 5. Retain samples of cements, sands, aggregates and color additives used in mockup for comparison with materials used in remaining work.
  - 6. Accepted mockup provides visual standard for all work.
  - 7. Mockup shall remain through completion of work for use as a quality standard for finished work.
  - 8. Provide suitable protections to preclude damage to mockup.
  - 9. Remove mockup when directed.

#### 1.8 TESTING

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- A. Owner will retain a testing entity to perform observation and testing of the work under this Section. The testing entity's presence does not constitute supervision or direction of Contractor's work. Neither the presence of the testing entity nor any observations and testing performed by him, nor any notice or failure to give notice shall excuse Contractor from conformance with these Specifications or from defects discovered in his work.
- B. Testing shall include sampling and testing concrete materials proposed for use in the work and testing the design mix for each class of concrete.
- C. Tests will be required to determine whether the concrete being produced complies with the standard of quality and strength as specified.
- D. Concrete Replacement: Failure of any test or to follow proper installation procedures will require that the concrete be removed and properly replaced at the Contractor's expense.

**1.9 DELIVERY, STORAGE AND HANDLING**

- A. Schedule delivery of concrete to provide consistent mix times from batching until discharge. Mix times shall meet manufacturers' written recommendations.
- B. Packaged materials shall be delivered to the project site in their original, unopened package or container bearing label clearly identifying manufacturer's name, brand name, material, weight or volume, and other pertinent information. Packaged materials shall be stored in their original, unbroken package or container in a weather-tight and dry place until ready for use in the work.
- C. Unpackaged aggregates shall be stored to avoid excessive segregation, contamination with other materials or other size aggregates, or freezing.
- D. Reinforcement and other metal items shall be protected from corrosion and shall be kept free from ice, grease, and other coatings that would destroy or reduce bond.
- E. Colored Admixture: Comply with manufacturer's instructions. Deliver colored admixtures in original, unopened packaging. Store in dry condition.

**1.10 PROJECT CONDITIONS**

- A. Environmental Requirements
  - 1. Avoid placing concrete if rain, snow, or frost is forecast within 24-hours.
  - 2. Protect fresh concrete from rain, moisture, and freezing.
  - 3. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.

**PART 2 PRODUCTS**

**2.1 PORTLAND CEMENT**

- A. Cement: ASTM C 150. One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.
- B. Unless otherwise specified, cement shall be Type IA.

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**2.2 READY-MIX CONCRETE**

A. Ready Mix Concrete: Portland Cement Concrete, air-entrained, ASTM C94.

1. Compressive Strength:

- a. Unless otherwise indicated, minimum compressive strength at 28 days shall be 4,000 psi minimum.
- b. Sidewalks, stairs and landings, pedestrian and vehicle ramps, and curbing: Minimum compressive strength at 28 days shall be 4,500 psi minimum.

2. Water/cement ratio: Maximum 0.45.

3. Air content by volume: 6 percent  $\pm$  1 percent, ASTM C231 (primary method) or ASTM C173 (secondary method).

4. Slump: no less than 2 inches, not greater than 4 inches, ASTM C143.

5. Standard Color: Natural grey.

6. Colored Concrete: See the Article "Integral Colorant" herein if applicable.

B. Aggregate

1. Coarse aggregate: ASTM C33. Broken stone or gravel consisting of clean durable fragments of uniform quality throughout. It shall be free from soft, disintegrated pieces, mud, dirt, organic or other injurious material. Coarse aggregate of a size retained on a 1-inch square opening sieve shall not contain more than 8% of flat or elongated pieces, whose longest dimension exceeds five times their maximum thickness.

2. Fine aggregate: ASTM C33. Sand consisting of clean, hard, durable, uncoated particles of quartz or other rock, free from lumps of clay, soft or flaky material, loam, organic or other injurious material. Fine aggregate shall contain not more than 3% of material finer than a #200 sieve, ASTM C117.

C. Water: Potable quality.

D. Admixtures

1. Concrete shall contain a water reducing agent, ASTM C494, to minimize cement and water content of the concrete mix at the specified slump.

2. Air-Entraining Admixtures: ASTM C260.

3. Pozzolan: Fly ash or other pozzolans used as admixtures shall conform to ASTM C618, Class C or Class F with 4 percent maximum loss on ignition. Pozzolan may be used to replace a maximum of 15 percent (15 %) of cement by weight.

4. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixtures other than those specified shall be used in the concrete without the specific written permission of Engineer in each case.

**2.3 FORMS**

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- A. Forms shall be substantially built and adequately braced so as to withstand the liquid weight of concrete without deforming. All linings, studding, walling and bracing shall be such as to prevent bulging, spreading, or loss of true alignment while pouring and displacement of concrete while setting.
- B. All edge forms for sidewalk pavements, curbs and gutters shall be of sufficient rigidity and adequately braced to accurately maintain line and grade. Form work shall be designed so that sections may be fastened together to prevent vertical or horizontal movement of ends.
- C. Forms for curved sections shall be so constructed and placed that the finish surface of walls and edge of sidewalks, curbs and gutters will not deviated appreciably from the arc of the curve.
- D. Exposed vertical and horizontal edges of the concrete in structures shall be chamfered as indicated on the Drawings by the placing of moldings in the forms.
- E. Forms for Exposed Finish: Plywood, metal, metal-framed plywood faced, or other acceptable panel materials. Form work materials shall produce a smooth, continuous, straight, and level surface.
  - 1. Plywood shall be APA A-A, A-B or A-C, Class 1, Exterior Grade. Thickness shall be as required to prevent movement or deformation but shall not be less than 5/8" thick.
- F. Forms for Non-Exposed Finish: Plywood, metal, metal-framed plywood faced, or other acceptable panel materials. Form work materials shall produce a generally smooth, continuous, straight, and level surface. Grain patterns or similar imperfections are acceptable. Lumber shall be dressed on at least two edges and one side.
  - 1. Plywood shall be at least B-B, Class 1, Exterior Grade. Thickness shall be as required to prevent movement or deformation but shall not be less than 5/8" thick.
- G. Cylindrical Forms: Sonotube Fibre Forms, wax-impregnated strippable forms or ABS or PVC plastic reusable forms.
- H. Form Ties: Provide prefabricated, adjustable length galvanized steel snap-off ties, with brackets, cones, corner locks and other accessories as necessary.
- I. Form Release Agent: Commercial formulation compounds that will not bond with, stain or adversely affect concrete.

**2.4 REINFORCEMENT MATERIALS**

- A. Reinforcing Bars: ASTM A 615, Grade 60 unless otherwise indicated.
- B. Galvanized Reinforcing Bars: ASTM A 767, Class II with galvanizing before fabrication.
- C. Weldable Reinforcing Bars: ASTM A 706, Grade 60 unless otherwise indicated. Maximum carbon content shall be 0.55 percent.
- D. Epoxy-Coated Reinforcing Bars: ASTM A 775, Grade 60 unless otherwise indicated.
- E. Steel Wire: ASTM A 82, 16 gauge or heavier black annealed wire.
  - 1. Ties for epoxy-coated bars shall be vinyl-coated or epoxy-coated.

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2. Ties for zinc-coated bars shall be zinc-coated.
- F. Welded Wire Reinforcement (WWR)
  1. Sidewalks: Plain wire, ASTM A1064 as indicated on the Drawings.
  2. Concrete Pavement: Plain wire, ASTM A1064 as indicated on the Drawings.
- G. Supports for Reinforcement
  1. Supports shall include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars and wire reinforcement in-place. Conform with CRSI Manual of Standard Practice for corrosion-resistant, plastic-protected wire, epoxy-coated, or stainless-steel supports.
  2. For exposed-to-view concrete surfaces and where support legs are in contact with forms, provide supports with plastic protection (CRSI, Class1) or stainless steel protection (CRSI, Class 2).
- H. Dowel Bars: Plain (smooth) high-chrome steel bar, ASTM A615 Grade 60 with full-length plastic sleeve as a combined unit, dimensions as indicated on the Drawings.
  1. Where epoxy-coated dowels are called for: ASTM A1078.
- I. Bar/Dowel Adhesive: Two component (1:1 ratio), 100% solids, high modulus, moisture-insensitive structural epoxy gel designed specifically for bonding bars, dowels, and bolts in concrete.

## 2.5 JOINT MATERIALS

- A. Preformed Joint Filler Strips
  1. Where no joint sealant is called-for: Nonextruding and resilient bituminous type conforming to ASTM D 1751, 1/2 inch thick, one piece for the full depth and width of the joint.
  2. Where joint sealant is called-for: Nonextruding and resilient nonbituminous type conforming to ASTM D 1752, Type I (sponge rubber) or Type II (cork), 1/2 inch thick, allowance for sealant at top and extending for the full depth and width of the joint.
- B. Joint Sealant Compound, ASTM C920
  1. Self-Leveling (Type SL; Grade "P")
    - a. Cold-applied and self-leveling, Type S or Type M elastomeric polymer sealant.
  2. Gun-Grade (Non-Sage; Grade "NS")
    - a. One-component (Type S) high-performance moisture-curing polyurethane sealant specifically formulated for bonding to masonry and concrete.
  3. Traffic Bound areas: T sealant.
  4. Non-Traffic Bound areas: NT sealant.
  5. Color: As approved by Engineer.

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6. Backer material: ASTM D5249, closed cell.

**2.6 DETECTABLE WARNING PANEL**

A. Surface-mount, UV-stabilized, polymer composite panel as indicated on the Drawings. Fasteners, adhesives, and sealants per manufacturer's requirements. Panel shall comply with Connecticut Building Code/ADA Guidelines.

1. Color: As approved by Engineer.

B. Duralast Detectable Warning Plate with Black Asphaltic Coating, Product Number 00700570 as manufactured by East Jordan Iron Works, 301 Spring Street, East Jordan, MI or approved equal.

**2.7 CONCRETE BONDING MATERIALS**

A. Aqueous-phase, film-forming, nonoxidizing, freeze and thaw-resistant compound suitable for brush or spray application conforming to ASTM C 932.

B. Epoxy-Resin Adhesive Binder: Two-component, penetrating high solids, epoxy-based primer/bond coat, 100% solids, moisture-tolerant, ASTM C-881, Types I, II, and V, Grade-2, Class C and AASHTO M-235.

**2.8 CONCRETE CURING MATERIALS**

A. Curing shall be by moist curing (preferred) or by use of curing compound. Sodium Silicate curing compounds shall be used where required by the weather, approved construction schedules and construction that is not adaptable to damp curing.

B. Curing compound shall be a resin-base, white pigmented compound, ASTM C309, Type 2.

C. Curing compounds shall contain a fugitive dye or when hot weather conditions dictate, a fugitive heat reflecting pigment.

D. Moisture-Retaining Cover:

1. Waterproof paper, ASTM C 171, regular or white.

2. Polyethylene sheeting, ASTM C 171.

3. Polyethylene-coated burlap consisting of a laminate of burlap and a white opaque polyethylene film permanently bonded to the burlap. Burlap: ASTM C 171, Class 3. Polyethylene film: ASTM C 171.

4. When tested for water retention in accordance with ASTM C 156, weight of water lost 72 hours after application of moisture retaining covering material shall not exceed 0.039 gram per square centimeter of the mortar specimen surface.

E. Water: Potable Quality.

F. Membrane-Forming Curing Compound

1. Liquid type, ASTM C 309, Type 1, clear, Type 2, white, pigmented.

**2.9 BOND BREAKER**

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- A. Asphalt felt conforming to ASTM D2626, Type I or 6-mil polyethylene sheeting, ASTM D4397.

**2.10 SEALER**

- A. Consolideck® Saltguard® silane/siloxane water repellent and chloride screen as manufactured by Prosoco, Inc., 3741 Greenway Circle, Lawrence, KS 66046, or approved equal.

**2.11 COLORED CONCRETE**

- A. Integral Colorant

1. Colored, water-reducing admixture containing no calcium chloride with coloring agents that are limeproof and ultra-violet resistant. Admixture shall conform to the requirements of ACI 303.1, ASTM C979 and ASTM C494 and shall be dispensed at the batch plant.
2. Curing and Sealing Compound: ASTM C309. Clear, non-yellowing, solvent-borne, membrane-forming with low-gloss finish.
3. Compound shall be of same manufacturer as colored admixture, for use with integrally colored concrete.

- B. Dry Colorants

1. Pigmented Mineral Dry-Shake Color Hardener: ASTM C 979, factory-packaged dry combination of Portland cement, graded quartz aggregate, non-fading finely-ground mineral oxide coloring pigments, and plasticizing admixture.
2. Pigmented-Powder Release Agent: Factory-packaged, nonfading finely-ground, streak free, colored powder that facilitates release of stamps and texture rollers from colored concrete and imparts a secondary accent color.

- C. Stains

1. Reactive Chemical Concrete Stain: Reactive, water-based solution of metallic salts which react with calcium hydroxide in cured concrete substrates to produce permanent variegated or translucent color effects. Zero VOC content.

- D. Colors

1. Cement: Color shall be white.
2. Sand: Color shall be locally available natural sand.
3. Aggregate concrete producer's standard aggregate complying with specifications.
4. Color of admixture, dry colorant, or stain: As indicated on the Drawings or selected by Engineer.

**2.12 STAMPED AND TEXTURED CONCRETE**

- A. Furnish tools and stamping equipment as recommended by the stamping system manufacturer and as approved by Engineer. Use stamping equipment and materials from a single manufacturer throughout the entire project.

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- B. Stamp Mats: Semi-rigid polyurethane mats with projected texture and ridged underside capable of imprinting texture and joint patterns to plastic concrete.
  - 1. Pattern: As indicated on the Drawings.
- C. Stencils: Moisture-resistant paper stencils, designed for use on plastic concrete.
  - 1. Pattern: As indicated on the Drawings.
- D. Texture Rollers: Manually controlled, abrasion-resistant polyurethane rollers capable of imprinting texture on plastic concrete.
  - 1. Pattern: As indicated on the Drawings.
- E. Accessory Stamp Tools: Aluminum detailing tools capable of imprinting joints and dressing stamped joints of plastic concrete.

### **PART 3 EXECUTION**

#### **3.1 GENERAL**

- A. Verify site conditions before proceeding with the work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.
- B. Provide construction techniques in accordance with applicable provisions of ACI 224R, ACI 224.3R, and ACI 302.1R-04.
- C. Engineer shall be notified of concrete placement sufficiently in advance of start of operation to allow their representative to complete preliminary inspection of the Work, including subgrade, forms, and reinforcing steel, if used.
- D. Adjacent work, etc., shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original conditions at the contractor's expense. No concrete walks shall be poured after 12 noon unless a guard is visibly stationed nearby to prevent graffiti. Contractor shall be responsible for replacing any graffiti if he fails to provide adequate protection.
- E. Concrete surface shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, 1/2-inch thick plywood sheets shall be used to protect exposed surfaces.
- F. Retempering of concrete is not permitted.
- G. Contractor is responsible for the protection and resetting of all existing utility covers/castings to finish grade; as well as, setting all new utility covers/castings to finish grade prior to placement of concrete. The repair of any settlement, or protrusion above finish grade, shall be the responsibility of Contractor at no additional cost to Owner.

#### **3.2 PREPARATION OF SUBGRADE**

- A. Compact and bring area to required subgrade elevation in accordance with Section 31 2310 – Earthwork. Provide for final fine grading, and compaction of areas as required to form a firm, uniform, accurate and unyielding subgrade at required elevations and to required lines.



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- B. Existing subgrade material, which will not readily compact as required, shall be removed and replaced with satisfactory materials in accordance with Section 31 2310 – Earthwork.
- C. Subgrade of areas to receive concrete shall be recompact as required to bring the top 8 inches of material, immediately below the base course, to a compaction at optimum moisture content of at least 95 percent (95%) of maximum density, as determined by ASTM D1557. Subgrade compaction shall extend for a distance of at least 1 foot beyond pavement edge.
- D. Materials shall not be stored or stockpiled on subgrade.
- E. Disposal of debris and other material excavated under this section, and material unsuitable for, or in excess of requirements for, completing work of this section shall be disposed of off-site.
- F. Prepared subgrade shall be inspected and approved by Engineer Representative before installation of the gravel base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the Specification.

### 3.3 AGGREGATE BASE COURSE

- A. Prepare aggregate base course for concrete in accordance with Section 31 2310 – Earthwork and as shown on the Drawings.
- B. Width of base course shall be greater than or equal to the width of concrete surface, if continuous lateral support is provided during rolling. The width of base course shall extend at least 2 x base thickness beyond the edge of the course above, if it is not so supported.
- C. Aggregate shall be applied in lifts less than or equal to 6 inches thick, compacted measure. Each lift shall be separately compacted to specified density.
  - 1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
  - 2. The base shall be wetted and rolled or tamped after the spreading of each lift.
  - 3. Rolling shall begin at the sides and progress to the center of crowned areas, and shall begin on the low side and progress toward the high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
  - 4. Surface irregularities, which exceed 1/2-inch, as measured by means of a 10-foot long straightedge, shall be replaced and properly re-compacted.
- D. Density: Base course shall be compacted at optimum moisture content to not less than 95 percent of maximum density as determined by ASTM D1557.
- E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and the area repaired.
- F. Portions of subgrade, or of construction above, which become contaminated, softened, or dislodged by the passing of traffic, or otherwise injured, shall be cleaned, replaced, or otherwise repaired to conform to the requirements of this specification before proceeding with the next operation.

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**3.4 FORMS**

- A. Forms shall be securely staked, braced and held firmly to the required line and grade and shall be sufficiently tight to prevent leakage of mortar. All forms shall be cleaned and oiled or wetted before concrete is placed against them.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Complete and approve formwork. Remove debris and foreign material from interior of forms before start of concrete placing.
- D. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.
- E. The maximum cross slope for sidewalks shall be 2.0 percent, sloped towards the gutter. Verify formwork prior to concrete placement. Make corrections as required and bring discrepancies to attention of Engineer.

**3.5 JOINTS**

- A. Locate joints as located on the Drawings, as shown on Engineer-approved joint plan. Conform with applicable sections of ACI 224.3R.
- B. Construction Joints: Effected at the end of a pour, lift, or at the end of a day's concrete placement. This type of joint is a plane surface between two distinct sections of concrete.
  - 1. Construction Joints shall be ½ inch wide and full-depth of slab.
  - 2. Joint filler: Unless otherwise specified, Construction Joints shall be constructed with joint filler. Joint filler shall extend the full depth of the slab and shall extend the full length of the joint. Use of multiple pieces of joint material of lesser dimensions to make up required depth and width of joint will not be permitted.
  - 3. Where joints are to receive filler, recess joint filler 1/4-inch below finish surface or as otherwise indicated on the Drawings.
  - 4. Where called-for on the Drawings, install dowels at Construction Joints.
- C. Isolation Joints: Installed at intersections of structures on any type including but not limited to buildings, walks with steps, pre-cast concrete curb, light foundations, walls, pads, slabs at footings, or other structures. Isolation Joints shall not be required where concrete flatwork abuts granite curbing.
  - 1. Isolation Joints shall be ½ inch wide.
  - 2. Joint Filler: All Isolation Joints shall be constructed with joint filler. Joint filler shall extend the full depth of the slab and shall extend the full length of the joint. Use of multiple pieces of joint material of lesser dimensions to make up required depth and width of joint will not be permitted.

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3. Where joints are to receive filler, recess joint filler 1/4-inch below finish surface or as otherwise indicated on the Drawings.
- D. Control/Contraction Joints: Installed to form a weakened plane in a concrete member to provide a reduction in member thickness for the purpose of controlling shrinkage stresses to that specific area. Control/Contraction Joints shall be synonymous with "Dummy Joints."
  1. Control/Contraction Joints shall be tooled or saw-cut.
    - a. Tooled joints: Tool-form joint into the concrete 1 inch in depth, but in no case less than 25 percent of slab depth. Joint width shall be 1/4-inch. Each side of tooled joint shall be dressed to match final overall slab finish. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab, but before the slab has achieved its final set.
      - 1) Where tooled joints are to receive joint sealant, provide 1/2-inch wide tooled joint and install backer rod material to create 1/4-inch recess below finished surface.
    - b. Saw-cut joints: Saw-cut joint into concrete 1 inch in depth, but in no case less than 25 percent of slab depth. Joint width shall be 1/8-inch. Cut joint using rotary saw within 4 to 12 hours after the concrete has been finished.

### 3.6 STEEL REINFORCEMENT

- A. Install steel reinforcement as shown on the Drawings.
  1. Welded Wire Reinforcement: Where WWR is called-for, install material in the upper 30 to 40 percent (30%–40%) of the overall slab thickness, or at the nearest depth below top of slab as required to achieve a minimum of 2-inches of cover.
- B. Before being placed in position, reinforcing for reinforced concrete shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material, which may reduce the bond between the concrete and reinforcing. Where there is a delay in placing concrete after reinforcement is in place, bars shall be re-inspected and cleaned when necessary.
- C. Any bar showing cracks after bending shall be discarded.
- D. Minimum Cover: 2 inches, except where concrete is cast against and permanently exposed to earth minimum cover shall be 3 inches.
- E. For slab-type construction, welded wire reinforcement and reinforcing bars shall be elevated off the base material by use of supports as specified herein. Adjacent sheets of welded wire reinforcing shall lap 6 inches.
- F. Joints
  1. Construction Joints: Reinforcement shall not continue through construction joints. Allow for 2-inches of cover at end of slab. Where called-for on the Drawings, install pins at Construction Joints per detail.
  2. Isolation Joints/Expansion Joints: Allow for 2-inches of cover at end of slab.

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3. Control/Contraction Joints: Cut at least one-half of reinforcement at joints.

- G. Reinforcing shall be securely wired in the position called for, and shall be maintained in that position until concrete is placed and compacted.

**3.7 PLACEMENT**

- A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint, and other material which might tend to reduce bond.
- B. Existing concrete, earth, forms, and other water-permeable material against which new concrete is to be placed and shall be thoroughly damp when concrete is placed. There shall be no free water on the surface.
- C. Concrete shall arrive at the job site in a timely manner so that no additional water will be required to produce the desired slump. When conditions develop that require the addition of water to produce the desired slump, permission of the Engineer must be obtained. The concrete shall be transported from the mixer to its place of deposit by a method that will prevent segregation or loss of material.
- D. Concrete, which has set, or partially set, before placement shall not be employed.
- E. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall be thoroughly damp when concrete is placed. There shall be no free water on surface.
- F. Concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.
- G. When joining fresh concrete to concrete which has attained full set, the latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8-inch thick shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

**3.8 STAMPED OR TEXTURED CONCRETE**

- A. Construct concrete as recommended by the stamping system manufacturer. Apply pigmented release agent to tools and forms in accordance with the stamping system manufacturer's specifications. Place concrete and screed to the specified grade. Float the surface and evenly apply dry shake color hardener according to manufacturer's specifications.
- B. Imprint the surface of the plastic concrete with the forms to obtain the specified pattern. The pigmented release agent will serve as the curing agent. Do not clean the surface until adequate curing has been obtained, as recommended by the stamping system manufacturer.
- C. Saw cut all joints one-quarter inch wide and one-inch-deep, following the joint patterns illustrated in the typical sections, or as directed by the Engineer. Seal all joints, including expansion joints and sawed joints, with color-matched joint sealant, as recommended by the stamping system manufacturer. Apply two coats of low-lustre, matte finish clear surface sealer to the finished decorative concrete as recommended by the stamping system manufacturer.

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- D. Take steps to avoid the contamination of adjacent surfaces while placing and finishing colored, stamped concrete; clean all surfaces that do get contaminated. Areas that were not properly protected and/or cannot be cleaned to the satisfaction of the Engineer must be removed and replaced. All costs associated with this removal and replacement will be borne by the Contractor.

### 3.9 FINISHING

- A. Concrete flatwork surfaces shall be screened off and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.
  - 1. Finished concrete surface for concrete subbase shall be woodfloated to a slightly rough surface. Surface shall not deviate more than 1/4-inch in 10 feet.
  - 2. Finished concrete surface for concrete pavement, walks, and pads shall be wood-floated and steel troweled to a smooth surface. Surface shall not deviate more than 1/8-inch in 10 feet.
- B. Unless otherwise indicated, horizontal surfaces of concrete surfaces, which will be exposed, shall be given a light broomed finish, with direction of grooves in concrete surface perpendicular to length of concrete band, slab or pad. After concrete has set sufficiently to prevent coarse aggregate from being torn from the surface, but before it has completely set, brooms shall be drawn across it to produce a pattern of small parallel grooves. Broomed surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by the brooming operation.
- C. Immediately following finishing operations, arises at edges and both sides of expansion joints shall be rounded to a ¼ inch radius. Control joints to be tooled shall be scored into slab surface with scoring tool. Adjacent edges of control joint shall be same time be finished to a ¼ inch radius.
- D. Where finishing is performed before the end of the curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

### 3.10 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 and to receive a rubbed finish.
  - 2. After repairing and patching, areas to receive spray applied stain finish shall receive one of the following surface preparations;
    - a. Power washing with a minimum of 3000 psi pressure.

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- b. Sand blasting to open concrete only, not to the degree of seeing exposed aggregate.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
  - 1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  - 2. 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.

### 3.11 CURING

- A. Cure in accordance with ACI 308R.
- B. Concrete shall be kept continuously damp from time of placement until the end of the specified curing period.
- C. Water shall not be applied to curing concrete within 24 hours after initial placement. Any water shall be applied only to maintain damp conditions. Do not add water during floating and troweling operations.
- D. Between finishing operations, the surface shall be protected from rapid drying by covering with a material specified herein. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of fine-spray of water, applied as often as necessary to prevent drying after the initial 24-hour cure period.
- E. Concrete surfaces shall be cured by completely covering them with curing paper or an application of a curing compound.
  - 1. Concrete cured using waterproof paper shall be completely covered with paper with seams lapped and sealed with tape. Concrete surface shall not be allowed to become moistened between 24 and 36 hours after placing concrete. During curing period surface shall be checked frequently, and sprayed with water as often as necessary to prevent drying, but not earlier than 24 hours after placing concrete.
  - 2. If concrete is cured with a curing compound, the compound shall be applied at a rate of 200 square feet per gallon, in two applications perpendicular to each other.
  - 3. Curing period shall be seven days minimum. Full-strength shall be considered after 28 days.
- F. Only if additional protection is required, the surface should remain uncovered for at least 4 days, after which time new and unwrinkled non-staining reinforced waterproof Kraft curing paper may be used.

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- G. Integrally Colored Concrete: Cure using a curing compound specific for integrally colored concrete according to manufacturer's instructions using manufacturer's recommended application techniques. Apply curing and sealing compound at consistent time for each pour to maintain close color consistency.

### 3.12 COLD WEATHER CONCRETING

- A. Comply with ACI 306R Guide to Cold Weather Concreting.
- B. Materials for concrete shall be heated for concrete, which is mixed, placed or cured when the mean daily temperature is below 40 degrees F or is expected to fall below 40 degrees F within 72 hours. The concrete, after placement, shall be protected by covering, heat, or both.
- C. Details of handling and protecting concrete during freezing weather shall be subject to the approval of Engineer.

### 3.13 HOT WEATHER CONCRETING

- A. Comply with ACI 305R: Guide to Hot Weather Concreting.
- B. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placement shall be sprinkled with cold water. Every effort shall be made to minimize delays that will result in excessive mixing of the concrete after arrival on the job.
- C. During periods of excessively hot weather (95°F, or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305R. Any concrete with a temperature below 95°F, when ready for placement, will not be acceptable, and will be rejected.
- D. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. Records shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the Work so that conditions surrounding the construction of any part of the structure can be ascertained.

### 3.14 PROTECTION

- A. Concrete surface shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, ½ inch thick plywood sheets shall be used to protect the exposed surface.

### 3.15 CLEAN UP

- A. Remove all debris, residuals, and materials at the conclusion of the work. Dispose of all materials in accordance with applicable waste management regulations.

END OF SECTION 033200





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SECTION 04 7205 - CAST STONE MASONRY (SITE APPLICATIONS)

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. Cast stone wall caps.

1.3 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  - 6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Product Data: For each type of product.

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1. For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
  1. Include building elevations showing layout of units and locations of joints and anchors.
- D. Samples for Initial Selection: For colored mortar.
- E. Samples for Verification:
  1. For each color and texture of cast stone required, 10 inches square in size.
  2. For each trim shape required, 10 inches in length.
  3. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer and testing agency.
  1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.
- B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.
  1. Provide test reports based on testing within previous two years.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Coordinate delivery of cast stone with cast-in-place concrete foundation work to avoid delaying the Work and to minimize the need for on-site storage.
- B. Pack, handle, and ship cast-stone units in suitable packs or pallets.
  1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast-stone units if required, using dollies with wood supports.

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- 2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

#### 1.7 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

#### 2.2 CAST-STONE MATERIALS

- A. General: Comply with ASTM C 1364.
- B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast-stone color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33/C 33M; gradation and colors as needed to produce required cast-stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33/C 33M, gradation and colors as needed to produce required cast-stone textures and colors.

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- E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- F. Admixtures: Use only admixtures specified or approved in writing by Architect.
  - 1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
  - 2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
  - 3. Air-Entraining Admixture: ASTM C 260/C 260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
  - 4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.
- G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast-stone material.
  - 1. Epoxy Coating: ASTM A 775/A 775M.
  - 2. Galvanized Coating: ASTM A 767/A 767M.

## 2.3 CAST-STONE UNITS

- A. Cast-Stone Units: Comply with ASTM C 1364.
  - 1. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
  - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
- C. Fabrication Tolerances:
  - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
  - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
  - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
- D. Cure Units as Follows:
  - 1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
- E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- F. Colors and Textures: As selected by Architect from manufacturer's full range.

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- G. Colors and Textures: Provide units with fine-grained texture and buff color resembling sand-rubbed Indiana limestone.

#### 2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- E. Water: Potable.

#### 2.5 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from .
- B. Dowels: 1/2-inch- diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Diedrich Technologies, Inc.
    - b. ProSoCo, Inc.

#### 2.6 MORTAR MIXES

- A. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Use portland cement-lime mortar unless otherwise indicated.

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B. Comply with ASTM C 270, Proportion Specification.

1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.

**2.7 SOURCE QUALITY CONTROL**

A. Engage a qualified independent testing agency to sample and test cast-stone units according to ASTM C 1364.

1. Include one test for resistance to freezing and thawing.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

**3.2 SETTING CAST STONE IN MORTAR**

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors indicated or necessary to secure units in place.

B. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

C. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 1/4 to 3/8 inch wide unless otherwise indicated.
2. Fill dowel holes and anchor slots with mortar.
3. Fill collar joints solid as units are set.
4. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
5. Keep joints at shelf angles open to receive sealant.

D. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

E. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

F. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

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- G. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.
- H. Point joints with sealant to comply with applicable requirements in Section 079200 "Joint Sealants."
  - 1. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- I. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.
  - 1. Keep joints free of mortar and other rigid materials.
  - 2. Build in compressible foam-plastic joint fillers where indicated.
  - 3. Form joint of width indicated, but not less than 3/8 inch.
  - 4. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
  - 5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

### 3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

### 3.4 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
  - 3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

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5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 7205



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SECTION 05 0513 – SHOP APPLIED COATINGS FOR METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Factory-applied powder prime-coat and powder-coated finish for the following fabrications including, but not limited to:
  - 1. Steel round bollards.
  - 2. Accessible parking signage bollards.
  - 3. Exterior railings, handrails and guardrails.

1.02 REFERENCE STANDARDS

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).

1.03 29 CFR 1926, SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION.

- A. American Architectural Manufacturers Association
  - 1. AAMA 2605 – High Performance Exterior
- B. American Welding Society
  - 1. D1.1/D1.1M:2006, Structural Welding Code - Steel
- C. ASTM International (ASTM).
  - 1. ASTM A385 - Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
  - 2. ASTM A780 - Practice for Repair of Damaged Hot-Dip Galvanized Coatings.
  - 3. ASTM B117 - Practice for Operating Salt Spray Apparatus.
  - 4. ASTM D523 - Standard Test Method for Specular Gloss
  - 5. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
  - 6. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
  - 7. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
  - 8. ASTM D2967 - Standard Test Method for Corner Coverage of Powder Coatings.

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9. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

10. ASTM D4585 - Practice for Testing Water Resistance of Coatings Using Controlled Condensation.

11. ASTM D5861 - Standard Guide for Significance of Particle Size Measurements of Coating Powders.

D. National Association of Architectural Metal Manufacturers (NAAMM).

1. "Pipe Railing Manual, Including Round Tube"

E. Master Painters Institute (MPI)

#### 1.04 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings of metal components to be finished, showing sizes, details of fabrication and construction, bends and radii, handrail brackets, locations of hardware, anchors, and accessories, and installation details. Shop Drawings shall be submitted to Engineer for approval prior to ordering materials.

2. Submit manufacturers' product data of coating system and powder coating product.

#### 1.05 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.

#### 1.06 WARRANTY

A. Coating Warranty: Coating Applicator's warranty in which Applicator agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated.

1. Exposed Coating: Deterioration includes but is not limited to:

a) Color fading per ASTM D2244.

b) Peeling, cracking, or cracking of coating adhesion to metal.

B. Warranty Period: 10 Years from date of Substantial Completion.

#### 1.07 DELIVERY, STORAGE AND HANDLING

A. Supply: Component materials must be supplied in consistent quality in appearance and physical properties.

B. Materials shall be wrapped or otherwise packaged for shipment and storage as appropriate.

C. Store materials to avoid damage from moisture, abrasion, and other construction activities.

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**PART 2 PRODUCTS**

**2.01 STEEL BOLLARDS AND RAILINGS**

- A. Bollards and railings shall receive a duplex coating of powder primer and powder coat finish.
- B. Galvanizing
  - 1. Hot dip galvanized, ASTM F 1083. Type "A" internal and external surfaces, ASTM F1043.
  - 2. Safeguarding against steel embrittlement: conform with applicable requirements of ASTM A143.
  - 3. Safeguarding against warpage and distortion of steel members: conform with applicable requirements of ASTM A384.
  - 4. Shop galvanized metalwork necessitating field welding which in any manner removes original galvanizing shall be restored by galvanizing repair in accordance with ASTM A780.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Review product manufacturer's special instructions for surface preparation, application, temperature, re-coat times, and product limitations.
- B. Do not begin finishing until substrates have been properly prepared.
- C. Ensure that surfaces to receive paint are dry immediately prior to application.
- D. Examine surfaces to receive coatings for surface imperfections and contaminants that could impair performance or appearance of coatings, including but not limited to, loose primer, rust, scale, oil, grease, mildew, algae, or fungus, stains or marks, cracks, indentations, or abrasions.
- E. Correct conditions that could impair performance or appearance of coatings in accordance with specified surface preparation procedures before proceeding with coating application.
- F. If substrate preparation is the responsibility of another installer, notify Landscape Architect of unsatisfactory preparation before proceeding. Commencement of work constitutes acceptance of conditions.

**3.02 SURFACE PREPARATION**

- A. Steel: Should be cleaned by the surface preparations described below.
  - 1. Near White Metal Blast Cleaning, SSPC-SP10 or NACE 2: Remove all rust scale, mill scale, previous coating, etc., leaving only light stains from rust, mill scale, and small specks of previous coating. Random staining shall be limited to no more than 5% of each area of surface (a unit of area is defined as 9 square inches).
- B. Following White-Metal Blast Cleaning, pretreat surfaces to receive coatings using applicator's proprietary wash coat process including chemical conversion and five stage wash.

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**3.03 APPLICATION**

- A. Apply coatings in accordance with manufacturer's instructions to uniform surface free from blemishes.
- B. Electrostatically apply powder coating to 2 to 4 mil thickness.
- C. After application polymerize coatings at 400 degrees F for 20 minutes.

**3.04 POLYESTER POWDER COATING**

- 1. Polyester Powder Primer: Electrostatically applied zinc-rich primer powder coating, heat cured to chemically bond primer to metal substrate.
- 2. Polyester Powder Coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to primer substrate.
  - a) Minimum hardness measured in accordance with ASTM D3363: 2H.
  - b) Direct impact resistance tested in accordance with ASTM D2794: Withstand 160 inch-pounds.
  - c) Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than [3/16 inch] [5 mm] undercutting.
  - d) Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.
- 3. Color: Black (Federal Standard 27038) ASTM D 7803, 2 mil minimum finish coat thickness.
- 4. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

**END OF SECTION**

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SECTION 055200 – METAL RAILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section Includes:
  - 1. Furnishing and installing steel pipe guard rails and hand-rails at ramps, steps, and other location indicated on the Drawings.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCE STANDARDS

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM).
  - 1. ASTM A36 - Specification for Structural Steel.
  - 2. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. ASTM A143 - Recommended Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - 4. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 5. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - 6. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
  - 7. ASTM A384 Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
  - 8. ASTM A385 - Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
  - 9. ASTM A449 - Specification for Quenched and Tempered Steel Bolts and Studs.

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- 10. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- 11. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
- 12. ASTM A780 - Practice for Repair of Damaged Hot-Dip Galvanized Coatings.
- 13. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- 14. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
- 15. ASTM D2092 - Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint.
- D. National Association of Architectural Metal Manufacturers (NAAMM).
  - 1. "Pipe Railing Manual, Including Round Tube"
- E. Society of Automotive Engineers (SAE)
  - 1. Standard J404 200901, Chemical Compositions of SAE Alloy Steels.
- F. State of Connecticut
  - 1. State Building Code, including all Amendments, Supplements, and Errata.
- G. American Welding Society
  - 1. D1.1/D1.1M:2006, Structural Welding Code - Steel
- H. Master Painters Institute (MPI)
- I. Steel Structures Painting Council (SSPC).
  - 1. SSPC-SP 1 Solvent Cleaning.
  - 2. SSPC-SP 3 Power Tool Cleaning.
  - 3. SSPC-SP 10 Near-White Blast Cleaning.
  - 4. SSPC-SP 11 Power Tool Cleaning to Bare Metal.

**1.4 ACTION SUBMITTALS**

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.

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3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### 1.5 SYSTEM DESCRIPTION

- A. Provide guardrail and railing systems as indicated on the Drawings as complete systems in accordance with design intent, actual site conditions, and State Building Code.
- B. Performance Requirements
  1. Structural Performance: Railings shall withstand all loads as required by State Building Code.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 1.6 SUBMITTALS

- A. Shop Drawings
  1. Submit shop drawings of metal guardrails, handrails, and railings, showing sizes, details of fabrication and construction, bends and radii, handrail brackets, locations of hardware, anchors, and accessories, and installation details. Shop Drawings shall be submitted to Engineer for approval prior to ordering materials.
  2. Submit manufacturers' product data of railing system and railing components, handrails, and handrail brackets. Include corrosion-inhibitive shop coat painting system.

#### 1.7 QUALITY ASSURANCE

- A. General: Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.
- B. Installer Qualifications: Minimum of 3 years of experience on similar type projects / work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Contractors failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

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- C. Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer. Railing materials must be supplied in consistent quality in appearance and physical properties.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

##### A. Delivery and Storage

1. Transportation carrier shall use appropriate methods to ensure materials are properly packaged, stacked, and restrained during transport. Utilize protective packaging as required.
2. Protect materials during storage against moisture, soiling, staining, and physical damage.
3. Any railing or associated component showing manufacturing flaws upon receipt at the Project Site shall be referred to Engineer for determination as to whether it shall be repaired, rejected, or used.
4. Protect railing materials during storage to avoid damage from moisture, abrasion, and other construction activities.

##### B. Handling

1. Handle railing materials to prevent abrasion, chipping, marring, soiling and other damage.
2. Damaged equipment shall not be installed. Contractor shall bear responsibility for damage to equipment until final acceptance by Owner. Any installed equipment exhibiting damage shall be replaced or repaired to the satisfaction of Engineer, and Contractor shall assume all costs related thereto.

#### 1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

#### 1.10 COORDINATION

- A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### 1.11 SCHEDULING

- A. Schedule installation so handrails and railings are mounted only on completed walls or associated with concrete stem wall installation / pour. Do not support temporarily by any means that does not satisfy structural performance requirements.



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**PART 2 PRODUCTS**

**2.1 STEEL TUBING HANDRAIL**

- A. Steel Pipe, seamless, ASTM A500, Grade C, "Standard Weight" railing (Schedule 40), unless another grade and weight are required by structural loads. Diameter and dimensions as indicated on the Drawings. Special instructions shall be given the pipe manufacturer to provide "Architectural Handrail Grade Pipe".

**2.2 STAINLESS STEEL TUBING HANDRAIL**

- A. Stainless Steel Handrails: ASTM A 269, stainless steel tube: 304 or 316, welded ornamental tubing - (1.9 inches O.D. for guardrail and 1.5 inches O.D. for handrail). Special instructions shall be given the pipe manufacturer to provide Architectural Handrail Grade pipe.
- B. Stainless Steel Finishes
  - 1. Stainless steel pipe and tubing: #6 polish.
  - 2. Machined stainless steel fittings: # 8 polish.

**2.3 FITTINGS, BRACKETS, AND PLATES**

- A. Fittings, Brackets, Flanges, and Plates: Cast or formed metal of the same type of material and finish as rails unless otherwise indicated.
- B. Steel: Galvanized malleable iron, manufactured for the purpose, for anchorage to concrete.
- C. Stainless Steel: 304 or 316 stainless steel to match finish. Stainless steel fittings shall be used in all applications where stainless steel railings are called-for.
- D. Plates: Steel plate shall be standard steel plate, ASTM A36, weldable quality.

**2.4 ANCHORS, FASTENERS, AND ACCESSORIES**

- A. Provide all required anchors, fasteners, miscellaneous components, and accessories as required for complete and finished railing installations.
  - 1. Bolts and studs, nuts, and washers: ASTM A307, A449, and A563, as applicable.
  - 2. Galvanizing: ASTM A153.
- B. Expansion Bolts: Where anchors are not included in the concrete construction, provide galvanized expansion type anchors with matching galvanized steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts. Expansion bolts require approval of Engineer before they may be installed in post-tensioned slabs. Expansion bolts will not be permitted for use on concrete curbs or along the edge of concrete or a concrete joint.

**2.5 FABRICATION**

- A. Rails
  - 1. Metal handrails and railings shall be fabricated by firms or shops experienced and skilled in the custom fabrication of architectural metal handrails and railings, and shall meet the quality requirements of NAAMM's Pipe Railing Manual.

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2. Bends in rails shall be precision-formed to a smooth continuous radius by skilled workers. Work quality and finish shall be true to detail. Butt joints shall have internal pipe sleeve or dowel. Ends shall be closed with similar materials, welded and ground smooth.
  3. Steel welded connections shall be made in accordance with applicable requirements of the AWS Structural Welding Code. Welding shall be performed in the shop unless otherwise indicated. Welded joints of handrails and railings shall be ground and dressed smooth to match adjacent surfaces and so that the shape and profile of the item welded is maintained.
  4. Metal handrails and railings shall be prefabricated and preassembled in the factory or shop as far as practicable.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form work true to line and level with accurate angles and surfaces.
- D. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove flux immediately.
  4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- E. Form changes in direction by bending or by inserting prefabricated elbow fittings.
- F. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.
- G. Close exposed ends of railing members with prefabricated end fittings.
- H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

**2.6 GALVANIZING**

- A. Ferrous metal railings and related items on the exterior of the building, or as otherwise indicated, shall be galvanized, after fabrication, by the hot-dip process in accordance with ASTM A123 and ASTM A385. Weight of zinc coating shall conform with requirements specified under "Weight of Coating" in ASTM A123.
- B. Safeguarding against steel embrittlement: conform with applicable requirements of ASTM A143.
- C. Safeguarding against warpage and distortion of steel members: conform with applicable requirements of ASTM A384.
- D. Shop galvanized metalwork necessitating field welding which in any manner removes original galvanizing shall be restored by galvanizing repair in accordance with ASTM A780.

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- E. Bolts and screws for attachment of galvanized items shall be galvanized in accordance with ASTM A153, or of compatible, non-corrodable material.

## 2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.
- E. Primer
  - 1. Etch Primer: For galvanized surfaces, utilize etch primer, MPI #25, to roughen and dull the surface. Allow surface to dry 24 hours minimum, then prime.
  - 2. Waterborne primer, acrylic or modified acrylic, suitable for use on exterior galvanized metal surfaces.
  - 3. Drying time. Dry-to-touch time shall be a maximum of one hour, and the dry-to-recoat time shall be a maximum of 4 hours when tested in accordance with ASTM D 1640.
- F. Paint
  - 1. Waterborne paint, acrylic or modified acrylic, suitable for use on exterior metal surfaces.
  - 2. Color: As indicated on the Drawings.
  - 3. Drying time. Dry-to-touch time shall be a maximum of one hour, and the dry-to-recoat time shall be a maximum of 4 hours when tested in accordance with ASTM D 1640.

## 2.8 GROUT AND ANCHORING CEMENT

- A. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout, ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Interior Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.
- C. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

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**PART 3 EXECUTION**

**3.1 GENERAL**

- A. Install metal handrails and railings as indicated and in accordance with the approved Shop Drawings, using workers skilled and experienced in the installation of the type of work involved. Conform with installation requirements of NAAMM's Pipe Railing Manual, as applicable.
- B. Install metal handrails and railings with accessories furnished by the railing fabricator as required for complete and finished railing installations. The rail elements shall be erected to produce a smooth, continuous rail.
- C. Installation of handrails and railings shall be in accordance with approved Shop Drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure. Include all fittings and components, sleeves, hardware, backing plates, and accessories as required for complete and finished handrail installations.
- D. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

**3.2 INSTALLATION**

**A. Concrete Mounting**

- 1. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- 2. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
- 3. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
- 4. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- 5. Anchor posts in concrete by inserting into formed or core-drilled holes and grouting annular space.

**B. Wall Mounting**

- 1. Attach railings to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
- 2. Secure wall brackets and railing end flanges to building construction as follows:
  - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
  - b. For hollow masonry anchorage, use toggle bolts.
  - c. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs.

**C. Coordinate with stud installation to locate backing members.**

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**3.3 GALVANIZING REPAIR**

- A. Repair galvanized surfaces which have become damaged from welding, handling, or installation immediately after installation in accordance with ASTM A780.

**3.4 CLEANING AND PAINTING**

- A. Clean galvanized railings in accordance with ASTM D2092.
- B. Prior to site surface preparation and coating applications, remove, mask, or otherwise protect, finished work, hardware, hardware accessories, and other such items not to be coated. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.
- C. All surfaces of metal handrails and railings shall be cleaned and treated to assure maximum paint adherence, prior to application of the shop prime coat, in accordance with SSPC-SP 1, SSPC-SP 3, SSPC-SP 10, SSPC-SP 11 as applicable for the type of substrate, exposure, and application.
- D. Ferrous metalwork shall be given a shop coat of rust-inhibitive metal primer, or other approved rust-inhibitive metal primer standard with the railing manufacturer.
- E. After installation, exposed painted surfaces, field welds, and other abraded or damaged primed surfaces shall be prepared as required and touched up with an additional coat of the same primers for ferrous and galvanized surfaces as hereinbefore specified for shop painting.
- F. Lightly sand and feather out such damaged surfaces so that paint touch-up becomes invisible.

**3.5 ADJUSTING AND CLEANING**

- A. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

END OF SECTION 055200

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SECTION 09 9113 – EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Exterior metal railings.
  - 2. Accessible signage parking bollards.
- B. Related Sections include the following:
  - 1. Division 05 Section “Shop-Applied Coatings for Metal” for factory-applied metal primer for exterior metal framing and fabrications.

1.3 SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section “Sustainable Design Requirements” and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

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6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Product Data: For each type of product indicated.
- C. Samples for Initial Selection: For each type of topcoat product indicated.
- D. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
  1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  2. Step coats on Samples to show each coat required for system.
  3. Label each coat of each Sample.
  4. Label each Sample for location and application area.
- E. Product List: For each product indicated, include the following:
  1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

#### 1.4 QUALITY ASSURANCE

- A. MPI Standards:
  1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
  2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
  2. Final approval of color selections will be based on benchmark samples.
    - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
  1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

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**1.6 PROJECT CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

**1.7 EXTRA MATERIALS**

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
  - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Benjamin Moore & Co.
  - 2. ICI Paints.
  - 3. PPG Architectural Finishes, Inc.
  - 4. Sherwin-Williams Company (The).

**2.2 PAINT, GENERAL**

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.

**2.3 EXTERIOR ALKYD PAINTS**

- A. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).
  - 1. VOC Content: E Range of E1.
    - a. Benjamin Moore: Benjamin Moore - Urethane Alkyd Gloss Enamel; No. M22.



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- b. ICI Paints: Devoe Coatings - Devguard Alkyd Enamel; No. 4308-0100.
- 2. VOC Content: E Range of E2.
  - a. PPG: Speedhide I - Ext. Alkyd Enamel – Gloss; No. 6-282.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

**3.2 PREPARATION**

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
  - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

**3.3 APPLICATION**

- A. Apply paints according to manufacturer's written instructions.

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1. Use applicators and techniques suited for paint and substrate indicated.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### 3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
  1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
  2. Testing agency will perform tests for compliance of paint materials with product requirements.
  3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 EXTERIOR PAINTING SCHEDULE

- A. Galvanized-Metal Substrates:
  1. Alkyd System: MPI EXT 5.3B.
    - a. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - b. Topcoat: Exterior alkyd enamel (gloss).

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END OF SECTION 09 9113



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**SECTION 101426 – POST AND PANEL SIGNAGE**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Non-illuminated post and panel signs.

**1.3 COORDINATION**

- A. Furnish templates and tolerance information for placement of sign-anchorage devices embedded in permanent construction by other installers.

**1.4 ACTION SUBMITTALS**

- A. CTHPB Documentation Submittals: Comply with Division 01 Section “Sustainable Design Requirements” and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  - 6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

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Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

**1.5 SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For post and panel/pylon signage.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
- C. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

**1.6 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: For special warranty.

**1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by the manufacturer.

**1.8 FIELD CONDITIONS**

- A. Field Measurements: Verify locations of embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

**1.9 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five years from date of Substantial Completion.

**PART 2 PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

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- A. Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

## 2.2 POST AND PANEL/PYLON SIGNS

- A. Post and Panel Sign: Sign of single-panel configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Laminated, Aluminum-Sheet Sign Panels: Aluminum sheet laminated to both sides of acrylic core sheet with painted edges.
    - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
    - b. Surface-Applied Graphics: Applied vinyl film.
  - 2. Posts: Galvanized Steel Pipe.
    - a. Shape: Round.
    - b. Size: 2-3/8" OD Pipe (Sch 40).
    - c. Installation Method: Direct burial with concrete footing.
    - d. Finish and Color: Black
    - e. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
      - 1) Polymer coating over metallic coating.
  - 3. Decorative Metallic-Coated Steel Tubular Picket Fence Posts: Comply with ASTM F2408, for light industrial (commercial) application (class) unless otherwise indicated.
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - b. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc alloy-coated steel sheet.
    - c. The interior surface of tubes formed from uncoated steel sheet shall be coated with zinc-rich thermosetting coating to comply with ASTM F2408.
    - d. Size: Square tubes 2 by 2 inches (51 by 51 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch

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(2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.

- 1) Length: As indicated on the Drawings.
  - 2) No pre-punched openings.
- e. Post Caps: Formed from steel sheet and hot dip galvanized after forming.

4. Text and Typeface: typeface as indicated by manufacturer's designation and variable content as scheduled.

## 2.3 MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Copper Sheet: ASTM B 152/B 152M.
- D. Steel Materials:
  1. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial or forming steel.
  2. Bolts for Steel Framing: ASTM A 307 or ASTM A 325 (ASTM A 325M) as necessary for design loads and connection details.
  3. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.
- E. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.
- F. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

## 2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
  1. Use concealed fasteners and anchors unless indicated to be exposed.
  2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
  3. Exposed Metal-Fastener Components, General:



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- a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
  - b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant, Allen-head or one-way-head slots unless otherwise indicated.
- 4. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. Anchoring Materials:
  - 1. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.
  - 2. Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 3. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Preassemble signs in the shop to the greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in locations concealed from view after final assembly.
  - 2. Mill joints to tight, hairline fit. Form joints exposed to weather to resist water penetration and retention.
  - 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
  - 4. Conceal fasteners and anchors unless indicated to be exposed; locate exposed fasteners where they will be inconspicuous.
  - 5. Internally brace signs for stability and for securing fasteners.
- B. Sign Message Panels: Construct sign-panel surfaces to be smooth and to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.
  - 1. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.

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2. Increase panel thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations.
  3. Continuously weld joints and seams unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.
- C. Post Fabrication: Fabricate posts designed to withstand wind pressure indicated for Project location and of lengths required for installation method indicated for each sign.
1. Aluminum Posts: 2-3/8" OD Pipe (Sch 40), coated, extruded-aluminum tubing unless otherwise indicated, with brackets or slots to engage sign panels. Include post caps, fillers, spacers, junction boxes, access panels, reinforcement where required for loading conditions, and related accessories required for complete installation.
  2. Direct Burial: Fabricate posts 36 inches (910 mm) longer than height of sign to permit direct burial and embedment in concrete foundations or concrete-filled postholes.

## 2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## 2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

## 2.8 METALLIC-COATED STEEL FINISHES

- A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.
- B. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).

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**2.9 STEEL FINISHES**

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, and prepare for coating according to coating manufacturer's written instructions.
  - 1. For Baked-Enamel or Powder-Coat Finish: After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
- B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.
- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreatment, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Install signs so they do not protrude or obstruct according to accessibility standard.
  - 3. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.
  - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

**3.3 INSTALLING POSTS**

- A. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet.
- B. Direct-Burial Method and Concrete Footing:
  - 1. Excavation: Excavate posthole to dimensions indicated. Reconstruct subgrade that is not firm, undisturbed, or compacted soil, or that is damaged by freezing temperatures, frost, rain, accumulated water, or construction activities by excavating an additional 12

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inches (300 mm), backfilling with satisfactory soil or well-graded aggregate, and compacting to original subgrade elevation.

2. Setting in Earth: Set post in position, support to prevent movement.
3. Setting in Cast-in-Place Concrete: Set post in position, support to prevent movement, and place concrete for concrete foundation as indicated.
4. Setting in Preformed Hole in Concrete Foundation: Form or core drill holes in concrete foundation not less than 3/4 inch larger than outside dimension of post for installing posts in concrete. Set post in position, shim to prevent movement, and fill annular space between post and hole with nonshrink, nonmetallic grout, mixed and placed to comply with manufacturer's written instructions.
  - a. Leave anchorage joint exposed with 1/8-inch anchoring material sloped away from post.

#### 3.4 FINISH AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101426

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SECTION 107516 – GROUND-SET FLAGPOLES

GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Ground-set flagpoles made from aluminum.
  - 2. American Flag.
  - 3. Solar flagpole-mounted downlighting.
- B. Related Sections:
  - 1. Division 00 Section “Subsurface Information” for geotechnical report.
  - 2. Division 03 Section “Site Cast-in-Place Concrete” for flagpole footing.
  - 3. Division 26 Section “Exterior Lighting” for lighting attached to top of flagpole.

1.3 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section “Sustainable Design Requirements” and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

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5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- C. Shop Drawings: For flagpoles.
1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
  2. Include section, and details of foundation system.
- D. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.
- E. Delegated-Design Submittal: For flagpoles.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

**2.2 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.

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- B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
  - 1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is New Haven, Connecticut.
  - 2. Base flagpole design on polyester, nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

### 2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: Cone or Entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Flagpole.
    - b. Eder Flag Manufacturing Company, Inc.
    - c. Morgan-Francis Flagpoles and Accessories.
    - d. Pole-Tech Company Inc.
- B. Exposed Height: 30 feet (9 m).
- C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
  - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
  - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- D. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.
- E. Cast Aluminum Base: Provide cast aluminum octagonal base Model No. MF 3380-1 with anodized finish to match color of flagpole as manufactured by Morgan-Francis Flagpoles and Accessories, 9850 East 30th Street, Indianapolis, IN 46229 (800) 814-9568 or approved equal.

### 2.4 FITTINGS

- A. Cast Aluminum Ball Finial: Sized as indicated.
  - 1. Cast aluminum with gold anodic finish.
- B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
  - 1. Halyard Flag Snaps: Stainless-steel swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

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2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Furnish two per halyard.
  - a. Product: Subject to compliance with requirements, provide "Quiet Halyard" flag clasp by Acme/Lingo Flagpoles LLC.
- C. Basis-of-Design Solar Flagpole Light: Subject to requirements, provide Supreme Solar Disk Flagpole Light as manufactured by PoleTech downlight or approved equivalent by one of the following:
  - a. Manufacturers:
  - b. X40 Solar Flagpole Light by HD Flagpoles.
  - c. Professional Solar Disk Flag Light by Liberty Flagpoles.
2. Requirements:
  - a. LED lights.
  - b. Solar powered.
  - c. 1100 lumens minimum.
  - d. Switches on and off automatically at dusk/dawn (with button switch).
  - e. 10 to 12 hour minimum run time.
- D. American Flag:
  1. Material: Nylon.
  2. Construction: Sewn stripes, embroidered stars, constructed with heavy canvas heading material, 4 rows of stitching at the fly end, and rugged brass grommets. Flag shall be designed for outdoor use and to resist fading and fraying.
  3. Size: 4 feet by 6 feet.

## 2.5 MISCELLANEOUS MATERIALS

- A. Drainage Material: Crushed stone or crushed or uncrushed gravel; coarse aggregate.
- B. Elastomeric Joint Sealant: Multicomponent nonsag urethane, single-component nonsag urethane, or single-component neutral-curing silicone joint sealant as recommended by flagpole manufacturer and complying with requirements in Section 07 9200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- B. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
- C. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.



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- D. Place concrete, as specified in Section 03 3000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

**3.2 FLAGPOLE INSTALLATION**

- A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.
- B. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION



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SECTION 11 6833.33 — FIELD EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Bat Rack.
  - 2. Two-tier Team Benches (8-foot long).
  - 3. Foul Pole.
  - 4. Soccer Goals.
  - 5. Baseball and Softball bases.
- B. Related Sections:
  - 1. Division 32 Section "Cast-in-place Concrete" for concrete dugout foundations onto which dugouts are attached.
- C. Alternates: Refer to Division 01 Section "Alternates" for description of Work of this Section affected by alternates.

1.3 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

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- 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
- 6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Product Data: For each type of product.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, and hardware.
- D. Samples: For each exposed product and for each color and texture specified.
- E. Samples for Initial Selection: For units with factory-applied finishes.
- F. Samples for Verification: For each type of exposed finish, not less than 6-inch- (152-mm-) long linear components and 4-inch- (102-mm-) square sheet components.
  - 1. Include full-size Samples of communications box.
- G. Product Schedule: For athletic field equipment. Use same designations indicated on Drawings.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For track and field equipment to include in maintenance manuals.

**1.5 QUALITY ASSURANCE**

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. National Federation of State High School Associations (NFHS).
  - 2. International Amateur Athletic Association (IAAF).

**1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products and materials in original unopened packages, containers, or bundles with manufacturer's label intact and legible.
- B. Remove items delivered in broken, damaged, rusted, or unlabeled condition from project site immediately.
- C. Handle and store so as to avoid damage.

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**PART 2 - PRODUCTS**

**2.1 BAT RACK**

- A. Basis of Design: Subject to compliance with requirements, provide Stand Alone Bat Rack, Model No. SUABRPL15 as manufactured by Sports Field Specialties Inc., (888) 975-3343, [www.sportsfieldspecialties.com](http://www.sportsfieldspecialties.com) or a comparable product by the following, as approved by the Landscape Architect:

1. Patterson-Williams Athletic Manufacturing Company; Bat Holder.
2. Requirements:
  - a. Size: 34 inches long x 29 inches tall x 11 inches deep.
  - b. Description: Fifteen (15) bat storage 4-inch diameter tubes anchored to concrete pavement.
  - c. Construction: Constructed of heavy-duty aluminum.
  - d. Finish: Powder-coated finish. Color as selected by Landscape Architect.

**2.2 TWO-TIER TEAM BENCHES**

- A. Basis of Design: Subject to compliance with requirements, provide Two-Tier Polyboard Team Benches, Model No. PBTB8 as manufactured by Sports Field Specialties Inc., (888) 975-3343, [www.sportsfieldspecialties.com](http://www.sportsfieldspecialties.com) or a comparable product by the following, as approved by the Landscape Architect:

1. BaseballRacks.net; Elite Bench.
2. Requirements:
  - a. Size: 8-feet (96-inches) long x 24 inches tall x 16 inches deep.
  - b. Description: Two-tier seating aluminum frame with synthetic polyboard planking.
  - c. Frame Finish: Power-coat.
  - d. Frame Color: As selected by Owner from manufacturer's full range.
  - e. Polyboard Color: As selected by Owner from manufacturer's full range.
  - f. Mounting: Permanent or portable as selected by Owner.

**2.3 FOUL POLE**

- A. Basis of Design: Subject to compliance with requirements, provide Foul Pole with Wing, Model No. FPW420 as manufactured by Sports Field Specialties Inc., (888) 975-3343, [www.sportsfieldspecialties.com](http://www.sportsfieldspecialties.com) or a comparable product by the following, as approved by the Landscape Architect:

1. BaseballRacks.net; Elite Bench.
2. Requirements:
  - a. Height: 20-feet (609 cm) above finish grade.

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- b. Pipe: 4-inch O.D. x 1/8-inch wall thickness 6061 Aluminum Tube or 3.5-inch dia. Schedule 40 Aluminum Pipe (4-inch O.D.).
- c. Finish: Powder Coated.
- d. Color: Yellow.
- e. Mount: Ground Sleeve cast into concrete footing.
- f. Mesh Wing: Fabricated from of Stamped 1/8-inch thick aluminum panel with double reinforced bends welded at corners using 1 ½ inch square open mesh.
- g. Wing Size: 18 inches wide from top of upright pole to 8 feet above finished grade
- h. Assembly Hardware: Stainless steel.

## 2.4 SOCCER GOALS

- A. Soccer Goal: Round-faced soccer goal, Model No. SG4590 fabricated from extruded aluminum tube with the following attributes:
  - 1. Length: 24 feet.
  - 2. Front Frame: Round faced.
  - 3. Backside Corners: Radiused.
  - 4. Finish: Powder-coated – White.
  - 5. Accessories:
    - a. Welded aluminum net clips.
    - b. Polypropylene Soccer Net – Orange.
    - c. Stainless steel hardware.
- B. Soccer Goal Safety System, Model No. SG2SGP consisting of a powder-coated aluminum clamp with stainless steel hardware.
- C. Soccer Goal Mobility Kit, Model No. SG4955 consisting of wheel inserts with welded stainless-steel frame, plastic wheels, and stainless steel hardware and stainless steel mobility handle.

## 2.5 BASEBALL AND SOFTBALL BASES

- A. Basis of Design: Subject to compliance with requirements, provide Foul Pole with Wing, Model No. FPW420 as manufactured by Sports Field Specialties Inc., (888) 975-3343, [www.sportsfieldspecialties.com](http://www.sportsfieldspecialties.com) or a comparable product by the following, as approved by the Landscape Architect:
  - 1. Jaypro Sports Equipment, Waterford, CT (860) 243-0533
- B. Provide the following:
  - 1. Set of three Bases, 15-inch x 15-inch x 2 ½-inch, with ground anchors and anchor plugs (Model No. SHBBPL).
  - 2. Home Plate, 1 ½-inches thick, with 7-inch stanchion, (1) ground anchor, (1) anchor plug, and (5) zinc-plated mounting spikes (Model No. SHP-UM).
  - 3. Pitching Rubber, 6-inch x 24-inch, (Model No. SHBBPB).

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**2.6 GENERAL FINISH REQUIREMENTS**

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

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

**3.2 INSTALLATION, GENERAL**

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of equipment where required.
- B. All athletic equipment shall be installed as indicated on approved submittals as recommended and in strict accordance with manufacturer's written directions and as indicated on the drawings and specified herein.
- C. All concrete footings for athletic equipment shall be installed as indicated on the drawings and in accordance with Division 03 Section "Cast-in-Place Concrete".
- D. All sleeves required for athletic equipment installation shall be set plumb and true to line and grade in concrete as indicated on the drawings and per manufacturer's recommendation.
- E. All athletic equipment shall be installed in strict accordance with the latest rules, regulations and specifications governing that sport or event for which it is being installed.

END OF SECTION 11 6833.33





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SECTION 311005 – ATHLETIC FIELD SITE PREPARATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Strip turf from all existing athletic field turf areas.
  - 2. Removal and screening of all exiting root zone medium to an approximate depth of 6 inches and properly stockpile the material for later reuse. The root zone material will be screened and all debris, organic material, and stones greater than 3/8 inch must be removed.
  - 3. Rough grading of the exposed subbase material and consolidated to provide a 2 percent slope longitudinally from the center line of the field to the perimeter.
  - 4. Upon re-grading of existing surfaces and installation of any required additional material, install, roll, and compact subbase material to the final grades according to the Drawings. The final grading will be completed using three-axis computer-controlled laser grading to within ½ inch.
  - 5. Protection of all stockpiled materials from erosion and contamination by stone, organic matter, construction debris, or other inappropriate materials.

1.3 RELATED REQUIREMENTS

- A. Section 32 9113.29 - Athletic Field Root Zone Mixing: Preparation and blending of root zone mix.
- B. Section 32 9219 Athletic Field Seeding: Seeding of athletic fields.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 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.
- C. Protection of all stockpiled materials from erosion and contamination by stone, organic matter, construction debris, or other inappropriate materials. Any contaminated stockpiled materials

will need to be screened to remove contaminating debris. Cleaned materials can only be used with the approval of the Landscape Architect.

### 3.2 EXAMINATION

- A. Examine areas to be worked 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 athletic field renovation 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 athletic field renovation area, remove the soil and contamination as directed by Landscape Architect replace with new material to meet the existing specified material.
- D. Alert the Landscape Architect so that the new material and installation technique may be inspected and approved.
- E. The Landscape Architect must approve any changes to the means and methods of the athletic field construction, and/or materials.
- F. Completion of work is subject to adverse climatic conditions, which could affect the date of substantial completion. Any/all delays must be communicated with the Construction Manager as soon as possible
- G. No work can progress unless testing results are approved by the Landscape Architect.

### 3.3 TURF REMOVAL, EXCAVATION AND SUB-BASE PREPARATION WORK

- A. All work must be performed in the approximate sequence as listed below:
- B. Mobilize Equipment:
  - 1. Delivery and removal of all required equipment to site. Mobilization will require forty-eight (48) hour notice of intent prior to delivery of any construction equipment to be left on site. Notify the Construction Manager and Landscape Architect for authorization of mobilization.
- C. Land Survey:
  - 1. Prior to the use of any construction equipment, the Contractor's proposed field layout and elevation control strategies must be determined and marked.
  - 2. Prior to work commencing, the Contractor is responsible for examining the site, and its existing contours. The field must meet final elevations according to the Drawings.
  - 3. The Contractor must make sure the field reconstruction meets the final elevations provided in new grading plans (provided in this specification)
- D. Topsoil Excavation and Stockpile:

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1. The Contractor shall provide all labor, materials, and equipment (including LGP equipment) required to provide earth moving and sub-base elevations.
  2. Remove any existing stone, remaining surface stabilization materials, and other debris to the depth of the existing sub-base (eastern edge temporary access road)
  3. Transport all stone and debris material to stockpile holding area utilizing LGP hydraulic dump box trailers or equal attached to LGP tractors.
  4. Remove existing topsoil material down to existing sub-base.
  5. Transport topsoil to existing topsoil stockpile area to be prepared for screening and decontamination of unwanted material (which would include but not limited to stone, gravel, asphalt, etc.)
- E. Excavation of Temporary Stabilization Material:
1. The Contractor shall provide all labor, materials, and equipment (including LGP equipment) required to provide earth moving and sub-base elevations.
  2. Remove any existing stone, remaining surface stabilization materials, and other debris to the depth of the existing sub-base.
  3. Transport all stone and debris material to stockpile holding area utilizing LGP hydraulic dump box trailers or equal attached to LGP tractors.
- F. Sub-Base Preparation:
1. The existing sub-base material may require decompaction to enable accurate regrading to take place this would be following a consultation between the Contractor, the Construction Manager and the Landscape Architect.
  2. Laser grade sub-base to 0.25 inch of finish sub base elevation according to the Site Grading Drawing utilizing a LGP compact motorized cross slope dual laser grader or equal. The sub-base shall mirror the final grading plan of the field.
  3. The sub-base should be compacted to a 95% compaction level.

END OF SECTION



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SECTION 311100 – CLEARING AND GRUBBING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section Includes
  - 1. Cutting of trees and other vegetation.
  - 2. Clearing of miscellaneous vegetation.
  - 3. Removal of roots and related growth.
  - 4. Disposal of all waste materials.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. State of Connecticut Department of Transportation (ConnDOT)
  - 1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 818 and any supplements.
- C. Code of Federal Regulations (CFR)
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction

1.4 DEFINITIONS

- A. Clearing: Clearing shall consist in the felling, cutting up, and satisfactory disposal of trees and other vegetation designated for removal in accordance with these specifications.
- B. Drainage Course: Layer supporting basement grade used to minimize capillary flow of pore water.
- C. Grubbing: Grubbing shall consist of the removal of roots 1 ½ inch and larger, organic matter and debris, and stumps having a diameter of three inches or larger, to a depth of at least 18 inches below the surface and or subgrade; whichever is lower, and the disposal thereof.

1.5 SAFETY REQUIREMENTS

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- A. Contractor shall conduct all clearing and grubbing activities in conformance with applicable regulations, including those relating to barriers, warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Contractor shall provide and maintain barricades, warning signs, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.
- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.

**1.6 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are trained, experienced, and as required licensed, in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

**PART 2 PRODUCTS – NOT USED**

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Secure the work area and take precautions for preventing injuries to persons or damage to property in or about the work. Protect structures, utilities, sidewalks, pavements and other facilities or sensitive areas from damage by clearing and grubbing operations.
- B. Establish all required erosion and sedimentation controls prior to initiating work.

**3.2 CLEARING AND GRUBBING**

- A. Clear, grub, remove, and dispose of all vegetation and debris within the limits of construction, as designated on the plans or as required by Engineer. Contractor shall remove only those trees and shrubs absolutely necessary to allow for the construction. The work shall also include the preservation and protection of all vegetation designated to remain.
- B. A preconstruction meeting shall be held with Engineer, Owner, local authorities, property owner(s) and other appropriate personnel, if required, prior to any clearing.
- C. The area within the limits of construction or as designated shall be cleared and grubbed of all trees, stumps, roots, brush, undergrowth, hedges, heavy growth of grasses or weeds, debris and rubbish of any nature which, in the opinion of Engineer, is unsuitable for foundation material. Nonperishable items that will be a minimum of five (5) feet below the finish elevation of the earthwork or slope of the embankment may be left in place.
- D. Contractor shall provide barricades, fences, coverings, or other types of protection necessary to prevent damage to existing improvements, not indicated to be removed, and improvements on adjoining property. All improvements damaged by this work shall be restored to their

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original condition or to a condition acceptable to the owner or other parties or authorities having jurisdiction.

- E. Protection of Trees and Vegetation: Contractor shall protect existing trees and other vegetation indicated on the Drawings to remain in place against cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences or barricades as required to protect trees and vegetation to be left standing at no additional cost.
- F. Trees and shrubs that are to remain within the construction limits will be indicated on the Drawings or conspicuously marked on the Project Site. Unless otherwise noted, trees within the construction limits shall become the property of the Contractor and shall be removed from the site.
- G. Carefully and cleanly cut roots and branches of trees indicated to remain where the roots and branches obstruct construction of utilities or other subsurface improvements. Contractor shall provide protection for roots and branches over 1 ½ inches diameter that are cut during construction operations. Temporarily cover all exposed roots with wet burlap to prevent roots from drying out. Provide earth cover as soon as possible.
- H. Damaged trees and vegetation designated to remain shall be repaired or replaced at Contractor's expense in a manner acceptable to Engineer if they are damaged by construction operations. Repair tree damage as directed by a qualified tree surgeon.
- I. Trees and vegetation designated to remain shall be repaired or replaced at Contractor's expense in a manner acceptable to Engineer if they are damaged by construction operations. Repair tree damage as directed by a qualified arborist.
- J. All brush, tree tops, stumps, and debris shall be hauled away and disposed of in accordance with all applicable laws and regulations. Contractor shall clean up debris resulting from clearing operations continuously with the progress of the work and remove promptly all salvageable material that becomes his property and is not to be reused in construction. Sale of material on the site is prohibited. Debris from the site shall be removed in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, dust, and debris at all times.
- K. The method of stripping, clearing and grubbing the site shall be at the discretion of the Contractor. However, all stumps, roots and other debris protruding through the ground surface or in excavated areas shall be completely removed to a minimum depth of 18 inches below surface and/or subgrade whichever is lower and disposed of off the site by the Contractor, at his expense.
- L. Marginal Areas: In marginal areas, with Engineer's permission, remove trees where the following conditions exist.
  - 1. Root Cutting: When clearing up to the "clearing limits," the Contractor shall also remove any tree which is deemed marginal such that when the roots are cut and the tree could be rendered unstable by the affects of high winds and in danger of toppling into either the right-of-way or onto private property.
  - 2. Slender Bending Trees: Where young, tall, thin trees are left unsupported by the clearing operation, and are likely to bend over into the right-of-way, Contractor, during the clearing operation, shall selectively remove those trees which are located outside and adjacent to the clearing limits and any right-of-way or easement as well. During the

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course of construction and during the one-year warranty period, the Contractor shall remove such young trees that overhang into the right-of-way or cleared area.

- M. Stripping of Topsoil: Remove the existing topsoil to a depth of 6 inches or to the depth encountered from all areas in which excavation will occur. The topsoil shall be stored in stockpiles, separate from the excavated material, if the topsoil is to be respread. Otherwise material shall be disposed of off-site at Contractor's expense.

**3.3 DISPOSAL**

- A. Contactor shall consolidate and clean-up debris resulting from clearing and grubbing operations continuously with the progress of the work.
- B. All brush, treetops, stumps, and debris resulting from clearing and grubbing operations shall be hauled away and disposed of in accordance with all applicable laws and regulations. Any materials salvaged by Contractor from clearing and grubbing operations shall be promptly removed from the Project Site.
- C. Contractor will be responsible for obtaining all applicable permits and paying all fees for the disposal of excess material.
- D. Sale of material on the Project Site is prohibited.
- E. Burning of material is prohibited.

END OF SECTION 311100



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SECTION 312310 – EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Preparation and grading subgrades for slabs-on-grade, walks, pavements, and landscaping.
  - 2. Excavating and backfilling for structures.
  - 3. Excavation and backfilling for underground utilities and associated appurtenances.
  - 4. Excavation, backfill and compaction for the demolition/removal of subsurface utilities and improvements.
  - 5. Earth retention systems.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 GENERAL

- A. Contractor is advised that lines and grades, as shown on the Drawings, are subject to change. Although it is intended to adhere to what is shown on Drawings, Engineer reserves the right to make changes in lines and grades of utilities or other subsurface construction when such changes may be necessary or advantageous.
- B. In open trenching on public roadways, Contractor shall be governed by the conditions, restrictions and regulations made by the local or state authority as applicable. All such regulations shall be in addition to those set down in the Specifications.

1.4 EXCAVATION CLASSIFICATIONS

- A. Excavation - Excavation shall be unclassified and no consideration will be given to the nature of the materials. Excavation 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 include but not limited to earth, fill, boulders, foundations, pavements, curbs, piping, cobbles, stones, footings, bricks, concrete, previously abandoned drainage structures and utility structures abandoned and not removed by the utility and debris.
- B. Common Excavation - Excavation of all materials that can be excavated, moved, loaded, transported, and unloaded using heavy equipment or that can be excavated and dumped into place or loaded onto hauling equipment by excavation equipment (shovel, bucket, backhoe, dragline, or clam shell) or moved with dozer-type equipment, appropriate to the material type,

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character, and nature of the materials. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material. All Common Excavation shall be included in the Base Bid.

- C. Rock Excavation - Rock Excavation as defined herein. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of Common Excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

## 1.5 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. State of Connecticut Department of Transportation (ConnDOT)
1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 818 and any supplements.
- C. Code of Federal Regulations (CFR)
1. 29 CFR 1926, Safety and Health Regulations for Construction
- D. American Concrete Institute (ACI)
1. ACI 229R-99 - Controlled Low-Strength Materials (CLSM).
- E. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO Method T 90 - Determining the Plastic Limit and Plasticity Index of Soils.
  2. AASHTO T104 - Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
  3. AASHTO Method T146 - Standard Method of Test for Wet Preparation of Disturbed Soil Samples for Test.
- F. ASTM International (ASTM).
1. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.
  2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
  3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN-m/m<sup>3</sup>)).
  4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
  5. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

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6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

7. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

**1.6 DEFINITIONS**

- A. Backfill: Soil material or flowable concrete used to fill an excavation.
- B. Bedding Course: Layer placed over the excavated sub-grade in a trench before laying pipe.
- C. Benching: A method of limiting cave-in potential by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Clearing: Clearing shall consist in the felling, cutting up, and satisfactory disposal of trees and other vegetation designated for removal in accordance with these specifications.
- F. Drainage Course: Layer supporting basement grade used to minimize capillary flow of pore water.
- G. Earth Retention Systems: Any structural system, such as sheeting and bracing or cofferdams, designed to retain in-situ soils in place and prevent the collapse of the sides of an excavation in order to protect employees and adjacent structures.
- H. Excavation: Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
  - 1. Additional Excavation: Excavation beyond required dimensions or below subgrade elevations that is requested and/or directed by Engineer. Additional Excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - 2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
  - 3. Unauthorized Excavation: Excavation below the elevations specified on the plans, beyond the limits indicated on the plans, or where no dimensions are indicated, beyond depths, elevations, and dimensions reasonably necessary for construction of the work without the request and/or direction of the Engineer. Unauthorized excavation, as well as any remedial work directed by Engineer, or if applicable Geotechnical Engineer, shall be without additional compensation.
- I. Fill: Soil materials used to raise existing grades.
- J. Finished Grade: The proposed final elevations shown on the Drawings or called for in the Specifications.
- K. Geotechnical Engineer: A qualified and licensed entity designated for the project as the authority on the assessment, design, and oversight of soil and/or rock conditions and construction affected by such conditions.

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- L. Geotechnical Testing Agency: An independent testing agency employed by Owner, or by Contractor is called-for, and qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- M. Grubbing: Grubbing shall consist of the removal of roots 1 ½ inch and larger, organic matter and debris, and stumps having a diameter of three inches or larger, to a depth of at least 18 inches below the surface and or subgrade; whichever is lower, and the disposal thereof.
- N. Protective System: A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include earth retention systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.
- O. Regular Excavation: Removal and disposal of any and all material above subgrade elevation, except solid rock and undercut excavation, located within the limits of construction.
- P. Rock: Solid ledges, bedded deposits, unstratified masses and conglomerations of material so firmly cemented as to possess the characteristics of solid rock which cannot be removed without systematic drilling or hoe ramming. All boulders containing a volume of more than one (1) cubic yard shall be considered rock.
- Q. Rock Excavation: Removal and satisfactory disposal of Rock, which, in the opinion of Engineer, cannot be excavated except by drilling, wedging, jack hammering or hoe ramming or the excavation of boulders or rock fragments containing a volume of more than one (1) cubic yard. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.
- R. Licensed Professional Engineer: A person who is licensed as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.
- S. Satisfactory Materials: Earth material that meets the classification, use, and/or gradation requirements herein that does not contain limestone, shale, clay, ash, slag, friable material, organic or vegetative materials, topsoil, wood, trash, broken concrete, masonry rubble, trash, refuse, or frozen materials.
- T. Shield System: A structure that is designed to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built in accordance with 29 CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."
- U. Sloping: A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.
- V. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- W. Sub-grade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below drainage fill.

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- X. Surplus Material: Excavated acceptable material that cannot be utilized elsewhere on the site as backfill or embankment fill, or as otherwise directed by the Engineer.
- Y. Temporary Dewatering System: A system to lower and control water to maintain stable, undisturbed subgrades at the lowest excavation levels. Dewatering shall be provided for all pipelines, structures and for all other miscellaneous excavations.
- Z. Testing Laboratory: A qualified entity engaged to perform specific laboratory tests.
- AA. Testing Agency: A qualified entity engaged to collect samples, perform specific in-field tests, and/or inspections. The Testing Laboratory may provide the services of the Testing Agency.
- BB. Trench: A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.
- CC. Unacceptable Material: Soil material that contains organic silt, peat, vegetation, wood or roots, stones or rock fragments over six (6) inches in diameter or exceeding 40 percent by weight of the backfill material, porous biodegradable matter, loose or soft fill, construction debris, or refuse, or material which cannot be compacted to the specified or indicated density.

**1.7 SUBMITTALS**

- A. Site Characterization of Off-Site Borrow Sources: The following information shall be submitted to Engineer for review at least two weeks prior to use of an off-site borrow source:
  - 1. Location and name of the borrow source site.
  - 2. Owner and contact information for the borrow source site.
  - 3. Present and past usage of the source site and materials.
  - 4. Any previously existing report(s) associated with an assessment of the source site as relates to the presence of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.
  - 5. Location within the site from which the material will be obtained.
- B. Chemical Testing Data: For each type/classification of earth material proposed and each source of earth material proposed: Submit a letter signed by an authorized representative of material supplier stating that such proposed material is free of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.
- C. Material Testing Data: Provide results for all proposed bedding, fill, aggregates, and backfill. Submit complete laboratory reports.
  - 1. Gradation analysis.
  - 2. Soil classification and Moisture-Dry Density Curve.
  - 3. Loss on Abrasion.
  - 4. Soundness.
- D. Samples: 50-pound sample of each type of off-site bedding, fill, aggregates, and backfill that are proposed for use at the Project Site in an air-tight container for the testing laboratory, a

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minimum of two weeks prior to delivery of such material to the site. Use of these proposed materials by Contractor prior to testing and approval or rejection shall be at Contractor's risk.

E. Product Data

1. Plastic warning tape.
2. Separation fabric, filter fabric, geogrids, or similar geotextiles.

F. Field Testing Results

1. Compaction test results keyed to date and specific location of testing. Provide Engineer with copies of testing reports within 24 hours of field test.

1.8 SAFETY

- A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.
- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.9 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Utility Mark-out
  1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).
  2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.

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3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.
- C. Codes and Standards: Perform the work of this Section in accordance with all applicable codes, standards, and the requirements of authorities having jurisdiction.
- D. Engineer reserves the right to perform all in-field testing specified in this Section and reserves the right to determine the suitability of all materials to be used for fills and reject any fill not meeting the specifications.
- E. Field Density testing and subgrade observation shall be performed by the designated entity
- F. Weather Limitations:
  1. Material excavated when frozen or when air temperature is less than 32 degrees Fahrenheit (32 F) shall not be used as fill or backfill until material completely thaws.
  2. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

#### 1.10 TESTING

- A. The Owner will retain a testing entity to perform sampling and testing of the work under this Section during construction. The testing entity's presence does not constitute supervision or direction of Contractor's work. Neither the presence of the testing entity nor any observations and testing performed by him, nor any notice or failure to give notice shall excuse Contractor from conformance with these Specifications or from defects discovered in his work. Contractor shall remain responsible for all pre-construction sapling and testing.
- B. Borrow and Fill: Contractor shall provide testing as defined below.
  1. Gradation analysis for each type of borrow and on-site fill materials by ASTM D422.
  2. Soil classification (ASTM D2487) and Moisture-Dry Density Curve (Proctor Test-Modified) by ASTM D1557 for all proposed fill and backfill materials at the frequency specified below:
    - a. For suitable soil materials removed during Trench Excavation, perform one test for every 1,000 cubic yards of similar soil type. Similarity of soil types will be as determined by the Engineer.
    - b. For borrow materials, perform tests from each proposed source, at a rate of one test for every 1,000 cubic yards of soil type. Similarity of soil types will be as determined by the Engineer.
  3. Loss on Abrasion: Where called-for, AASHTO Method T 96.
  4. Soundness: Where called-for, AASHTO Method T 104.
- C. Compaction Testing: Owner will conduct compaction testing (i.e. ASTM D2922 and ASTM D3017 or ASTM D1556) at the frequency indicated below.
  1. Trench: 1 test per lift, every 1,000 square feet or 200 feet of trench.

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2. Embankment: 1 test per lift, every 1,000 square feet.
  3. Additional compaction testing may be required when there is evidence of a change in the quality of moisture control or the effectiveness of compaction.
  4. If all compaction test results within the initial 25% of the total anticipated number of tests indicate compacted field densities equal to or greater than 95% of maximum dry density at optimum moisture content, Engineer may reduce frequency of compaction testing. In no case will the frequency be reduced to less than one test for every 500 cubic yards of material backfilled.
  5. If testing indicates that compacted subgrade, backfill, or fill are below specified density, additional compaction and/or replacement of material shall be provided at no expense to Owner.
- D. Chemical Testing: Prior to delivery of any earth material to the Project Site, Contractor shall conduct chemical testing to demonstrate that such material is free of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.

**1.11 EXCAVATED MATERIAL**

**A. Placement**

1. Excavated material shall be so placed as not to interfere with travel or movement on existing streets, driveways, sidewalks or other areas designated to remain undisturbed. Excavated material shall not be deposited on private property without the written consent of the property owner(s) and approval of Engineer.
  2. No excavated material shall be stored on top of installed pipe or other construction. Contractor shall consider surcharge loads when stockpiling excavated material adjacent to trenches, and take any measure required to prevent cave-in, including but not limited to, trench support systems and/or stockpiling excavated material remote from trench.
- B. Suitable excavated material may be used for Common Fill or Backfill on other parts of the Work, if specifically approved by Engineer.
- C. Material excavated from private property shall belong to the property Owner, or his representative, and shall be disposed of by the Contractor, as required by said Owner or his representative. If the Contractor fails to promptly remove such surplus material, Engineer may have the same done and charge the cost thereof as money paid to the Contractor.
- D. Contractor shall be responsible for the proper disposal of all unsuitable excavated materials. Engineer shall determine what is suitable or unsuitable material where questions arise. Generally, unsuitable material shall include, but not be limited to, pavement (bituminous and concrete), large boulders, pipe, conduit and metal.
- E. Contractor shall submit to Engineer, for approval, the location(s) to be utilized during the Contract period for waste material disposal. This approval must occur before any export of waste material from the project site. Any change in the disposal site during construction shall be submitted for approval.

**1.12 SHEETING, SHORING AND BRACING**



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- A. Provide earth retention systems as required by federal, state and local regulations. Shoring and bracing of trenches and other excavations shall be in accordance with the latest OSHA Standards and Interpretations, and to all other applicable codes, rules and regulations of federal, state and local authorities.

**1.13 DRAINAGE**

- A. At all times during construction, Contractor shall temporarily provide, place and maintain ample means and devices with which to remove promptly, and dispose of properly, all water entering trenches and other excavations, or water that may flow along or across the site of the Work, and keep said excavations dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be damaged. At the conclusion of the work, Contractor shall remove such temporary means and devices.
- B. All groundwater which may be found in the trenches and foundation excavations, and any water which may get into them from any cause whatsoever, shall be pumped or bailed out, so that the trench shall be dry during pipe laying and backfilling and during the placement of concrete.
- C. All water pumped or drained from the Work shall be managed in accordance with applicable discharge permits, without undue interference with other work or damage to pavements, other surfaces, or property.

**1.14 COORDINATION**

- A. Prior to commencing earthwork operations, meet with representatives of governing authorities, Engineer, testing entity, and other pertinent entities.
  - 1. Review earthwork procedures and responsibilities including Contractor's schedule of operations, scheduling observation and testing procedures and requirements.
  - 2. Notify participants at least three (3) working days prior to convening conference. Record discussions and agreements and furnish copies to each participant.
  - 3. Contractor shall at all times so conduct his work as to insure the least possible inconvenience to the general public and the residents in the vicinity of the work. Fire hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by Contractor to ensure the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed except as approved by Engineer.
- B. Benchmark/Monument Protection: Protect and maintain benchmarks, monuments or other established reference points and property corners. If disturbed or destroyed, replace at no cost to Owner.
- C. Provide five (5) days advance notice to Engineer and testing entity for any proposed earthwork operation requiring observation and/or testing.

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**PART 2 PRODUCTS**

**2.1 SOIL MATERIALS**

- A. All materials used in the work of this Section shall be Satisfactory Material, and any material that does not meet this classification shall be considered an Unsatisfactory Material and shall not be used.
- B. Unsatisfactory Soils: Soil materials not meeting the requirements for Satisfactory Soils.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within two (2) percent of optimum moisture content at time of compaction.

**2.2 COMMON FILL/ORDINARY BORROW**

- A. Earth materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GP-GC, SW, SP, and SM that are free of clay.
- B. Common Fill material is subject to the approval of Engineer and may be either material removed from excavations or borrow from off site. It shall have physical properties such that it can be readily spread and after it has been placed and properly compacted, it will form a dense, stable fill.
- C. Common Fill shall be graded as follows:

Gradation of Common Fill

Sieve	Percent Passing by Weight
6"	100
3.5 "	50-100
3/4"	50-90
No. 4	25-55
No. 200	0-20

- 1. Less than twenty (20) percent of material by weight passing the No. 4 sieve shall pass the No. 200 sieve.
- 2. Common Fill shall not be used at locations where use of select fill is indicated.

**2.3 COMMON FILL/ORDINARY BORROW**

- A. Satisfactory Material that is well-graded meeting ASTM D 2487 classification group GW, GP, GM, SW, SP, and SM. No particle shall exceed 6-inches in size and no greater than 10% by weight of the material shall pass the No. 100 sieve and no greater than 5% by weight of the material shall pass the No. 200 sieve.
- B. Common Fill is subject to the approval of Engineer and may be either material removed from on-site excavations or borrow pits or imported from off-site, approved sources. It shall have physical properties such that it can be readily spread and after it has been placed and properly compacted, it will form a dense, stable fill.

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**2.4 BANK RUN GRAVEL**

- A. Granular material, well graded from fine to coarse, obtained from approved natural deposits and unprocessed, except for the removal of unacceptable material and stones larger than the maximum size permitted.
- B. Bank Run Gravel shall be graded as follows:

Gradation of Bank Run Gravel (ConnDOT Grading "C")

Sieve	Percent Passing by Weight
1 1/2"	100
3/4"	45-80
1/4"	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

**2.5 GRANULAR FILL**

- A. Broken or crushed stone, gravel, or a mixture thereof.
- B. Broken or crushed stone
1. The product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation. Broken or crushed stone shall consist of sound, tough, durable stone, reasonably free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces.
- C. Bank or crushed gravel
1. Sound, tough, durable particles of crushed or uncrushed gravel, free from soft, thin, elongated or laminated pieces and vegetable or other deleterious substances. Crushed gravel shall be the manufactured product resulting from the deliberate mechanical crushing of gravel with at least 50% of the gravel retained on the No. 4 sieve having at least one fractured face.
- D. Granular Fill shall be graded as follows:

Gradation of Granular Fill (ConnDOT Grading "A")

Sieve	Percent Passing by Weight
3 1/2"	100
1 1/2"	55-100
1/4"	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

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- E. Reclaimed material shall not be considered acceptable for use as granular fill.

**2.6 SCREENED GRAVEL AND CRUSHED STONE**

- A. Screened gravel, well graded in size from 3/8 inch to 3/4 inch. The gravel shall consist of clean, hard, and durable particles or fragments. Crushed rock of suitable size and grading may be used instead of screened gravel.
- B. Screened Gravel shall be graded as follows:

Gradation of Screened Gravel (ConnDOT Gradation No. 6)

Sieve	Percent Passing by Weight
1"	100
3/4"	90-100
1/2"	20-55
3/8"	0-15
No. 4	0-5

**2.7 PROCESSED AGGREGATE BASE**

- A. Coarse aggregates and fine aggregates shall be combined and mixed by approved methods so that the resulting material shall conform to the following gradation:

Gradation of Processed Aggregate Base

Sieve	Percent Passing by Weight
2 1/2"	100
2"	95-100
3/4"	50-75
1/4"	25-45
No. 40	5-20
No. 100	2-12

- B. Coarse Aggregate: Either gravel, broken stone or a combination thereof. When tested by means of the Los Angeles Machine, using AASHTO Method T 96, the coarse aggregate shall not have a loss of more than 50%.
1. If gravel is used for the coarse aggregate, it shall consist of sound, tough, durable particles of crushed or uncrushed gravel or a mixture thereof, free from soft, thin, elongated or laminated pieces, lumps of clay, loam and vegetable or other deleterious substances.
  2. If broken stone is used for the coarse aggregate, it shall consist of sound, tough, durable fragments of rock of uniform quality throughout. It shall be free from soft disintegrated pieces, mud, dirt, organic or other injurious material.
  3. Soundness for Gravel and Broken Stone: When tested by magnesium sulfate solution for soundness using AASHTO Method T 104, the coarse aggregate shall show a loss of not more than 15% at the end of 5 cycles.

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- C. Fine Aggregate: Natural sand, stone sand, screenings or any combination thereof. The fine aggregate shall be limited to material 95% of which passes a No. 4 (4.75-mm) sieve having square openings and not more than 8% of which passes a No. 200 (75- $\mu$ m) sieve. The material shall be free from clay, loam and deleterious materials.
1. Plasticity: When natural sand is used, the fine aggregate shall conform to the following:
    - a. When the fraction of the dry sample passing the No. 100 mesh sieve is 4% or less by weight (mass), no plastic limit test will be made.
    - b. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 4% and not greater than 8% by weight (mass), that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
    - c. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 8% by weight (mass), the sample will be washed; and the additional material passing the No. 100 mesh sieve shall be determined by AASHTO Method T 146, except that the No. 100 mesh sieve will be substituted for the No. 40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that passed the No. 100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
  2. Plasticity: When screenings or any combination of screenings and natural sand or any combination of stone sand and natural sand are used, the following requirements shall apply:
    - a. When the fraction of the dry sample passing the No. 100 mesh sieve is 6% or less by weight (mass), no plastic limit test will be made.
    - b. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 6% and not greater than 10% by mass, that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test, using AASHTO Method T 90.
    - c. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 10% by weight (mass), the sample shall be washed; and additional material passing the No. 100 mesh sieve shall be determined by AASHTO Method T 146, except that the No. 100 mesh sieve shall be substituted for the No. 40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that have passed the No. 100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.

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**2.8 BEDDING**

**A. Slabs on grade**

1. Granular Fill unless otherwise indicated.

**B. Utilities**

1. Unless otherwise indicated, bedding shall consist of screened gravel, maximum size 3/4 inches and minimum size 3/8 inches.
2. When clay, wet, soft or silty soil conditions prevail, 3/4-inch crushed stone shall be used for bedding of pipe.

**2.9 SAND**

- A.** Sand shall consist of clean, hard, durable, uncoated particles of quartz or other rock. It shall not contain more than 3% of material finer than a #200 sieve.
- B.** Organic Impurities: Fine aggregate subjected to the colorimetric test shall not produce a color darker than Gardner Color Standard No. 11, using AASHTO T 21. If the fine aggregate fails to meet this requirement, the provisions of AASHTO M 6, Section 5.2, will govern.
- C.** Sand shall be uniformly graded as follows:

Gradation of Sand

Sieve	Percent Passing by Weight
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

- D.** The above gradation represents the extreme limits which shall determine suitability for use from all sources of supply. The gradation from any one source shall be reasonably uniform and not subject to the extreme percentages of gradation specified above. For the purpose of determining the degree of uniformity, a fineness modulus determination will be made upon representative samples from any source. Fine aggregate from any one source having a variation in fineness modulus greater than 0.20 either way from the fineness modulus of the representative sample will be rejected.

**2.10 FLOWABLE CONCRETE FILL/BACKFILL (FLOWFILL)**

- A.** Cementitious material, ACI 229R, comprised of cement, aggregates, fly ash, water, and admixtures, capable of being poured or pumped, self-leveling, self-curing to specified strengths.
- B.** Excavatable flowfill: Concrete strength shall be liquid enough to flow, be self-leveling and excavatable by hand methods. Unless otherwise specified, excavatable flowfill shall have a minimum 28 day compressive strength of 30 psi, and shall not exceed 100 psi.

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- C. Non-excavatable flowable: Concrete strength shall be liquid enough to flow and be self-leveling and excavatable by machine equipment. Unless otherwise specified, non-excavatable flowfill shall have a minimum 28-day compressive strength of 125 psi, and shall not exceed 200 psi.

#### 2.11 DETECTABLE WARNING TAPE

- A. Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
  - 1. Red: Electric power lines, electric power conduits and other electric power facilities.
  - 2. Blue: Water.
  - 3. Orange: Communication lines or cables, including but not limited to telephone, fire signals, cable television, and electronic controls.
  - 4. Green: Storm drainage and sanitary sewer systems, including force mains and other non-hazardous materials.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Notify "Call-Before-You-Dig" to request a utility mark-out for the Project Site prior to any earth disturbance. Provide written confirmation to Engineer that such mark-out has been completed.
- B. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any discrepancies or hazardous conditions.
- C. Take precautions for preventing injuries to persons or damage to property in or about the work. Protect structures, utilities, sidewalks, pavements and other improvements from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- D. Protect sub-grades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- E. Provide 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.
- F. When excavations are to be made in paved surfaces, the pavement shall be removed so as to provide a clean uniform edge with a minimum disturbance of remaining pavement. Saw cutting the pavement to provide a clean, uniform edge shall unless otherwise indicated.
- G. If pavement is removed in large pieces, it shall not be mixed with other excavated material, but shall be disposed of away from the site of the Work before the remainder of the excavation is made.

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**3.2 CLEARING AND GRUBBING**

- A. Clear, grub, remove, and dispose of all vegetation and debris within the limits of construction, as designated on the plans or as required by Engineer. Contractor shall remove only those trees and shrubs absolutely necessary to allow for the construction. The work shall also include the preservation from injury or defacement of all vegetation or object designated to remain.
- B. Refer to Section 31 1100 – Clearing and Grubbing.

**3.3 PROTECTION OF EXISTING FEATURES**

**A. General**

- 1. Protect all existing improvements from damage unless those improvements are specifically designated for permanent removal, relocation, or temporary removal and replacement.
- 2. As excavation approaches underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.
- 3. Pavements: On paved surfaces to remain, do not use or operate tractors, bulldozers, or other power operated equipment, the treads or wheels of which are so shaped as to cut or otherwise damage such surfaces. All surfaces, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations. Suitable materials and methods shall be used for such restoration.

**B. Utilities**

- 1. Existing utilities remaining in service, including those remaining in service until after relocation, and relocated utilities shall be protected from damage. Before excavating near any existing utilities, notify the utility owner, coordinate protective work and comply with the utility owners' requirements. Coordinate with respective utility owners/operators as required.
- 2. Safeguard and protect from damage or movement any existing services, utilities, and utility structures uncovered or encountered which are to remain in service.
- 3. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.
- 4. Where known utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.
- 5. When uncharted or incorrectly charted piping or utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

- C. Retaining Structures: Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utility systems, paving, or other improvements. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto. Retain the services of a licensed engineer as required to design bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures.

**D. Replacement and Relocation**



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1. In case of damage, Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. When the Owner does not wish to make the repairs themselves, all damage shall be repaired by Contractor, or, if not promptly done by him, Engineer may have the repairs made at the expense of Contractor.
2. If certain existing structures are encountered that in the opinion of Engineer require temporary or permanent relocation or removal, Engineer may order in writing that Contractor undertake all or part of such work or to assist the Owner in performing such work. For such occurrences, Contractor shall be compensated as applicable, as extra work.
3. In removing existing structures, Contractor shall use care to avoid damage to the material, and Engineer shall include for payment only those new materials, which, in his judgment, are necessary to replace those unavoidably damaged.
4. The structures to which the provisions of the preceding two paragraphs shall apply include structures which (1) are not indicated on the Drawings or otherwise provided for, (2) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (3) in the opinion of Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced. (See Item 3.19, "Sub Surface Obstructions" also).

#### 3.4 DEWATERING

- A. Comply with all applicable permit requirements.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrade and from flooding Project site and surrounding area.
- C. Protect sub-grades from softening, undermining, washout and damage by rain or water accumulation.
  1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  2. Install de-watering system to keep subgrades dry and convey ground water away from excavations.

#### 3.5 EXCAVATION

- A. Dust Control: During the progress of the Work, Contractor shall conduct his operations and maintain the area of his activities in order to minimize the creation and dispersion of dust. Refer to Section 01 5714- Temporary Dust Control.
- B. Excavate to the exact elevations shown on the plans, or as directed by Engineer. Where no dimensions are indicated, make excavations in such manner, and to such depths, elevations, and dimensions, that will give suitable room for construction of the work indicated on the Drawings. As applicable for utility installations, comply with trench limits shown on the Drawings.
- C. Furnish and place all sheeting, bracing, and supports, and render the bottom of the excavation firm and dry, and in all respects, acceptable for construction of the work.

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- D. If Contractor excavates below the elevations specified on the plans, beyond the limits indicated on the plans, or where no dimensions are indicated, beyond depths, elevations, and dimensions reasonably necessary for construction of the work, Contractor shall bring the excavation back to the proper elevation and/or dimension by backfilling with Suitable Material that is approved by Engineer in accordance with the backfilling provisions specified herein. Engineer, or if applicable Geotechnical Engineer, shall have sole authority in determining the specific composition of such Suitable Material.
  - 1. Any increase in cost resulting from Unauthorized Excavation, including but not necessarily limited to backfilling, haul-off, increasing the size of footings or foundations, testing, schedule impact, or administrative impact shall be at Contractor's sole expense.
- E. If utilities are to be laid in new embankments, or other new fill areas which are more than 12 inches deep below the invert of the pipe, the fill material shall be placed and properly compacted to final grade or to a height of at least 3 feet above the top elevation of the pipe, whichever is the lesser, before laying pipe. Particular care shall be taken to ensure maximum consolidation of material under the pipe location. The pipe trench shall then be excavated as though in undisturbed material.

### 3.6 TRENCH EXCAVATION

- A. In general, trenches shall be excavated to such depth as will provide a cover depth as indicated on the Drawings from finished grade to the top of the pipe barrel. Deeper trenches shall be provided where necessary on account of the conformation of the ground and to permit the alignment of the pipe without undue deflection of joints.
- B. Trenches shall be excavated by hand or machinery to the width and depth indicated on the Drawings and specified herein. Depth shall account for thickness of the pipe and thickness of bedding. All loose materials shall be removed from the bottom of the trench so that the bottom of the trench will be in an undisturbed condition.
- C. If in the opinion of Engineer, the material at or below the depth to which excavation for structures and pipes would normally be carried is unsuitable for foundation, it shall be removed to such widths and depths as directed and replaced with suitable material.
- D. Trench widths shall be 3 feet greater than the nominal inside diameter of pipe for such diameters of 36 inches or less. For diameters greater than 36 inches, the width shall be 4 feet greater than nominal inside diameter. Trench excavation for manholes, catch basins, drop inlets, etc. shall be two (2) feet outside the neat lines of the foundations. These limits may be adjusted for field conditions at the direction of Engineer.
- E. Bedding for pipe and utility structures will be as detailed on the Drawings.

### 3.7 APPROVAL OF SUBGRADE

- A. Notify Engineer, and Geotechnical Engineer if applicable, when excavations have reached required subgrade elevation.
- B. If Engineer and, if applicable, Geotechnical Engineer determines that Unacceptable Material is present, continue excavation of such Unacceptable Material and replace with approved Satisfactory Materials as directed. The replacement of Unacceptable Material with Satisfactory Materials will be paid for as a change in the work according to applicable provisions of the contract.

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- C. Protect subgrade from disturbance at all times. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water or construction activities, as directed by Engineer. Excavation and replacement with structural fill of any disturbed or softened materials resulting from inadequate preparation, inadequate dewatering, or inadequate protection, shall be at Contractor's sole expense.

**3.8 FILL AND BACKFILL**

- A. Fill: Contractor shall remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas upon which embankments will be built or material will be placed as fill to adjust subgrade prior to final grading. The subgrade shall be prepared by forking, furrowing, or plowing such that the first layer of the new material placed thereon, will be well bonded to it.
- B. Backfill: Common Fill material may be used as backfill when indicated on the Drawings or when authorized by Engineer (or as applicable Geotechnical Engineer) if Contractor can achieve required minimum dry density after compaction. Backfilling shall be done as promptly as is consistent with non-injury to pipe or structures, but no backfilling shall be done before Engineer (or as applicable Geotechnical Engineer) gives permission.
- C. Frozen material shall not be placed in any fill or backfill, nor shall any fill or backfill be placed upon frozen material. Previously frozen material shall be removed, or shall be otherwise treated as required, before new fill or backfill is placed.
- D. After the subgrade has been prepared, fill material shall be placed thereon and built up in successive layers not exceeding twelve (12) inches before compaction until it has reached the required elevation.
  - 1. When gravel fill or other material is used for foundation of structures, it shall be spread in layers of uniform thickness not exceeding six (6) inches before compaction.
- E. Upon completion of filling and backfilling, all surplus material shall be removed and surfaces to remain which are affected in any way by the work restored to the condition in which they were before ground was broken. All surplus materials shall become the property of Contractor. If Contractor fails to promptly remove such surplus materials, Engineer may have the same done and charge all associated costs to Contractor, including deduction from payments due.

**3.9 BACKFILLING UTILITIES**

- A. As soon as practical after utility has been placed into bedding and joints properly made, backfilling shall begin, and shall continue without delay.
- B. Placement of bedding over pipe prior to placement of backfill shall be as indicated on the Drawings. Hand-place bedding at the sides of the pipe and to the limits indicated on the Drawings over the pipe. Bedding placed over pipe shall be in 6-inch layers, leveled along the length and width of the trench and thoroughly compacted with approved tampers.
- C. Install warning tape as indicated on the Drawings unless otherwise specified by the utility owner/operator.

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**3.10 BACKFILLING AT STRUCTURES**

- A. No backfill shall be deposited against concrete until the concrete has obtained sufficient strength to withstand the earth pressure placed upon it and in no case less than seven days, nor before carrying out and satisfactorily completing the tests for watertight structures specified elsewhere.
- B. Prior to placing backfill, subgrade shall be thoroughly compacted. Soft or loose material evident during compaction shall be removed and replaced with Granular Fill.
- C. Fill placed around arches, rigid frames, box culverts and piers shall be deposited on both sides of the structure to approximately the same elevation at the same time. Each layer of backfill shall be spread to a thickness not exceeding 6 inches deep after compaction and shall be thoroughly compacted by the use of power rollers or other motorized vehicular equipment, by tamping with mechanical rammers or vibrators, or by pneumatic tampers. Any equipment not principally manufactured for compaction purposes or which is not in proper working order in all respects shall not be used within the area described above.
- D. Bring backfill to sub-grade elevations. Slope backfill at exterior of building to drain water away from building.

**3.11 COMPACTION**

- A. Each layer of fill or backfill material shall be compacted by the use of compaction equipment consisting of rollers, compactors or a combination thereof. Earth-moving and other equipment not specifically manufactured for compaction purposes will not be considered as compaction equipment. At such points as cannot be reached by mobile mechanical equipment, or where such equipment is not permitted, the materials shall be thoroughly compacted by the use of suitable power- driven tampers.
- B. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or application of water, to compact it properly. At such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.
- C. Special attention shall be given to compaction in places close to walls where motorized vehicular compaction equipment cannot reach. Within 3 feet of the back face of walls and within a greater distance at angle points of walls, each layer of backfill shall be compacted by mechanical rammers, vibrators or pneumatic tampers.
- D. Each layer of fill or backfill shall be compacted at optimum moisture content. No subsequent layer shall be placed until the specified compaction is obtained for the previous layer.
- E. Compaction Density: Compaction density shall be expressed as a percentage of maximum dry density at optimum moisture content according to ASTM D 1557 Method C. Density indicated is minimum required.
  - 1. Under structures, building slabs, and steps: 95 %
  - 2. At building foundations: 95 %
  - 3. Utilities, below pipe centerline: 95%
  - 4. Utilities below unpaved surface, above pipe centerline: 92%

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5. Utilities below paved surface, above pipe centerline: 95%
6. Embankments: 92%
7. Landscaped areas: 90 %.
8. Natural grass athletic fields and similar recreational fields: 93%

**3.12 SUBSURFACE OBSTRUCTIONS**

- A. As a general rule, sub-surface obstructions encountered along the route of the pipeline shall be considered as follows:
1. Crossing Obstruction: All pipes, conduits, wires, etc. of whatever nature whose centerline lies at an angle of 20 degrees or greater to the centerline of the pipe being installed shall be considered as crossing obstructions and shall be protected, or repaired or replaced if damaged, or relocated, all at no additional cost to the Owner.
  2. Interfering Obstructions: All pipes, conduits, wires, etc. of whatever nature whose centerline lies at an angle of less than 20 degrees, but more than 5 degrees to the centerline of the pipe being installed, shall be considered as interfering obstructions. Costs for supporting such obstructions in place during installation of the new pipe shall be paid for by the Owner. Costs for supporting interfering obstructions shall not be construed to include any costs for excavation. Repairing or replacing damaged interfering obstructions, or relocation shall be accomplished at no additional cost to the Owner.
  3. Parallel Obstructions: All pipes, conduits, wires, etc. of whatever nature whose centerline lies at an angle of 5 degrees or less, or is truly parallel and less than 0.5 feet offset from outside the normal trench limits, as specified in Subarticle 3.5 B. of this Section, of the pipe being installed, shall be considered parallel obstructions. Costs for supporting such obstructions in place during installation of the new pipe, including excavation, may be paid for by the Owner, or Owner may elect to pay for the cost of replacing such obstructions. Should Owner first elect to pay the cost of supporting the obstruction and then elect to pay the cost of replacing the obstruction, approved costs for supporting the obstruction, including excavation, incurred prior to electing replacement costs shall also be paid. After Owner elects to pay replacement costs, only replacement costs will be paid for all additional work in the vicinity of the parallel obstruction.
  4. Angle measurement between centerline of obstructing pipe, conduit, wire, etc. and centerline of the pipe being installed shall be taken from between the horizontal projection of the centerlines at ground surface. Parallel offset distance between centerline of obstructing pipe, conduit, wire, etc. and the outside of normal trench limits of the pipe being installed shall be taken from between the horizontal projection of the centerlines and outside trench limit at ground surface.

END OF SECTION 312310



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SECTION 312319 – DEWATERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section Includes:
  - 1. Removal of surface water and ground water as necessary to perform the construction required by the contract.
  - 2. Constructing, installing, building, and maintaining all necessary temporary water extraction and management facilities.
  - 3. Furnishing, installing, and operating all necessary pumps, piping, and other equipment.
  - 4. Complying with all applicable approvals, authorizations or permits associated with the management of dewatering wastewaters.
  - 5. Removing all such temporary works and equipment after their intended function is no longer required.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR)
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. Connecticut Department of Energy and Environmental Protection (DEEP)
  - 1. Connecticut Guidelines for Soil Erosion and Sediment Control, DEP Bulletin 34, State of Connecticut Council on Soil and Water Conservation, 2002.
  - 2. Connecticut Department of Energy and Environmental Protection General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities, (DEEP-WPED-GP-015), latest issue.

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3. Connecticut Department of Energy and Environmental Protection General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer (DEP-WD-GP-007), latest issue.
  4. Connecticut Department of Energy and Environmental Protection General Permit for the Discharge of Groundwater Remediation Wastewater Directly to Surface Water (DEP-PED-GP-020), latest issue.
  5. Connecticut Department of Energy and Environmental Protection General Permit for the Discharge of Groundwater Remediation Wastewater Directly to Surface Water (DEP-PED-GP-020), latest issue.
- D. Regulations of Connecticut State Agencies (RCSA)
1. RCSA Section 22a-372-1, 22a-377(b)-1, 22a-377(c)-1, 22a-377(c)-2, Water Diversion.
  2. RCSA Section 22a-430-3 through 4, General Conditions Applicable to Water Discharge Permits and Procedures and Criteria for Issuing Water Discharge Permits.
  3. RCSA Section 22a-430-8, Underground Injection Control.

**1.4 DESCRIPTION OF THE WORK**

- A. Prevent surface water and subsurface or groundwater from flowing into excavations or earthwork areas which would cause flooding of the Project Site and surrounding area, or softening or loosening of the soil at excavation or earthwork subgrade.
- B. Provide adequate and satisfactory dewatering and drainage of excavations and furnish all materials and equipment and do all incidental work required in conjunction with the furnishing, installing, and maintaining of same to permit proper and timely completion of all work required.
- C. Contractor may choose any satisfactory dewatering method he wishes subject to the approval of Engineer, provided such method performs the dewatering required and complies with applicable approvals, authorizations and permits.
- D. Contractor shall assume all responsibility for the adequacy of the methods, materials, and equipment employed. Contractor shall take all precautions necessary to prevent loosening or softening of the subgrade. In this regard, Contractor shall at all times be prepared to alter his construction method or sequence.
- E. The work shall be maintained dry until the structures (building slabs and footings, paved area, pipe, drainage structure, embankments, etc.) are completed.
- F. All dewatering required by pumping and drainage shall be performed without damage to the excavation, pipe trench, pavements, pipes, electrical conduits, other utilities and any other work or property. Existing or new sanitary sewers shall not be used to dispose of drainage.

**1.5 SUBMITTALS**

- A. Dewatering Plan: Prior to installation of the dewatering system, submit design data showing the following, for review by Engineer:
  1. Locations and associated construction where dewatering is required.



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2. Specific methods and devices proposed for dewatering.
3. Details on protection at the inlet and outlet of pumps, method for floating the pump intake, or other methods to minimize and retain the sediment.
4. Proposed location of dewatering discharge and details of infiltration basins or other discharge location. Per the General Permit, where feasible and appropriate, dewatering wastewaters will be infiltrated into the ground.
5. Details on any containment berm construction when dewatering earth materials.
6. Identification of a contingency plan for emergency operations should the dewatering operation prove inadequate to meet the dewatering need or is found to be causing unacceptable turbidity problems (e.g., alternative discharge locations or use of a portable sediment tank). If turbidity or siltation problems are not adequately controlled by the contingency plan, then the operation will be ceased and a revised dewatering plan submitted for approval prior to further implementation.

**1.6 REGULATORY COMPLIANCE**

**A. Comply at all times with the following as applicable to the Project:**

1. Connecticut Department of Energy and Environmental Protection General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities, (DEP-PED-GP-015), latest revision. Conditions of such permit, other conditions of approval or authorizations, and any Stormwater Pollution Prevention Plans shall become part of the Contract Documents.
2. Connecticut Department of Energy and Environmental Protection General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer (DEP-PERD-GP-007), latest revision. The conditions of such permit, other conditions of approval or authorizations, and any supplemental plans shall become part of the Contract Documents.
3. Connecticut Department of Energy and Environmental Protection General Permit for the Discharge of Groundwater Remediation Wastewater Directly to Surface Water (DEP-PED-GP-020), latest revision. The conditions of such permit, other conditions of approval or authorizations, and any supplemental plans shall become part of the Contract Documents.

**PART 2 PRODUCTS – NOT USED**

**PART 3 EXECUTION**

**3.1 JOB CONDITIONS**

- A. Surface Drainage: Intercept and divert precipitation, and surface water, away from excavations through the use of temporary diversion swales, temporary sediment traps, pipes, sumps or other approved means.
- B. Drainage of Excavated Areas: Provide and maintain ditches of adequate size to collect surface and seepage water, which may enter the excavations. Divert the water into sumps and storm drains or pump into drainage channels or storm drains. When water is to be diverted into a storm drain, provide dewatering settling basins, or other accepted apparatus, such as fractionation tanks, as required to reduce the amount of fine particles, which may be

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carried into the drain. If a storm drain becomes blocked due to dewatering operation, it shall be cleaned by the Contractor at his own expense.

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**3.2 DEWATERING**

- A. Where feasible and appropriate, dewatering wastewaters will be infiltrated into the ground. Dewatering wastewaters discharged to surface waters will be discharged in a manner that minimizes the discoloration of the receiving waters. The following measures will be employed to ensure that dewatering wastewaters will not cause scouring or erosion or contain suspended solids in amounts that could reasonably be expected to cause pollution:
- B. Divert surface waters away from areas needing dewatering.
- C. Consider if well points and sumps can be used to lower the groundwater table reducing the need for settling facilities.
- D. For sites that don't require continuous pumping, pump work areas before construction activities begin each work day.
- E. Provide filtration near the suction intake.
- F. Locate pumps, intake sumps, and other intake structures in areas which will not require constant moving, when possible.
- G. Locate pump discharge facilities (portable, permanent, or bio-filtering structures) such that a minimum disturbance of existing wetlands and watercourses is incurred.
- H. Provide protection at outlets from pumping operations to dissipate pumping surges and prevent erosion at the point of discharge.
- I. Maintain the water level at such lowered elevations that no danger to structures can occur because of the buildup of excessive hydrostatic pressure on the subgrade, or bottom of trench, unless otherwise permitted by Engineer.
- J. Do not allow water to accumulate in excavations. At all times during construction, provide ample means and devices with which to remove promptly and dispose properly of all water entering roadway, trench, and structure excavations and keep them dry until the structures to be built thereon are completed.
- K. No pipe/culvert/structure shall be laid in water. No masonry shall be laid in water, and no water shall be allowed to rise over masonry (either concrete or brick) in 24 hours after being placed. Nor shall moving water be allowed to rise over masonry for four days. In no event shall water be allowed to rise so as to set up unequal pressures in the structures until the concrete or mortar has set at least 24 hours. The Contractor shall constantly guard against the possibility of flotation of pipe or structures after installation. He shall place adequate backfill promptly in accordance with Section 31 2310 - Earthwork to prevent this occurrence, and his method of handling drainage and carrying on these operations shall always be adequate to prevent flotation.

END OF SECTION 312319



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SECTION 312543 – GEOTEXTILES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Furnishing and installation geotextile materials for the separation of earth materials.
  - 2. Furnishing and installation geotextile materials for the stabilization of earth materials.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. State of Connecticut Department of Transportation (ConnDOT)
  - 1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 818 and any supplements.
- B. ASTM International (ASTM).
  - 1. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
  - 2. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - 3. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
  - 4. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - 5. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  - 6. ASTM D4873 – Guide for Identification, Storage, and Handling of Geotextiles.
  - 7. ASTM D6241 – Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
  - 8. ASTM D6706 – Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil.

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C. Code of Federal Regulations (CFR)

1. 29 CFR Part 1926 Subpart P – OSHA Excavation Regulations 1926.560 through 1926.562 including Appendices A through F.

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**1.4 ACTION SUBMITTALS**

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  - 6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

**1.5 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.

**1.6 SUBMITTALS**

- A. Submit to Engineer for approval material specifications, manufacturer's product data, manufacturer's installation guidelines, and shop drawings for all materials furnished under this Section.
- B. Connection details for geotextile.
- C. Proposed mechanical connection devices.

**1.7 DELIVERY, STORAGE AND HANDLING**

- A. Geotextile labeling, shipment, and storage shall follow ASTM D4873. Product labels shall be clearly labeled and/or marked to specifically identify each product and clearly show the manufacturer's name, style name, and roll number.

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- B. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants. Protect rolls from crushing or abrasion during shipping and hauling.
- C. Geotextile shall be stored on a prepared surface (not wooden pallets) and should not be stacked more than two rolls high. Storage shall be such that the geotextile is protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or cold, or other damaging circumstances. Temporary storage at the Project Site shall be away from standing water such that crushing or flattening of roll goods does not occur.

## **PART 2 PRODUCTS**

### **2.1 SEPARATION GEOTEXTILE**

- A. Separation Geotextile shall be utilized to separate layers of earth materials in utility trenches, drains, layered systems and similar installations in a non-structural configuration.

1. Composition: Woven geotextile made of 100% polypropylene slit film yarns.

2. Physical properties:

#### **Mechanical and Physical Properties of Separation Geotextile**

<b>Mechanical Properties</b>	<b>Test Method</b>	<b>Unit</b>	<b>Minimum Average Roll Value</b>
Grab Tensile Strength, Ultimate	ASTM D4632	Pounds	120
Grab Tensile Strength, Elongation at Ultimate	ASTM D4632	Percent (%)	50
Trapezoid Tear Strength	ASTM D4533	Pounds	50
CBR Puncture Strength	ASTM D6241	Pounds	310
Apparent Opening Size (AOS)	ASTM D4751	(U.S. Sieve)	70
Permittivity	ASTM D4491	sec <sup>-1</sup>	1.7
Flow Rate	ASTM D4491	gal/min/ft <sup>2</sup>	135
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70

### **2.2 LIGHT-DUTY STABILIZATION GEOTEXTILE**

- A. Light-Duty Stabilization Geotextile shall be utilized under temporary sidewalks and unit pavers when called-for.

1. Composition: Woven geotextile made of 100% polypropylene slit film yarns.

2. Physical properties:

#### **Mechanical and Physical Properties of Light-Duty Stabilization Geotextile**



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Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Tensile Strength @2% Strain (MD/CD)	ASTM D4595	Pounds/foot	600/600
Tensile Strength @5% Strain (MD/CD)	ASTM D4595	Pounds/foot	1620/1620
Flow Rate	ASTM D4491	Gal/min/ ft <sup>2</sup>	70
Permittivity	ASTM D4491	sec <sup>-1</sup>	90
Apparent Opening Size (AOS)	ASTM D4751	(U.S. Sieve)	40
Interaction Coefficient	ASTM D6706	-	0.89
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	90

MD – Machine Direction

CD – Transverse (Crosswise) Direction

### 2.3 STABILIZATION GEOTEXTILE

- A. Stabilization Geotextile shall be utilized for stabilization of subgrades where unsuitable subsurface soil conditions are present. Stabilization geotextile shall only be utilized with the approval of Engineer.

1. Composition: Woven geotextile made of 100% polypropylene slit film yarns.
2. Physical properties:

Mechanical and Physical Properties of Stabilization Geotextile

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength, Ultimate (MD/CD)	ASTM D4595	Pounds/foot	7200/5760
Tensile Strength at 2% Strain	ASTM D4595	Pounds/foot	1370/1560
Tensile Strength at 5% Strain	ASTM D4595	Pounds/foot	3600/3600
Tensile Strength at 10% Strain	ASTM D4595	Pounds/foot	6600/5760
Flow Rate	ASTM D4491	Gal/min/ ft <sup>2</sup>	15
Permittivity	ASTM D4491	sec <sup>-1</sup>	0.23
Apparent Opening Size (AOS)	ASTM D4751	(U.S. Sieve)	20
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	80

MD – Machine Direction

CD – Transverse (Crosswise) Direction

## PART 3 EXECUTION

### 3.1 GENERAL

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- A. Install geotextile as shown on the Drawings or as called-for in the Specifications. Follow manufacture's guidelines.
- B. Ensure that geotextile is protected during installation from clogging, tears, and other damage.

**3.2 PIPE OR DRAINAGE SYSTEMS**

- A. Provide smooth side and bottom trench surfaces so the fabric does not bridge depressions in the soil and is not damaged by rock projections.
- B. Use fabric of a width to permit a minimum trench-width overlap across the backfill at the trench top.
- C. Lay the fabric flat in the prepared trench without stretching. Lay the top of the fabric back on the sides to allow for the placement of the aggregate backfill and pipe.
- D. Overlap ends of rolls an amount equal to the trench width prior to fabric placement. Where pockets or cavities occur in the trench bottom or sides, fill them with acceptable granular material to prevent distortion or damage to the fabric.
- E. Backfill aggregate and install pipe in a manner to prevent damage to the fabric. Compact aggregate backfill and overlap the fabric across the trench top. Do not allow the fabric to be exposed for more than 2 weeks without covering with backfill.

**3.3 LAYER SEPARATION AND/OR STABILIZATION**

- A. Place fabric on a normally prepared subgrade area attending the full width of the sub-base layer being protected.
- B. Place fabric in a loose and unstretched condition to minimize shifting, puncture, and/or tearing. Overlap fabric roll-ends and edges a minimum of 12 inches with adjacent material.
- C. Place subbase material within 2 weeks after placement of fabric to minimize exposure. Place sub-base material in a manner to minimize slippage of the fabric. If excessive slippage occurs, use steel securing pins per manufacturer's guidelines.

END OF SECTION 312543

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SECTION 314143 – SHEETING AND STAYBRACING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section Includes
  - 1. Shoring and bracing necessary to protect existing buildings, existing culvert, streets, walkways, utilities, and other improvements and excavation against loss or ground caving embankments.
  - 2. Maintenance of shoring and bracing.
  - 3. Removal of shoring and bracing, as required.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. State of Connecticut Department of Transportation (ConnDOT)
  - 1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2016 and any supplements.
- C. Code of Federal Regulations (CFR)
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.

1.4 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section “Sustainable Design Requirements” and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

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Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### 1.5 DESCRIPTION OF THE WORK

- A. Contractor shall install sheeting or staybracing as necessary in order to comply with the Applicable Safety Code; to accommodate traffic; to permit access to existing utilities; to provide an opening of proper depth and width in which to install the proposed pipes and other underground structures; and to protect his workmen, employees of the Owner and (Insert Name), State and the public, from death or injury from bank failure, earth collapse or earth movement of any nature whatsoever. In general, all trenches and excavations over 5 feet in depth, any other unstable excavations or excavations in unstable material, shall be protected against the hazard of collapse.

#### 1.6 SHEETING/STAYBRACING DESIGN

- A. Contractor shall be entirely and solely responsible for the adequacy and sufficiency of all supports and for all sheeting, bracing, shoring, underpinning, cofferdamming, etc. The Contractor shall assume the entire and sole responsibility for damages on account of injury to persons or damage to adjacent pavements and public and private property (including but not limited to, the Work under construction, existing buildings, facilities, etc.) which injury or damage results directly from said Contractor's failure to install, or to leave in place, adequate and sufficient supports, sheeting, bracing, underpinning, cofferdamming, etc.
- B. Contractor shall submit, in triplicate, a detailed written description of the equipment and sheeting methods he proposes to use to Engineer prior to the installation of any sheeting and/or shoring. These plans should include, but not be limited to, the type of sheeting or shoring, sizes and dimensions, bracing, spacing, methods of installation and removal, etc.
- C. All sheeting shall be designed and sealed by a Professional Engineer licensed to practice in the State where the Work is being performed. He shall be known as the Contractor's Engineer. Sheeting computations and sketches shall be submitted for Engineer's review.

#### 1.7 SHEETING LEFT-IN-PLACE

- A. Sheeting, shoring or other timbering may be left-in-place at the option of the Contractor when needed to protect other existing facilities or the Work built or to be built under this Contract. However, steel sheeting left-in-place will be paid for only where specifically shown as "Steel Sheeting Left-in-Place" on the Contract Drawings or where ordered by Engineer.
- B. It is expressly understood and agreed that removing or leaving-in-place any sheeting or shoring, etc., as noted above, shall not relieve the Contractor from any responsibility for any loss damage whatever due to omission of, or failure of, the sheeting, etc., failure to leave it in place, or the settling of the backfill, or any movement of the ground or any structure or object adjacent to any trench or excavation made by Contractor. Engineer will not order sheeting

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left-in-place at the expense of the Owner in order to accommodate the convenience of the Contractor or to save him the cost of its removal.

**1.8 OPTIONAL METHOD OF TRENCHING**

- A. Contractor may, with the approval of Engineer, lay back slopes in accordance with the provisions of the Applicable Safety Code in order to avoid the necessity of sheeting or limiting the quantity thereof. However, in the case of trenches, the toe of this slope will not be lower than one foot above the top of the pipe to be installed. A level bench of at least two (2) feet in width shall be maintained between the toe of the sloped section and vertical trench excavation for pipes with an outside diameter of six (6) feet or less; for pipes with an outside diameter over six (6) feet, a minimum four (4) foot bench shall be provided. Where sloping is used as a substitute for sheeting or staybracing, or used in combination therewith, it shall be sloped a minimum of one horizontal to one vertical except where instability of the material requires a slope flatter than one to one. If the Contractor elects and is allowed to lay back the slopes, there will be no additional payment made for the extra excavation outside of the normal trench or structure excavation payment limits.

**1.9 RESPONSIBILITY OF ENGINEER**

- A. There shall be no obligation on the part of Engineer to issue orders for sheeting, staybracing or sheeting left-in-place and/or to pass upon sufficiency and adequacy of sheeting; nor shall the failure on the part of Engineer to give such orders relieve the Contractor from liability for damages occasioned by negligence, or otherwise growing out of the Contractor's failure to either install sufficient and adequate sheeting and/or staybracing or to leave in place in the excavation sufficient and adequate support to prevent the caving in or moving of the ground adjacent to the sides of the excavation during and after the backfilling operation.

**PART 2 PRODUCTS**

**2.1 WOOD STAYBRACING**

- A. Wood Staybracing

**2.2 STEEL SHEETING**

- A. Steel sheeting: continuous and interlocking sheets, ASTM A-328.

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**2.3 TRENCH BOXES**

- A. Trench boxes shall not be used unless requested by the Contractor and authorized by Engineer. If authorized, they shall be used only when the protection of workmen is involved, not for support of existing adjacent utilities, structures, embankments, etc. A trench protected by the use of a trench box shall not be considered a sheeted trench.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Unless expressly authorized by Engineer, sheeting shall be driven ahead of the excavation to avoid loss of material from behind the sheeting. If it is necessary to excavate below the sheeting to facilitate driving, care shall be taken to avoid trimming behind the face along which the sheeting will be driven. Care shall be taken to prevent voids outside of the sheeting.
- B. All sheeting and staybracing shall be securely installed and properly braced in accordance with the Applicable Safety Code. Engineer may direct the Contractor at any time in writing to have sheeting, bracing, etc. in place to be embedded in backfill or concrete for the purpose of preventing subsequent injury to structures and property.
- C. The depth of pilot cuts for trenches/structures shall not exceed five (5) feet in depth at any time. Engineer may reduce the depth of the pilot cut should the soil and subsurface conditions warrant such action. Sheeting must be driven by drop hammer or other methods approved in writing by Engineer below the area of the pilot cut. Driving of sheeting above the pilot cut is subject to the directions of Engineer. Engineer may direct the Contractor to use other types of equipment, and to revise the procedure during the excavation of the pilot cut and the driving of the sheeting should it be found necessary to do so.
- D. Vibratory driving hammers shall not be used unless specifically authorized by Engineer.
- E. Where sheeting is specified to be left-in-place, it shall be wood sheeting unless otherwise specifically noted on the Contract Drawings. Where wooden sheeting cannot be driven due to the nature of the material, then steel sheeting may be driven and removed in lieu of the wooden sheeting providing the following procedures are followed:
  - 1. Simultaneously with the withdrawal of sheeting and as each layer is compacted in accordance with Section 312310 - Earthwork; or
  - 2. The trench/area will be backfilled to the surface. If the sheeting is to be withdrawn, backfilling will proceed up to each set of rangers and braces; the rangers and braces will be removed; the backfilling will proceed up to the next set of rangers and braces, etc. up to the top of the excavation. The backfill material shall be compacted to 98% of the maximum dry density as determined by AASHTO T 99, Method C. Alternate sections of sheeting from the left side and right side of the trench/area shall be removed and the cavity remaining there from shall be jetted thoroughly by high-pressure water, starting at the toe of the sheeting and being drawn to the surface. Sand shall be inserted with the jetting process.
  - 3. Where the bottom of the excavation is not free draining material (some areas of organic material or miscellaneous fill) or where granular backfill is not available or ordered by Engineer, the jetting shall be very carefully done with a minimum amount of water being expended. In such locations, the Contractor may request the approval of Engineer for other compaction methods in the sheeting cavity.

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4. Contractor shall remove the sheeting and/or staybracing from the excavation, except where it is specifically indicated on the Contract Drawings "To be Left- in-Place", or the Contractor may elect to leave in place the sheeting and/or staybracing for his own convenience, or to serve his own interest to protect existing facilities, the Work built or to be built under this Contract, or for the safety of the public, etc., at no cost to the Owner. No sheeting or bracing which is within three feet of the existing or proposed finished grade may be left-in-place without the prior permission of Engineer. This may require the Contractor cut off sheeting at this elevation and at no additional cost to the Owner.
5. Where sheeting, regardless of the type of sheeting used, is left in place, as specified or ordered or at the Contractor's convenience/option, unless otherwise specifically permitted in writing by Engineer, all elements such as rangers, braces, wales, etc. shall be left in place except as specified hereinbefore; and, except such temporary braces required to be removed to make way for the structure/utility. Where it is necessary to remove such temporary braces, the sheeting shall be rebraced, but in no case shall the sheeting be braced against the sides of the structure/utility to be constructed unless approved in writing by the owner of the structure/utility. Where lagging and "soldier" beams are used, the "soldier" beams and all the braces shall also be left in place.
6. Where wood sheeting has been driven below the excavation bottom to provide for a "toe-in", no wood sheeting below the top of pipe or structure shall be removed, but it shall be cut off at this elevation and the remaining sheeting above this line removed as described herein. There will be no payment made for this work, nor for the wood sheeting left-in-place.
7. Sheeting shall be cut away and removed from in front of capped outlets or other braces or inlets set in the pipe for future connections.
8. All sheeting, shoring and bracing removed shall be carefully removed from the excavation in such a manner as not to endanger the completed work or any adjacent pavements, buildings, structures, utilities, property, etc. The sheeting shall be withdrawn to such an extent that it is just above the backfill material being compacted and all voids left or caused by the withdrawal of such sheeting, shall be immediately refilled with approved material and compacted at no additional cost to the Owner.
9. Where the excavation is to be left open during non-working hours, the sheeting shall extend 42 inches above existing grade to protect pedestrian and vehicular traffic from the open excavation.

END OF SECTION 314143





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SECTION 321216 – BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Bituminous concrete paving for streets, driveways, playgrounds, and parking areas.
  - 2. Installation of bituminous concrete overlays over existing pavement, including surface preparation, truing and leveling pavement, tack coating and all other associated items and operations necessary and required to complete the installation.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut Department of Transportation (ConnDOT).
  - 1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 818 and any supplements.
  - 2. Standard Specifications for Roads, Bridges and Incidental Construction, Form 818 Supplemental Section 4.06 – Bituminous Concrete (Revised 3/17/14).
  - 3. Standard Specifications for Roads, Bridges and Incidental Construction, Form 818 Supplemental Section M.04 – Bituminous Concrete (Revised 1/28/15).
- D. American Association of State High and Transportation Officials (AASHTO).
  - 1. AASHTO M-17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
  - 2. AASHTO M 82, Cutback Asphalt (Medium-Curing Type) .
  - 3. AASHTO M-208 - Standard Method of Test for Unconfined Compressive Strength of Cohesive Soil-ASTM Designation D 2166.
  - 4. AASHTO M-320 - Standard Specification for Performance-Graded Asphalt Binder.
  - 5. AASHTO R-26 - Standard Recommended Practice for Certifying Suppliers of Performance-Graded Asphalt Binders.

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6. AASHTO R-29 - Standard Practice for Grading or Verifying the Performance Grade of an Asphalt Binder.
7. AASHTO T-27 - Sieve Analysis of Fine and Course Aggregates.
8. AASHTO T-84 - Specific Gravity and Absorption of Fine Aggregates.
9. AASHTO T-85 - Specific Gravity and Absorption of Coarse Aggregates.
10. AASHTO T-96 - Standard Method of Test for Resistance to Degradation of small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
11. AASHTO T 104 Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
12. AASHTO T-209 - Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
13. AASHTO T-245 - Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

E. American Society for Testing and Materials (ASTM)

1. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
2. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

1.4 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

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6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### 1.5 SPECIFICATIONS

- A. All work performed under this Section shall conform to the Standard Specifications for Roads, Bridges and Incidental Construction, Form 818 Supplemental Section 4.06 – Bituminous Concrete (Revised 3/17/14). This Specification is hereby incorporated into this Section by reference.

#### 1.6 TESTING

- A. Owner will retain a testing entity to perform observation and testing of the work under this Section. The testing entity's presence does not constitute supervision or direction of Contractor's work. Neither the presence of the testing entity nor any observations and testing performed by him, nor any notice or failure to give notice shall excuse Contractor from conformance with these Specifications or from defects discovered in his work.
- B. Each week, Contractor shall advise the University Representative of anticipated testing requirements during the following week, based on anticipated construction activities. The Contractor shall also notify the University Representative and testing laboratory 24 hours before the expected time of testing.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. All work performed under this Section shall conform to the Standard Specifications for Roads, Bridges and Incidental Construction, Form 818 Supplemental Section M.04 – Bituminous Concrete (Revised 1/28/15). This Specification is attached hereto and is hereby incorporated into this Section.

### PART 3 EXECUTION

#### 3.1 GENERAL

- A. Contractor shall install all pavements as specified in the location and to the grades as shown on the Drawings and/or approved by Engineer. Materials, methods of construction, and type and thickness of pavement courses shall be as shown on the Details of the Drawings and as specified herein.
- B. Owner and its representatives shall have access to all parts of the Work under construction at all times.

#### 3.2 SPECIFICATIONS

- A. Execute the work of this Section in accordance with the Standard Specifications for Roads, Bridges and Incidental Construction, Form 818 Supplemental Section 4.06 – Bituminous Concrete. This Specification is attached hereto and is hereby incorporated into this Section.

END OF SECTION 321216



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SECTION 321500 – AGGREGATE SURFACING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SECTION INCLUDES

- A. Stone Mulch Surfacing.

1.3 RELATED REQUIREMENTS

- A. Section 31 2200 – Earthwork: Preparation of site paving, compacted subbase for paving, and base courses.

1.4 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  - 6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

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Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification:
  - 1. For each stone type indicated. Include at least two samples in each set for each type of stone, exhibiting extremes of the full range of color and other visual characteristics expected in completed Work. Samples will establish the standard by which stone provided will be judged.
  - 2. Weed Control Barrier: 12 by 12 inches (300 by 300 mm).
  - 3. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.

## 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of aggregate through one source from a single manufacturer.
- B. Pre-installation conference: Conduct conference at project site to comply with requirements in Section 01 3000 - Administrative Requirements.

## PART 2 PRODUCTS

### 2.1 STONE SOURCE

- A. Varieties and Sources: Obtain materials of each type from same source for the entire project. Approval of stone supplier is required prior to purchase. Subject to compliance with requirements, provide stone of one of the following varieties from the following source or equivalent:

### 2.2 STONE MULCH SURFACING

- A. Riverwashed Stone Mulch: Screened, off-site crushed stone free of iron, fines, dust (less than 2 percent passing the No. 200 sieve), organic materials, snow, ice, and other unsuitable materials as approved by Landscape Architect.
  - 1. Size: 3/4-inch (19 mm) diameter. Mulch shall be washed free of all fines.
  - 2. Color: Readily available natural gravel color range as approved by Landscape Architect.
- B. Stone Mulch Edge Restraints: Standard commercial-aluminum angle edging, rolled edge, fabricated in sections of standard lengths.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide "Perma-Strip" angled aluminum landscape edging as manufactured by Permaloc Corporation or comparable product by a licensee of one of the following:
    - a) Brickstop Corporation.
    - b) Curv-Rite, Inc.
    - c) Sure-loc Edging Corporation.
  - 2. Edging Size: 3/16 inch (3.2 mm) thick by 6 inches (102 mm) tall by 1-1/2 inches wide.
  - 3. Stakes: 18 inches (300 mm) long, 3 minimum per 8-foot section.

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4. Accessories: Standard tapered ends, corners, and splicers.
5. Finish: Electrostatically-applied baked on paint.
6. Color: Black.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

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

#### **3.2 STONE MAINTENANCE STRIP INSTALLATIONS**

- A. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.
- B. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches (150 mm) and secure seams with galvanized pins.
  1. Mulch backfilled and compacted surfaces areas to receive stone mulch. Apply 4-inch (100-mm) average thickness of mineral mulch over whole surface, and finish level with adjacent finish grades.

#### **3.3 CLEANUP AND PROTECTION**

- A. During installation, keep adjacent paving and construction clean and work area in an orderly condition.
- B. After completing installation of stone materials, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

#### **3.4 DISPOSAL**

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

END OF SECTION 321500





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SECTION 321723 – PAVEMENT MARKINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Temporary or permanent painted pavement markings, including but not limited to center lines, lane lines and shoulder lines, stop bars, crosswalks, parking stalls, lane arrows, legends, markings within gore areas, and painting of paved islands or medians.
  - 2. Maintaining access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 SUBMITTALS

- A. Submit material specifications and shop drawings for all materials furnished under this Section.
- B. Submit material certificates signed by the material producer and Contractor, certifying that materials comply with these Specifications.

1.4 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section “Sustainable Design Requirements” and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

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5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### 1.5 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. State of Connecticut Department of Transportation (ConnDOT)
  1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 818 and any supplements.
- C. Code of Federal Regulations (CFR)
  1. 29 CFR 1926, Safety and Health Regulations for Construction
- D. ASTM International (ASTM)
  1. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
  2. ASTM D211 - Standard Specification for Chrome Yellow and Chrome Orange Pigments.
  3. ASTM D476 - Standard Classification for Dry Pigmentary Titanium Dioxide Products.
  4. ASTM D562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
  5. ASTM D605 - Standard Specification for Magnesium Silicate Pigment (Talc).
  6. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
  7. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
  8. ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.
  9. ASTM D869 - Standard Test Method for Evaluating Degree of Settling of Paint.
  10. ASTM D1475 - Standard Test Method for Density of Liquid Coatings, Inks, and Related Products.
  11. ASTM D1763 - Standard Specification for Epoxy Resins.
  12. ASTM D2240 - Standard Test Method for Rubber Property- Durometer Hardness.
  13. ASTM D2486 - Standard Test Methods for Scrub Resistance of Wall Paints.

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- 14. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
- 15. ASTM D4505 - Standard Specification for Preformed Retroreflective Pavement Marking Tape for Extended Service Life.
- 16. ASTM E303 - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
- 17. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.
- E. American Association of State Highway and Transportation Officials (AASHTO)
  - 1. AASHTO M 247 - Standard Specification for Glass Beads Used in Traffic Paints.
- F. American Concrete Institute
  - 1. ACI 503R - Use of Epoxy Compounds with Concrete.
- G. United States General Services Administration, Federal Specifications.
  - 1. Federal Specification TT-P-1952D - Paint, Traffic and Air Field Marking, Water Emulsion Base.
- H. United States General Services Administration, Federal Standards.
  - 1. Federal Standard No. 595 - Colors Used in Government Procurement.

**1.6 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Contractor shall furnish one technical expert, who shall be fully knowledgeable about all equipment operations and application techniques, to oversee the work of this Section.

**PART 2 PRODUCTS**

**2.1 WATERBORNE PAVEMENT MARKING PAINT**

- A. General
  - 1. White and yellow fast-drying waterborne pavement marking paint, low VOC, ready-mixed, one component, 100 percent acrylic, Federal Specification TT-P-1952D.
  - 2. Paint shall be capable of being applied with paint striping equipment at ambient temperatures.
  - 3. Weight per gallon shall not be less than 12.5 pounds/gallon when tested in accordance with ASTM D 1475.
  - 4. Colors: ASTM D211 and per Federal Standard No. 595.
- B. Manufacture

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1. Paint shall be formulated and manufactured from first-grade raw materials and shall be free from defects and imperfections that might adversely affect the serviceability of the finished product. The materials shall not exhibit settling or jellying after storage in the sealed containers as received that will affect the performance of the products. The paint shall provide the proper anchorage, refraction and reflection for the finished glass spheres when applied as specified.

**C. Composition**

1. Composition of the paint shall be at the discretion of the manufacturer, provided that the finished product meets the requirements of any applicable Federal, State or Local regulations for products of this type and the requirements as follows:
  - a. Paint shall not contain more than 0.06% lead.
  - b. Total nonvolatile shall not be less than 70% by weight (mass).
  - c. Pigment shall be 45-55% by weight (mass).
  - d. Resin solids shall be composed of 100% acrylic emulsion polymer.
  - e. Volatile organic compounds shall not exceed 150 grams/liter, excluding water.
  - f. Closed-cup flash point shall not be less than 100°F (38°C), and weight per gallon shall not be less than 12.5 pounds/gallon when tested in accordance with ASTM D 1475.

**D. Viscosity**

1. Consistency of the paint shall not be less than 80, nor more than 90 Krieb units when tested in accordance with ASTM D562. The paint shall have good spraying characteristics when the material is heated to application temperature of 130°F to 145°F.

**E. Flexibility**

1. Paint shall not show cracking or flaking when subjected to the TT-P-1952D flexibility test in which the panels used shall be tin plates that are 3 inches x 5 inches in area and 35 - 31 U.S. Gauge in thickness. The tin panels shall be lightly buffed with steel wool and thoroughly cleaned with solvent before being used for tests.

**F. Dry Opacity**

1. Both white and yellow paints shall have a minimum contrast ratio of 0.96. Contrast ratio shall be determined by applying a wet film thickness of 0.005 inches (127 microns) to a standard hiding power chart. After drying, the black and white reflectance values shall be determined using a suitable reflectometer and the contrast ratio determined.

**G. Bleeding**

1. Paints shall have a minimum bleeding ratio of 0.97 when tested in accordance with FS TT-P-1952D.

**H. Abrasion Resistance**

1. No less than 210 liters of sand shall be required to remove paint film when tested in accordance with TT-P-1952D.

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I. Color

1. Yellow: FS 595, No. 13538, latest issue.
2. White: No darker or yellower than FS 595, No. 17778, latest issue, when the material is placed in a type EH weatherometer for a period of 500 hours and weathered according to ASTM G153.
3. Color determination shall be made without beads, after a minimum of 24 hours. If not a visual match, the diffuse day color of the paint shall conform to the CIE Chromaticity coordinate limits as follows:

Paint CIE Chromaticity Coordinate Limits

	x	Y	x	y	x	y	x	y	Brightness
White	0.305	0.295	0.360	0.360	0.388	0.377	0.280	0.310	84.0 Min
Yellow	0.485	0.455	0.506	0.452	0.484	0.428	0.477	0.438	50.0 Min

4. Paint shall not discolor in sunlight and shall maintain colorfastness throughout its life, approximately two years.

J. Glass Bead Adhesion

1. Paint with glass beads conforming to M.07.30, applied at the rate of 6.0 pounds/gallon of paint, shall require not less than 150 liters of sand to remove paint film and glass beads.

K. Scrub Resistance

1. Paint shall pass 300 cycles minimum when tested in accordance with ASTM D2486.

L. Drying time

1. Reflectorized line shall dry to no pick up in 15 minutes or less as tested by ASTM D711 when applied at the ratio provided for specified glass spheres to paint (the paint at 15+ 1 mil (381 millimeters + 25 millimeters) wet film thickness equivalent to 100-115 square foot/gallon and the glass spheres at the equivalent rate of 6.0 pounds/gallon.

2.2 HOT-APPLIED WATERBORNE PAVEMENT MARKING PAINT

A. General

1. White and yellow fast-drying waterborne pavement marking paint, low VOC, ready-mixed, one component, 100 percent acrylic, Federal Specification TT-P-1952D.
2. Paint shall be capable of being applied with paint striping equipment at an application temperature of 130°F to 145°F.
3. Color: ASTM D211 and per Federal Standard No. 595.
4. Glass Beads: AASHTO M 247, Type 1.

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**B. Manufacture**

1. Paint shall be formulated and manufactured from first-grade raw materials and shall be free from defects and imperfections that might adversely affect the serviceability of the finished product. The materials shall not exhibit settling or jellying after storage in the sealed containers as received that will affect the performance of the products. The paint shall provide the proper anchorage, refraction and reflection for the finished glass spheres when applied as specified.

**C. Composition**

1. Composition of the paint shall be at the discretion of the manufacturer, provided that the finished product meets the requirements of any applicable Federal, State or Local regulations for products of this type and the requirements as follows:
  - a. Paint shall not contain more than 0.06% lead.
  - b. Total nonvolatile shall not be less than 76% by weight (mass).
  - c. Pigment shall be 58-63% by weight (mass).
  - d. Resin solids shall be composed of 100% acrylic emulsion polymer.
  - e. Volatile organic compounds shall not exceed 150 grams/liter, excluding water.
  - f. Closed-cup flash point shall not be less than 100°F, and weight per gallon shall not be less than 12.5 pounds/gallon when tested in accordance with ASTM D 1475.

**D. Viscosity**

1. Consistency of the paint shall not be less than 80, nor more than 90 Krieb units when tested in accordance with ASTM D562. The paint shall have good spraying characteristics when the material is heated to application temperature of 130°F to 145°F.

**E. Flexibility**

1. Paint shall not show cracking or flaking when subjected to the TT-P-1952D flexibility test in which the panels used shall be tin plates that are 3 inches x 5 inches (76 millimeters x 127 millimeters) in area and 35 - 31 U.S. Gauge in thickness. The tin panels shall be lightly buffed with steel wool and thoroughly cleaned with solvent before being used for tests.

**F. Dry Opacity**

1. Both white and yellow paints shall have a minimum contrast ratio of 0.96. Contrast ratio shall be determined by applying a wet film thickness of 0.005 inches (127 microns) to a standard hiding power chart. After drying, the black and white reflectance values shall be determined using a suitable reflectometer and the contrast ratio determined.

**G. Bleeding**

1. Paints shall have a minimum bleeding ratio of 0.97 when tested in accordance with FS TT-P- 1952D.

**H. Abrasion Resistance**

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1. No less than 210 liters of sand shall be required to remove paint film when tested in accordance with TT-P-1952D.

I. Color

1. Yellow: FS 595, No. 13538, latest issue.
2. White: No darker or yellower than FS 595, No. 17778, latest issue, when the material is placed in a type EH weatherometer for a period of 500 hours and weathered according to ASTM G153.
3. If not a visual match, the diffuse day color of the paint shall conform to the CIE Chromaticity coordinate limits as follows:

Paint CIE Chromaticity Coordinate Limits

	x	Y	x	y	x	y	x	y	Brightness
White	0.305	0.295	0.360	0.360	0.388	0.377	0.280	0.310	84.0 Min
Yellow	0.485	0.455	0.506	0.452	0.484	0.428	0.477	0.438	50.0 Min

4. Paint shall not discolor in sunlight and shall maintain colorfastness throughout its life, approximately two years. Color determination shall be made without beads, after a minimum of 24 hours.

J. Glass Bead Adhesion

1. Paint with glass beads shall require not less than 150 liters of sand to remove paint film and glass beads.

K. Scrub Resistance

1. Paint shall pass 300 cycles minimum when tested in accordance with ASTM D2486.

L. Drying time

1. ReflectORIZED line shall dry to no pick up in 120 seconds or less when applied at the ratio provided for specified glass spheres to paint (the paint at 15+ 1 mil (381 millimeters + 25 millimeters) wet film thickness equivalent to 100-115 square foot/gallon (2.45-2.82 square meters/liter) and the glass spheres at the equivalent rate of 6.0 pounds/gallon (0.72 kilograms/liter). The paint shall be applied with equipment so as to have the paint at a temperature of 130°F to 145°F (54°C to 63°C) at the spray gun.

2.3 EPOXY RESIN PAVEMENT MARKINGS

A. Epoxy Resin Material: The material shall be composed of epoxy resins and pigments only.

B. Composition:

1. White (percent by weight): 20% +/- 2% Titanium Dioxide, ASTM D476 Type 3 and 80% +/- 2% Epoxy Resins.

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2. Yellow (percent by weight): 25% +/- 2% Chrome Yellow, ASTM D211 Type 3 and 75% +/- 2% Epoxy Resins.

3. Epoxy Resins: ASTM D1763.

**C. Color**

1. Yellow: FS 595, No. 13538, latest issue.

2. White: No darker or yellower than FS 595, No. 17778, latest issue, when the material is placed in a type EH weatherometer for a period of 500 hours and weathered according to ASTM G153.

**D. Adhesion Capabilities**

1. When the adhesion of the material to portland cement concrete (test concrete shall have a minimum of 300 psi tensile strength) is tested according to ACI 503R testing procedure, the failure of the system must take place in the concrete. The concrete shall be 90 °F when the material is applied, after which the material shall be allowed to cure for 72 hours at 73 +/- 3.5 °F.

**E. Abrasion Resistance**

1. When the abrasion resistance of the material is tested according to ASTM C 501 with a CS-17 wheel under a load of 1000 grams for 1000 cycles, the wear index shall be no greater than 82. (The wear index is the weight (mass) in milligrams that is abraded from the sample under the test conditions).

**F. Hardness**

1. The Type D durometer hardness of the material shall be not less than 75 nor more than 90 when tested according to ASTM D2240 after the material has cured for 72 hours at 73 +/- 3.5 °F.

**G. Tensile Strength**

1. Tensile strength of the material, when tested according to ASTM D 638, shall not be less than 6,000 psi after 72 hours cure at 73 +/- 3.5 °F.

**H. Compressive Strength**

1. Compressive strength of the material, when tested according to ASTM D 695, shall not be less than 12,000 psi after 72 hours cure at 73 +/- 3.5 °F.

**I. Shelf Life**

1. Individual components shall not require mixing prior to use when stored for a period of 12 months.

**2.4 GLASS BEADS**

A. Beads shall be transparent, clean, colorless glass, smooth and spherically shaped, free of milkiness, pits, or excessive air bubbles.

B. Quality Assurance Control



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1. Beads shall be segregated into maximum lots of 2,500 pounds (1125 kilograms) and lot numbers shall be stamped onto each lot. Each lot shall be tested for gradation, rounds and embedment coating.

C. Gradation - The glass spheres shall meet the following gradation requirements:

Glass sphere gradation (ConnDOT Grading "A")

Sieve Size	% Passing
20 (850 um)	100
30 (600 um)	80-95
50 (300 um)	9-42
80 (180 um)	0-10

Glass sphere gradation (ConnDOT Grading "B")

Sieve Size	% Retained
10 (2.0 mm)	0
12 (1.7 mm)	0-5
14 (1.4 mm)	5-20
16 (1.18 mm)	40-80
18 (1.0 mm)	10-40
20 (850 um)	0-5
Pan	0-2

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- D. Roundness: Glass beads shall have a minimum of 80% rounds per screen for two highest sieve quantities and no more than 3% angular particles per screen for Grading "B". The remaining sieve fractions shall typically be no less than 75% rounds.
- E. Refractive Index: Glass beads shall have a refractive index of 1.50 to 1.52.

### **PART 3 EXECUTION**

#### **3.1 GENERAL**

- A. Pavement markings shall be applied in accordance with the details shown on the plans and the control points established by the Contractor and approved by the Engineer.
- B. No paint shall be applied to new bituminous pavement until the top course has cured at least one week minimum.
- C. Pavement areas to be painted shall be dry and sufficiently cleaned of sand and road debris so as to provide an acceptable bond between the paint and the pavement.
- D. All painting shall be performed in a neat and workmanlike manner. The lines shall be sharp and clear with no feathered edging or fogging and precautions shall be taken to prevent tracking by tires of the striping equipment. Paint shall be applied as shown on the Drawings with no unsightly deviations.
- E. Contractor shall protect the buildings, walks, pavement, curbing, trees, shrubs, mulch, etc. from over-spray of paint and damage by his operations.
- F. Operations shall be conducted only when the road surface temperature is at least 40°F or as allowed by Engineer. They shall be discontinued during periods of rain, and shall not continue until Engineer determines that the pavement surface is dry enough to achieve adhesion.
- G. After application, paint shall be protected from crossing vehicles using traffic cones or other acceptable method for a time at least equivalent to the drying or curing time of the paint.
- H. The material shall be applied to the pavement by equipment used specifically for the application of pavement markings and shall be of a standard commercial manufacturer.
- I. Contractor shall provide survey control for layout of pavement markings by utilizing his own surveyor or hiring a registered land surveyor. The cost of this survey control shall be included in other items of work.

#### **3.2 WATERBORNE PAVEMENT MARKINGS**

- A. Painted legend, arrows, and markings includes paint installed with a hand striping machine such as: stop bars, crosswalks, parking stalls, lane arrows, legends, markings within gore areas, and painting of paved islands or medians.
- B. Painted pavement markings and hot applied painted pavement markings include paint installed with a truck-mounted painting machine such as center lines, lane lines and shoulder lines.
- C. Waterborne Paint, Ambient Temperature
  - 1. Apply paint at a rate of 100 to 115 square feet per gallon, with glass beads applied at a rate of 6 pounds per gallon of paint for painted pavement markings and painted legend, arrows, and markings

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D. Waterborne Paint, Hot-Applied

1. Hot-applied paint shall be applied at a temperature of 130°F to 145°F at the spray gun.
2. Apply paint at a rate of 8 pounds per gallon of paint for hot-applied painted pavement markings.

3.3 EPOXY RESIN PAINTED PAVEMENT MARKINGS

- A. Epoxy resin pavement markings includes epoxy resin installed with a truck-mounted machine such as center lines, lane lines, and shoulder lines.
- B. Epoxy resin pavement markings, symbols and legends include stop bars, crosswalks, parking stalls, lane arrows, legends, and markings within areas such as paved islands, gore areas and paved medians.

C. Equipment

1. Equipment furnished shall include an applicator truck of adequate size and power, together with the following:
  - a. Remote application equipment designed to apply an epoxy resin material in a continuous pattern.
  - b. Portable glass bead applicators, one for each size bead, designed to provide uniform and complete coverage of the epoxy binder by a controlled free-fall method. Pressurized glass bead application shall not be used. Before epoxy color is changed, equipment shall be cleaned out sufficiently to ensure that the color of material applied will be correct.
2. When working on a highway with more than one lane in either direction, the applicator truck (striper) shall have a permanently mounted direction variable illuminated arrow board, fully operational and visible to approaching traffic. There will be no additional payment for the arrow board. Its cost shall be included in the bid price for this item.
3. For markings applied on pavements over one year old, equipment furnished shall also include a power washing machine capable of cleaning the pavement with a pressure of 2,400 to 2,800 psi with water heated to 180°F - 195°F. No chemicals shall be added to the water used in the process. The power washer shall be equipped with a turbo blast tip with an oscillating head and shall be capable of supplying a minimum of 5 gallons/minute gun.
4. All guns on the spray carriages shall be in full view of the operator(s) during operation.

D. Procedures

1. The road surface shall be cleaned at the direction of the Engineer just prior to application. Pavement cleaning shall consist of power washing using clean water heated to 180°F – 195 °F at a pressure of 2,240 - 2,800 psi. The areas to be power washed shall include all areas where epoxy marking symbols and legends (including stop bars and crosswalks) are to be applied and at least 1 inch beyond the area to be marked. The surface shall be cleaned to the satisfaction of the Engineer.
  - a. For other pavement areas, cleaning shall consist of brushing with rotary broom (non-metallic), and any additional work as recommended by the material manufacturer and acceptable to the Engineer.

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- b. New portland cement concrete surfaces shall be cleaned by abrasive blasting to remove any surface treatments and/or laitance.
  - c. New bituminous concrete surfaces are not to be power washed.
2. All surfaces that are power washed shall be allowed to dry sufficiently prior to the application of the epoxy markings. The areas to be marked shall be broom cleaned immediately prior to the application of the epoxy markings. Glass beads shall be applied immediately after application of the epoxy resin marking to provide an immediate notrack system.
  3. Contractor will place necessary "spotting" at appropriate points to provide horizontal control for striping and to determine necessary starting and cutoff points. Broken line intervals will not be marked. Longitudinal joints, pavement edges and existing markings shall serve as horizontal control when so directed.
  4. A tolerance of 0.25 inch under or 0.25 inch over the specified width shall be allowed for striping provided the variation is gradual and does not detract from the general appearance. Alignment deviations from the control guide shall not exceed 2 inches provided the variation is gradual and does not detract from the general appearance. Material shall not be applied over a longitudinal joint. Establishment of application tolerances shall not relieve Contractor of the responsibility to comply as closely as practicable with the planned dimensions.
  5. Glass beads conforming to the requirements of Grading "B" (larger beads) as specified herein shall be applied at a rate of 12 pounds per gallon of epoxy pavement marking material, immediately followed by a second drop of glass beads conforming to the requirements of Grading "A" (smaller beads) as specified herein applied at a rate of 13 pounds per gallon of epoxy pavement marking material.
  6. Time to No-Track: The material shall be in "no-tracking" condition within 15 minutes, or as allowed by Engineer. The no-tracking time shall be determined by passing over the line with a passenger car or pickup truck in the simulated passing maneuver. A marking showing no visual deposition of the material to the pavement surface when viewed from a distance of 50 feet (15 meters) shall be considered as showing "no-tracking" and conforming to this requirement for time to no-track.
  7. When stencils are used during the application of epoxy markings, care must be used when removing the stencils so that the epoxy resin does not drip on the road, sidewalk, grass, etc., and so that the applied markings have edges which are clean, straight and neat.
  8. Epoxy resin pavement markings may be applied over existing painted markings provided they are sufficiently worn to allow adequate adhesion. If required by the Engineer, existing plastic, thermoplastic, epoxy or freshly painted markings shall be removed prior to the application of epoxy markings.

**E. Crosswalks**

1. Only glass beads conforming to the requirements of Grading "A" (smaller beads) as specified herein shall be applied at a rate of 25 pounds per gallon of epoxy pavement marking material.

**F. Performance**

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1. In order to be accepted, the applied markings must meet the following minimum retroreflectivity reading as measured using an LTL 2000 Retrometer with 30-meter geometry 1 to 2 weeks after installation:

- a. White Epoxy 250 millicandelas per square foot per foot candle (millicandelas per square meter per lux).
- b. Yellow Epoxy 175 millicandelas per square foot per foot candle (millicandelas per square meter per lux).

END OF SECTION 321723



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SECTION 321813 – SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Furnish all labor, materials, tools and equipment necessary for the complete installation of a playground protective synthetic grass surfacing system that meets the requirements of ASTM F 1292-09 and IPEMA Certification of conformance as a safe public play surface as indicated on the plans and as specified herein; including components and accessories required for a complete installation, including but not limited to:
  - 1. Acceptance of prepared sub-base.
  - 2. Coordination with related trades to ensure a complete, integrated, and timely installation: aggregate base course, sub-base material (tested for permeability), grading and compacting, piping and drain components (when required; as provided under its respective trade section).

1.3 RELATED SECTIONS

- A. Section 00 00 00 – Site Preparation
- B. Section 31 23 00 – Excavation and Fill
- C. Section 31 23 16 – Excavation
- D. Section 31 23 23 – Fill
- E. Section 32 13 23 – Aggregate Base Course

1.4 REFERENCE STANDARDS

- A. ASTM – American Society for Testing and Materials.
  - 1. D1577 – Standard Test Method for Linear Density of Textile Fiber.
  - 2. D5848 – Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering.
  - 3. D1338 – Standard Test Method for Tuft Bind of Pile Yarn Floor Covering.
  - 4. D1682 – Standard Method of Test for Breaking Load and Elongation of Textile Fabrics.
  - 5. D5035 – standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test).
  - 6. D4491 – Standard Test Methods for Water Permeability of geotextiles by Permittivity.

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7. F1292-09 – Standard Test Method for Impact Attenuation or Critical Fall Height of Surfacing Materials Under and Around Playground Equipment.
8. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

- B. IPEMA – International Play Equipment Manufacturers Association
1. Public Play Surfacing Certified to ASTM F1292-09 - Standard Test Method for Impact
  2. Attenuation or Critical Fall Height of Surfacing Materials Under and Around Playground Equipment.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Completed playground protective synthetic grass surfacing system shall be capable of meeting the following performance requirements:
1. IPEMA Public Play Surfacing Certified.
  2. ASTM F1292-09: Impact attenuation. Playground protective surface shall meet performance requirements for the impact attenuation of playground surfacing materials installed within the use zone of playground equipment, as specified by Architect.
  3. ASTM D4491: Water permeability test. Synthetic grass surface shall drain at a rate of 300 inches or more, of water per hour.
  4. ASTM D1338: Tuft bind. Synthetic grass surfacing shall have a tuft bind, without infill material of 8 pounds or more.

#### 1.6 SUBMITTALS

- A. Substitutions: Other products are acceptable if in compliance with all requirements of these specifications. Submit alternate products to Architect for approval prior to bidding in accordance Section 01 25 13, Product Substitution Procedures.
1. Provide substantiation that proposed system does not violate any other manufacturer's patents, patents allowed or patents pending.
  2. Provide a sample copy of insured, non-prorated warranty and insurance policy information.
- B. Comply with Section 01 33 00, Submittals Procedures. Submit for approval prior to fabrication.
- C. Product Data:
1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations.
  2. Submit fiber manufacturer's name, type of fiber and composition of fiber.
  3. Submit shock absorbing pad manufacturer's name.
  4. Submit data in sufficient detail to indicate compliance with the contract documents.
  5. Submit manufacturer's instructions for installation.
  6. Submit manufacturer's IPEMA Certificate to indicate compliance with certified public play surfacing.
- D. Samples: Submit samples, illustrating details of finished product in amounts as required by General Requirements, or as requested by Architect.
- E. List of existing installations: Submit list including respective Owner's representative and telephone number.



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- F. Warranties: Submit warranty and ensure that forms have been completed in Owner's name and registered with approved manufacturer.
- G. Testing Certification: Submit certified copies of independent (third-party) laboratory reports on ASTM testing:
  - 1. Pile Height, Face Weight & Total Fabric Weight, ASTM D5848.
  - 2. Primary & Secondary Backing Weights, ASTM D5848.
  - 3. Tuft Bind, ASTM D1335.
  - 4. Grab Tear Strength, ASTM D1682 or D5034.
  - 5. Water Permeability, ASTM D4491
  - 6. Artificial turf fiber proposed for the field(s) must have successfully undergone a minimum of 200,000 cycles on the Lisport wear test. This fiber must be exactly the same fiber that is being proposed for the field(s). Official report must be provided.

**1.7 QUALITY ASSURANCE**

- A. Comply with Section 01 43 00, Quality Assurance.
- B. Manufacturer Qualifications: Engaged in manufacturing synthetic grass surfacing products for a minimum of fifteen (15) years.
  - 1. The Manufacturer shall be experienced in the manufacturing and installation of specified type of playground protective synthetic grass surfacing system. This includes use of a dual polymer monofilament fiber, slit-film fiber and texturized monofilament fiber, backing, the backing coating, shock absorbing playground pad and the installation method.
  - 2. The Manufacturer shall own and operate its own manufacturing plant. Manufacturing the fiber, tufting of the fibers into the backing materials and coating of the synthetic grass system must be done in-house by manufacturer.
  - 3. The Manufacturer must hold ISO 9001, ISO 14001 and ISO 45001 certifications demonstrating its manufacturing efficiency with regards to quality, environment and safety management systems.
  - 4. The Manufacturer must hold IPEMA certification for specified synthetic grass product.
- C. Installer/Contractor Qualifications: Company shall specialize in performing the work of this section.
  - 1. The Company shall provide competent workmen skilled in this specified type of playground protective synthetic grass system installation.
  - 2. The designated Supervisory Personnel on the project shall be certified, in writing by the manufacturer, as competent in the installation of specified type of synthetic grass system, including gluing seams and proper installation of the shock absorbing playground pad and infill material.
  - 3. The Company shall be certified by the manufacturer and licensed (if required).
- D. Pre-Installation Conference: Conduct conference at project site at time to be determined by Architect. Review methods and procedures related to installation including, but not limited to, the following:
  - 1. Inspect and discuss existing conditions and preparatory work performed under other contracts.
  - 2. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, The Owner's representative, and the Architect.
- E. The Installer/Contractor shall verify special conditions required for the installation of the playground protective synthetic grass system if required.

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- F. The Installer/Contractor shall notify the Architect of any discrepancies.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with Section 01 60 00, Product Requirements.
- B. Deliver and store components with labels intact and legible.
- C. Store materials/components in a secure manner, under cover and elevated above grade.
- D. Protect from damage during storage, handling and installation. Protect from damage by other trades.
- E. Inspect all delivered materials and products to ensure they are undamaged and in good condition.

**1.9 SEQUENCING AND SCHEDULING**

- A. Coordinate the Work with installation of work of related trades as the Work proceeds.
- B. Sequence the Work in order to prevent deterioration of installed system.

**1.10 WARRANTY**

- A. See Section 01780 - Closeout Submittals, For Additional Warranty Requirements.
- B. The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a period of ten (10) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the Owner or the manufacturer. The warranty shall be fully third party insured; pre paid for the entire 10 year term and be non-prorated. The Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to owner notification in writing that the field is officially added to the annual policy coverage, guaranteeing the warranty to the Owner. The insurance policy must be underwritten by an "AM Best" A rated carrier and must reflect the following values:
  - 1. Pre-Paid 10-year insured warranty from a single source.
  - 2. Maximum per claim coverage amount of \$33,000,000.
  - 3. Minimum of thirty-three million dollars (\$33,000,000) annual.
  - 4. Must cover full 100% replacement value of total square footage installed, minimum of \$7.00 per sq ft. (in case of complete product failure, which will include removal and disposal of the existing surface).
  - 5. Provide a sample copy of insured, non-prorated warranty and insurance policy information.
  - 6. Policy cannot include any form of deductible to be paid by the Owner.

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**PART 2 - PRODUCTS**

**2.1 BASIS OF DESIGN MANUFACTURER AND DISTRIBUTOR**

- A. Approved Manufacturer: FieldTurf USA, Inc.  
175 N. Industrial Boulevard,  
Calhoun, GA 30701
- Contact: Director of Contracting and Specifications at (573) 356-7355.
- B. Basis of Design Product: COMMAND CORE
- C. Approved Alternate Manufacturers: Shaw Sportex, AstroTurf.s

**2.2 MATERIALS AND PRODUCTS**

- A. Playground Protective Synthetic Grass Surfacing system shall consist of the following:
1. Synthetic grass surfacing made with a combination of dual polymer monofilament fibers, slit- film fibers and texturized monofilament fibers, tufted into a fibrous, perforated and porous backing.
  2. Shock absorbing playground pad.
  3. Anchoring device to secure perimeter edge of synthetic grass.
  4. Infill: Graded dust-free silica sand that partially covers the synthetic grass. Graded dust-free acrylic coated silica sand may be substituted for silica sand as requested by Architect.
  5. Glue, thread, seaming fabric and other materials used to install and mark the synthetic grass.
- B. Synthetic grass surfacing system shall have the following properties:

STANDARD	PROPERTY	SPECIFICATION
ASTM D1577	Fiber Denier A	14000
ASTM D1577	Fiber Denier B	10000+
ASTM D1577	Fiber Denier C	5000+
ASTM D5823	Pile Height	1.625"
ASTM D5793	Stitch Gauge	3/8"
ASTM D5848	Pile Weight	65 oz/square yard
ASTM D5848	Primary Backing	>9oz/square yard

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STANDARD	PROPERTY	SPECIFICATION
ASTM D5848	Secondary Backing	>21 oz/square yard
ASTM D5848	Total Weigh	>94 oz/square yard
ASTM D1338	Tuft Bind (Without Infill)	8lbs
ASTM D4491	Turf Permeability	300 inches/hour
N/A	Infill Component	3 lbs./square foot
Variation of +/- 5% on above listed property values is within normal manufacturing tolerances		

- C. Synthetic grass surfacing product shall consist of dual polymer monofilament fibers, slit-film fibers and texturized monofilament fibers tufted into a primary backing with a secondary backing.
- D. Backing:
  - 1. Primary backing shall be a triple-layered polypropylene fabric.
  - 2. Secondary backing shall consist of an application of porous urethane to permanently lock the fiber tufts in place.
  - 3. Perforated (with punched holes), backed turf is acceptable.
  - 4. Turf with attached scrim in lieu of porous urethane is unacceptable.
- E. Primary fiber shall be 14,000 denier, low friction, and UV-resistant fiber measuring not less than 1.625 inches high. Secondary fiber shall be +10,000 denier. Third fiber shall be +5,000 denier.
- F. Shock absorbing playground pad shall drain vertically and laterally without absorbing water or other liquids. Shock absorbing pad in 2"+ and a Double Layer of 2"+ pad measuring a total of 4"+ to meet specified use zone critical fall height requirements as requested by Architect.
- G. Infill materials shall be approved by the manufacturer.
  - 1. Infill shall consist of graded dust-free sand. Graded dust-free acrylic coated silica sand may be substituted for silica sand as requested by Architect.
- H. Glue and seaming fabric, for seaming of synthetic grass shall be as recommended by the synthetic grass manufacturer.

## 2.3 QUALITY CONTROL IN MANUFACTURING

- A. The manufacturer shall own and operate its own manufacturing plant in North America. Both tufting of the fibers into the backing materials and coating of the turf system must be done in-house by the synthetic grass manufacturer. Outsourcing of either is unacceptable.
- B. The manufacturer shall have full-time certified in-house inspectors at their manufacturing plant that are experts with industry standards.

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- C. The manufacturer's full-time in-house certified inspectors shall perform pre-tufting fiber testing on tensile strength, elongation, tenacity, and denier, upon receipt of fiber spools from fiber manufacturer.
- D. Primary backing shall be inspected by the manufacturer's full-time certified in-house inspectors before tufting begins.
- E. The manufacturer's full-time in-house certified inspectors shall verify "pick count", yarn density in relation to the backing, to ensure the accurate amount of face yarn per square inch.
- F. The manufacturer's full-time, in-house, certified inspectors shall perform product inspections at all levels of production including during the tufting process and at the final stages before the synthetic grass is loaded onto the truck for delivery.
- G. The manufacturer shall have its own, in-house laboratory where samples of synthetic grass are retained and analyzed, based on standard industry tests, performed by full-time, in-house, certified inspectors.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that all sub-base leveling is complete prior to installation.
- B. Installer/Contractor shall examine the surface to receive the synthetic grass, the shock absorbing playground pad, and accept the sub-base planarity in writing prior to the beginning of installation.
  - 1. Acceptance is dependent upon the Owner's test results indicating compaction and planarity are in compliance with manufacturer's specifications.
  - 2. The surface shall be accepted by Installer as "clean" as installation commences and shall be maintained in that condition throughout the process.
- C. Compaction of the aggregate base shall be 90%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0-1/4 inch over 10 feet and 0-1/2 inch from design grade.
- D. Correct conditions detrimental to timely and proper completion of Work.
- E. Do not proceed until unsatisfactory conditions are corrected.
- F. Beginning of installation means acceptance of existing conditions.

#### **3.2 PREPARATION**

- A. Prior to the beginning of installation, inspect the sub-base for tolerance to grade.
- B. Sub-base acceptance shall be subject to receipt of test results (by others) for compaction and planarity that sub-base is in compliance with manufacturer's specifications and recommendations.

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- C. When requested by Architect, installed sub-base shall be tested for porosity prior to the installation of the synthetic grass system. A sub base that drains poorly is an unacceptable substrate.

**3.3 INSTALLATION**

- A. The finished surface shall appear as mowed grass with no irregularities and shall be required to meet applicable ASTM, CPSC and ADA standards for the maximum fall height, as requested by the Architect.
- B. The installation shall be performed in full compliance with approved Shop Drawings.
- C. Only trained technicians, skilled in the installation of synthetic grass systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, top- dressing or brushing operations.
- D. The designated Supervisory personnel on the project must be certified, in writing by the manufacturer, as competent in the installation of this material, including gluing seams and proper installation of the Infill material.
- E. Install at location(s) indicated, to comply with final shop drawings, manufacturers'/installer's instructions.
- F. The Installer/Contractor shall strictly adhere to specified procedures. Any variance from these requirements shall be provided in writing, by the manufacturer's on-site representative, and submitted to the Architect and/or Owner, verifying that the changes do not in any way affect the Warranty. Infill materials shall be approved by the manufacturer and installed in accordance with the manufacturer's standard procedures.
- G. Shock absorbing playground pad shall be installed directly over the properly prepared aggregate base. Extreme care shall be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity.
  - 1. Repair and properly compact any disturbed areas of the aggregate base as recommended by manufacturer.
  - 2. Seams shall be flat, tight, and permanent with no separation or fraying.
- H. Playground protective synthetic grass system shall be installed directly over the shock absorbing playground pad.
  - 1. Seams shall be flat, tight, and permanent with no separation or fraying.
- I. Infill Materials:
  - 1. Infill materials shall be applied in thin lifts. The turf shall be brushed as the material is applied. The infill material shall be installed to a depth determined by the manufacturer.
  - 2. Infill material shall be installed in a systematic order.
  - 3. Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of graded dust-free silica sand. Graded dust-free acrylic coated silica sand may be substituted for silica sand as requested by Architect.
  - 4. The Installer/Contractor shall keep area clean throughout the project and clear of debris. Upon completion of installation, the finished project shall be inspected by the installation crew and an installation supervisor.

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**3.4 ADJUSTMENT AND CLEANING**

- A. Do not permit traffic over unprotected surface.
- B. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.
- C. All usable remnants of new material shall become the property of the Owner.
- D. The Contractor shall keep the area clean throughout the project and clear of debris.
- E. Surfaces, recesses, enclosures, and related spaces shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

**3.5 PROTECTION**

- A. Protect completed playground protective synthetic grass surfacing system throughout construction process until project completed.

END OF SECTION 321813





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SECTION 32 1823.15 – INFIELD MIX AND WARNING TRACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Baseball and Softball Skinned Surfacing.
  - 2. Warning Track Surfacing.
    - a. Using existing in-place materials and new materials as needed for grade adjustment, the Contractor shall furnish, and construct infield mix and warning track surfaces to the lines and grades shown on the plans as specified in this Section, including the provision of all materials, labor, tools, equipment and transportation necessary to complete the work.
    - b. In advance of installing the additional infield mix and warning track surfacing, the Contractor shall be responsible for skimming and relocation or removal of existing materials if needed.
    - c. of existing materials if needed.
- B. Related Sections:
  - 1. Division 11 Section "Baseball/Softball Field Equipment" for baseball and softball bases and pitching rubbers.
  - 2. Division 31 Section "Earthwork" for subgrade.
  - 3. Division 32 Section "Chain Link Fencing and Gates" for baseball and softball backstops.

1.3 REFERENCES

- A. ASTM - American Society for Testing and Materials.

1.4 SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.

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3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Product Data: For each type of product.
1. Include particle size analysis for infield mix.
- C. Samples: For each bulk-supplied material, 1-quart (1-L) volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

**1.5 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent operated laboratory; experienced in soil science, soil testing with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

**1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Remove contaminated and rejected material from project site immediately.
- B. Handle and store so to keep dry and maintain workability of infield materials.

**PART 2 - PRODUCTS**

**2.1 INFIELD MIX**

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following as approved by the Landscape Architect:
- a. DuraEdge Products, Inc. (866) 867-0052.

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- b. Partac Peat Corporation, (908) 637-8421.
- B. Infield Mix: As available from local infield mix suppliers and complying with the following requirements:
  - 1. Shall be clean, dry clay mixed with washed mason-type sand resulting in a weed-free mixture that is reddish brown in color, having a yield of 1.35 tons per cubic yard when placed loose or 1.5 tons per cubic yard when compacted to 85 to 90 percent on a Standard Proctor Test (ASTM D 689-07). Infield mix shall possess the following particle size analysis:
    - a. Total Sand Content: 70 to 75 percent.
    - b. Combined amount of sand retained on medium, coarse and very coarse sieves shall be greater than or equal to 50 percent.
    - c. Combined amount of silt and clay shall be 25 to 30 percent.
    - d. The SCR ratio (silt clay ratio) shall be 0.5 to 1.0.
    - e. No particles shall be greater than 3 millimeters.
    - f. Equal to or less than 5 percent of particles shall be retained on the 2-millimeter sieve.

## 2.2 PITCHING MOUND MIX

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following as approved by the Landscape Architect:
  - a. DuraEdge Products, Inc. (866) 867-0052.
  - b. Partac Peat Corporation, (908) 637-8421.
- B. Pitching Mound Mix: As available from local infield mix suppliers and complying with the following requirements:
  - 1. Shall be clean, dry clay mixed with washed mason-type sand resulting in a weed-free mixture that is reddish brown in color, having a yield of 1.35 tons per cubic yard when placed loose or 1.75 tons per cubic yard when compacted to 85 to 90 percent on a Standard Proctor Test (ASTM D 689-07). Pitching Mound mix shall possess the following particle size analysis:
    - a. Total Sand Content: 15 to 28 percent.
    - b. Total Clay Content: 30 percent.
    - c. The SCR ratio (silt clay ratio) shall be 0.75 to 1.25.
    - d. No particles shall be greater than 3 millimeters.

## 2.3 INFIELD TOPDRESSING

- A. Amendments shall be installed in accordance with the Infield Mix manufacturer's recommendations to include, but not be limited, to the following:
  - 1. Calcined Clay: "Turface Pro League Heritage Red Conditioner as manufactured by Profile Products LLC, 750 Lake Cook Road, Suite 440, Buffalo Grove, IL (800) 207-6457.
  - 2. Expanded Shale: "ProSlide Engineered Topdressing", a professional grade expanded shale topdressing.

## 2.4 WARNING TRACK MIX

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following as approved by the Landscape Architect:

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- a. DuraEdge Products, Inc. (866) 867-0052.
  - b. Partac Peat Corporation, (908) 637-8421.
- B. Warning Track Mix: As available from local infield mix suppliers and complying with the following requirements:
- 1. Shall be clean, crushed brick mixed with #10 limestone resulting in a mix that is reddish brown in color, having a yield of 1.3 tons per cubic yard and possessing the following particle size analysis:

Sieve Designation	Range of Percent Passing
3/8-inch	100
No. 4	90 to 100
No. 8	60 to 78
No. 16	42 to 55
No. 30	20 to 40
No. 50	8 to 20
No. 100	5 to 12
No. 200	0 to 5

**PART 3 - EXECUTION**

**3.1 SITE PREPARATION**

- A. Grade subgrade within 10 inches of finish grade and thoroughly compact.
- B. Check that finished grade will match proposed grades shown on plan. Make corrections as required prior to placing Infield Mix materials.

**3.2 BLECAVATE, INSTALL, ROLL AND COMPACT INFIELD MIX AREAS**

- A. All infield mix areas are to be tilled to a depth of 4-inches with a blecavator. Conventional tilling is unacceptable.
- B. The Contractor shall perform blending operations within the areas delineated on the plans. The contractor shall prepare the soil using the blecavator, which is a heavy duty contra-rotating rotor with blades that dig into the ground throwing soil, debris, and rocks against a sorting screen mounted behind the rotor for separating rocks and debris. The fine soil is deposited over the top and leveled off.

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The rear packer roll on the blecavator firms up the finished areas ready for fine grading. Within the area delineated on plans, the contractor shall be directed by the Engineer, to perform blending for 4-inch depth of infield mix in order to achieve a homogeneous blend of soil composition over the entire infield within the limits of the full depth renovation areas.

- C. delineated on plans, the contractor shall be directed by the Engineer, to perform blending for 4-inch depth of infield mix in order to achieve a homogeneous blend of soil composition over the entire infield within the limits of the full depth renovation areas.
- D. Upon regrading of existing surfaces and installation of the required additional material, the Contractor shall install, roll and compact the infield mixes and warning track materials specified to a compacted finished depth as specified on the construction plans. Complete installation of clay surfaces in conformance with the manufacturer's recommendations or as otherwise required by the Engineer.
- E. tion plans. Complete installation of clay surfaces in conformance with the manufacturer's recommendations or as otherwise required by the Engineer.
- F. The edges of the infield mixes and warning track shall meet the grades of adjacent turf areas. No ridges or depressions will be permitted at edges.
- G. Infield turf areas are to be seeded and maintained per Section 32 9219 "Athletic Field Seeding and Sodding"

### 3.3 SKINNED INFIELD AND PITCHING MOUND INSTALLATION

- A. Place mixes in lifts of 2 inches and compact with a 1-ton vibratory roller until an optimum compaction is achieved. Scarify the surface to facilitate bonding of the next lift and repeat until finish grade elevation is achieved.
  - 1. Pitching Mound Compaction: 90 to 95 percent.
  - 2. Skinned Infield Compaction: 85 to 90 percent.
- B. Apply calcium chloride evenly at the rate of 3/4 pounds per square yard as recommended by mix manufacturer. Mix into top 2 inches by raking or dragging.
- C. Rake to smooth grade; then compact with small roller leveling edges of existing grades. Remove all rocks and debris over 1/2 inch in size (in any dimension).
- D. Remove from the field of play all infield material contaminated by installation. Remove all infield materials from adjacent lawns or sod. Trim all edges with lawn straight and true.
- E. Finish Grading: Infield Mix shall be laser graded to a tolerance of 1/8 inch. Slope infield towards outfield at 1 percent slope.
- F. Topdressing: Following final approval of infield surfacing, topdressing shall be applied to the surface. Topdressing material shall be either expanded shale or calcined clay as recommended by manufacturer and applied at a rate of 1 pound per square foot.

### 3.4 WARNING TRACK INSTALLATION

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- A. Excavate material from the warning track area to a depth of 7 inches below the final finished grade.
- B. Compact the subgrade until 90 to 95 percent compaction is achieved.
- C. Install geotextile fabric to prevent weed migration through the warning track area.
- D. Place 3 inches of processed aggregate base capped with 1 inch of stone dust for a total of 4 inches.
- E. Place the warning track material of the top of the stone dust. The depth of the warning track material shall be 3 inches at completion of compaction.
- F. When placing the processed aggregate, stone dust and warning track materials, use lifts of 2 inches or less and compact with a minimum 1-ton vibratory roller until an optimum compaction between 90 and 95 percent is achieved. Scarify the surface to facilitate bonding of the next lift and repeat until finish grade elevation is achieved.

END OF SECTION 32 1823.15

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SECTION 323113 – CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Polymer-coated, industrial steel chain-link fence.
  - 2. Polymer-coated steel swing gates.
  - 3. Polymer-coated steel chain link baseball backstop with hood (20 feet tall).
  - 4. Polymer-coated steel chain link softball backstop with hood (20 feet tall).
  - 5. Polymer-coated, steel chain-link fabric.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM).
  - 1. ASTM A90 – Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc Alloy.
  - 2. ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. ASTM A153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
  - 4. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
  - 5. ASTM A392 – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

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6. ASTM A428 – Standard Test Method for Weight (Mass) of Coating on Aluminum-Coated Iron or Steel Articles.
7. ASTM A491 – Standard Specification for Aluminum Coated Steel Chain Link Fence Fabric.
8. ASTM A780 – Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
9. ASTM A817 – Standard Specification for Metallic-Coated Steel Wire for Chain Link Fence Fabric and Marcellled Tension Wire.
10. ASTM A824 – Standard Specification Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence.
11. ASTM B211 – Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.
12. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
13. ASTM F552 – Standard Terminology Relating to Chain Link Fencing.
14. ASTM F567 – Standard Practice for Installation of Chain Link Fence.
15. ASTM F626 – Standard Specification for Fence Fittings.
16. ASTM F668 – Specification for Polymer Coated Chain Link Fence Fabric.
17. ASTM F900 – Standard Specification for Industrial and Commercial Swing Gates.
18. ASTM F934 – Specification for Standard Colors for Polymer-Coated Chain Link.
19. ASTM F1043 – Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
20. ASTM F1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
21. ASTM F1183 – Standard Specification for Aluminum Alloy Chain Link Fence Fabric.
22. ASTM F1664 – Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.

**D. Chain Link Fence Manufacturer's Institute**

1. Chain Link Fence Manufacturer's Institute Product Manual, latest revision.

**1.4 ACTION SUBMITTALS**

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.



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3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### 1.5 SYSTEM DESCRIPTION

A. Temporary Construction Fence:

1. Fence Height: 8 feet.
2. Mesh Size: 2 inches.
3. Mesh Gage: 12
4. Gates: Height of gates shall match that of fence. Width of gates shall be as shown on the Drawings.
5. Anchored post or driven posts where indicated. No top or bottom rails required.
6. Panelized/modular units where indicated. Two stabilizers per panel.

B. Chain Link Fence:

1. Fence Height: Varies, refer to the Drawings.
2. Mesh Size: 2 inches.
3. Mesh Gage: 9, measured prior to application of any coating.
4. Gates: Height of gates shall match that of fence. Type and size of gates shall be as shown on the Drawings.
5. Top and bottom rails between posts unless otherwise indicated.

#### 1.6 SUBMITTALS

- A. Shop drawings showing the plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates and a schedule of components.

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- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
  - 1. Fence and gate posts, rails, and fittings.
  - 2. Chain-link fabric, fabric coatings, reinforcements, and attachments.
  - 3. Accessories: Privacy slats.
  - 4. Gates, locking mechanisms and hardware.
  - 5. Gate operators, including operating instructions.
  - 6. Motors (if applicable): Show nameplate data, ratings, characteristics, and mounting arrangements.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
  - 1. Gate Operator (if applicable): Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
  - 2. Wiring Diagrams (if applicable): For power, signal, and control wiring.
- D. Samples for Initial Selection: For components with factory-applied color finishes.
- E. Samples for Verification: Prepared on Samples of size indicated below:
  - 1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.
- F. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

**1.7 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified factory-authorized service representative.
- B. Product Certificates: For each type of chain-link fence system and gate, from manufacturer.
- C. Product Test Reports: For framing strength, ASTM F1043.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

**1.8 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
  - 1. Polymer finishes.
  - 2. Gate hardware.

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3. Gate operator.

**1.9 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. Supply material in accordance with Chain Link Fence Manufacturer's Institute Product Manual and this Specification.
- C. Perform installation in accordance with ASTM F567.
- D. Maintain all facilities installed under this Section in proper and safe condition throughout the progress of the work.

**1.10 PROJECT CONDITIONS**

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to existing improvements and/or proposed construction. Verify dimensions by field measurements. Notify Engineer of any dimensional discrepancies prior to proceeding with the work. Coordinate with Engineer regarding any adjustment or modification.

**1.11 DELIVERY, STORAGE AND HANDLING**

- A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.
- B. Packages shall be labeled with the manufacturer's name.
- C. Store fence fabric and accessories in a secure and dry place.

**1.12 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of gate operators and controls.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - c. Deterioration of coatings beyond normal weathering.
- B. Warranty Period: Five years from date of Substantial Completion.

**PART 2 PRODUCTS**

**2.1 GENERAL**

- A. All posts and rails shall be straight, true to section and of sufficient length for proper installation.
- B. Unless otherwise specified, hardware and accessories shall conform to the requirements of ASTM F626 and ASTM A123 or ASTM A153 as applicable for zinc-coating.

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**2.2 POSTS AND RAILS**

- A. Extruded steel tube, ASTM F1083 or rolled/welded tube, ASTM F1043, minimal yield strength 50,000 pounds per square inch (psi), hot dipped galvanized.
1. Extruded steel tube: Average zinc coating of 2.0 ounces per square foot (oz/ft<sup>2</sup>) interior/exterior, ASTM F1083.
  2. Rolled/welded tube: External zinc coating 1.0 oz/ft<sup>2</sup> with a clear polymeric overcoat, Type D interior 90% zinc-rich coating having a minimum thickness of 0.30 mils.
- B. Post size per Table 1.

Table 1 – Post and Rail Sizes

Item	Fence Height	Outside Diameter, Inches	F1083 Schedule 40 weight lb/ft	F1043-IC WT-40 weight lb/ft
Line Posts	up to 8 ft.	2.375	3.65	3.12
	8 to 12 ft.	2.875	5.79	4.64
Terminal Posts	up to 8 ft.	2.875	5.79	4.64
	8 to 12 ft.	4.000	9.11	6.56
Rails		1.660	2.27	1.84

- C. Truss rod shall be  $\frac{3}{8}$ -inch zinc-coated steel with adjustable turnbuckles or truss tightener.

**2.3 CHAIN-LINK FENCE FABRIC**

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
1. Fabric Height: As indicated on Drawings.
  2. Mesh Size: 2 inches.
  3. Selvage: Knuckled at both selvages (KK).
  4. Wire Fabric
    - a. Zinc-Coated Steel Fabric, 9-gauge, ASTM A817, hot-dip galvanized, ASTM A392 Class 2 – 2.0 oz/ft<sup>2</sup>, coated after weaving (GAW).
      - 1) Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
    - b. Polymer-Coated Steel Fabric: ASTM F668, 9-gauge core wire, 0.3 oz/ft<sup>2</sup> zinc-coated with Class 2b (thermally fused and bonded) PVC coating.
      - 1) Color: Black, ASTM F934.

**2.4 TENSION WIRE**

- A. Match coating type to that of the chain link fabric.

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1. Metallic-coated steel wire: Marcellled (spiraled or crimped), 7 gage, (0.177 inches) diameter, ASTM A824, zinc-coated, ASTM A817 Class 5 – 2.0 oz/ft<sup>2</sup>.
2. Polymer-coated steel wire: Marcellled (spiraled or crimped) 7 gage, (0.177 inches) diameter (before coating), ASTM F1664.
  - a. Color: Black, ASTM F934.

## 2.5 HARDWARE AND FITTINGS

- A. Tension and Brace Bands: Galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge (0.105 in.), minimum width of  $\frac{3}{4}$  in. and minimum zinc coating of 1.20 oz/ft<sup>2</sup>. Secure bands with  $\frac{5}{16}$  in. hot-dip galvanized steel carriage bolts.
- B. Terminal Post Caps, Line Post Loop Caps, Rail and Brace Ends, Boulevard Clamps, and Rail Sleeves: In compliance to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz/ft<sup>2</sup>.
  1. Rail sleeves shall not be less than 6 inches long.
- C. Truss Rod Assembly: In compliance with ASTM F626,  $\frac{3}{8}$  in. diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 oz/ft<sup>2</sup>, assembly capable of withstanding a tension of 2,000 lbs.
- D. Tension Bars: In compliance with ASTM F626. Galvanized steel one-piece length 2 in. less than the fabric height, minimum cross section of  $\frac{3}{16}$  in. by  $\frac{3}{4}$  in. and minimum zinc coating of 1.2 oz./ft<sup>2</sup>.
- E. Miscellaneous hardware, including but not limited to nuts, bolts, washers, clips, bands, rail ends, brackets, and straps shall be provided as required, hot-dip galvanized steel, ASTM F626.
- F. Brace bands shall be formed from flat or beveled steel and shall have a minimum thickness after galvanizing of 0.108 inches and a minimum width of  $\frac{3}{4}$  inch.
- G. Polymer-Coated Fittings: ASTM F626, PVC or polyolefin coating, minimum thickness 0.006 in., fused and adhered to the zinc-coated fittings. Color to match fence system.

## 2.6 TIE WIRE AND HOG RINGS

- A. Tie Wire and Hog Rings: Galvanized minimum zinc coating 1.20 oz/ft<sup>2</sup>, 9-gauge (0.148 in) steel wire, ASTM F626.
- B. Polymer coated materials shall match the coating, class and color to that of the chain link fabric.

## 2.7 FASTENERS

- A. All fasteners shall be hot-dip galvanized, ASTM F2329.
- B. Bolts: Steel, ASTM A307, Grade A min, Hex.
- C. Nuts: Steel, ASTM A563, Grade A min, Hex.
- D. Washers: Steel, round, ASTM F844.

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- E. Polymer Coated Color Fittings: In compliance with ASTM F626, PVC or polyolefin coating minimum thickness 0.006 in. fused and adhered to the zinc-coated fittings. Color to match fence system.

**2.8 MODULAR OR PANELIZED CHAIN LINK FENCE**

- A. Free-standing fence panels, minimum ten (10) foot panels of the height specified.
- B. Fabric as specified.
- C. Welded tubular steel frame.
- D. Stands: Four-sided welded tubular steel frame with center bar and tubular sleeves.

**2.9 GATES**

- A. Gate Construction: ASTM F900. Corners welded or assembled with special malleable or pressed-steel fittings and rivets or bolts to provide rigid connections.
- B. Pipe and Tubing: Zinc-Coated Steel: Comply with ASTM F1043 and ASTM F1083; protective coating and finish to match fence framing.
- C. Posts (Hing Posts): Round tubular steel.
  - 1. Up to 4-foot fencing: 2 $\frac{7}{8}$ -inch OD Pipe.
  - 2. Over 4-foot to 6-foot fencing: 4-inch OD Pipe.
  - 3. Over 6-foot to 12-foot fencing: 6.625-inch OD Pipe.
- D. Frames and Bracing: Round tubular steel.
  - 1. Framing:
    - a. 2.375 inch OD Pipe
    - b. Gate Leaves: Configured with intermediate members and diagonal truss rods or tubular members as necessary to provide rigid construction, free from sag or twist. When width of gate leaf exceeds 10 feet, install mid-distance vertical tubing of the same size and weight as frame members. When either horizontal or vertical bracing is not required, provide truss rods as cross-bracing to prevent sag or twist.
    - c. Horizontal bid bracing shall be used on all gates.
- E. Wire Fencing Fabric: Fabric shall match that of fence, attached securely to frame at intervals not exceeding 15 inches.
- F. Hardware:
  - 1. Latches, hinges, stops, keepers and other hardware items shall be furnished as required for proper operation. These elements may not be shown on the Drawings, but shall be supplied and installed as required for a complete gate system.

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2. Hinges: 360-degree inward and outward swing. Set screw shall be installed drilled into the steel post to lock each hinge to the gate post and prevent rotation. No-lift-off type. Box type hinges are not acceptable.
3. Latches: permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
4. Double gates and single gates with leaf width 4 feet and greater shall be equipped with a minimum ½" drop bar and gate hold-backs.
5. Latches, hinges, stops, keepers and other hardware items shall be furnished as required for proper operation.

**2.10 PRIVACY SLATS (IF APPLICABLE)**

- A. Material: PVC, UV-light stabilized, flame resistant, four ply, not less than 0.023 inch (0.58 mm) thick; sized to fit mesh specified for direction indicated.
- B. Material: Redwood, 5/16 inch (7.9 mm) thick, sized to fit mesh specified for direction indicated.
- C. Color: As selected by Owner.

**2.11 CONCRETE**

- A. Concrete shall conform to ASTM C94; or pre-packaged concrete mix, ASTM C387. Minimum 28-day compressive strength of 3,000 psi. No air entrainment.

**2.12 GROUT AND ANCHORING CEMENT**

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

**PART 3 EXECUTION**

**3.1 GENERAL**

- A. Install fence with properly trained crew as shown on the drawings in accordance with ASTM F567.
- B. Install all nuts for tension bands and hardware bolts on the side of the fence opposite the fabric.
- C. The temporary chain link fence shall be removed at the conclusion of the work.

**3.2 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.

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1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

### 3.3 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.

### 3.4 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F567 and more stringent requirements indicated.

1. Install fencing on established boundary lines inside property line.

### 3.5 CHAIN-LINK FENCE INSTALLATION

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

- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete post footings shall have a plan diameter 12 inches greater than the post diameter. Holes shall be clean and free of loose soil and debris. Concrete shall be placed continuously in one operation and tamped or vibrated for consolidation. Tops of the concrete footings shall be crowned to shed water.

3. Gate post/footings shall be installed a minimum of 42 inches below grade.

4. All corner, end posts, and gate posts shall be braced.

- a. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

- b. Corner and terminal posts are to be braced horizontally and diagonally. The braces are to extend over one adjacent panel. Changes in line of 30 degrees or more shall be considered as corners.

- c. Braces and truss rods shall be securely fastened to posts with appropriate hardware.

- d. Pull posts with two braces shall be provided for all heights where changes in horizontal or vertical alignment of ten (10) degrees or more occur.

5. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

- a. Concealed Concrete: Top 3 inches below grade as indicated on Drawings to allow covering with surface material.



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- b. 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.
  - c. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches deep and  $\frac{3}{4}$  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.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly as indicated on the Drawings. Unless indicated otherwise, spacing shall be 8 feet on-center.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F567, 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. horizontal braces at midheight of fabric 72 inches or higher, 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. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches on-center. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
  - 1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F567, 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.
- H. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch 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.
- J. 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 on-center.
- K. 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

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end to chain-link fabric per ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches on-center and to braces at 24 inches on-center.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.
- M. Privacy Slats: Install slats in direction indicated, securely locked in place.
1. Diagonally, for privacy factor of 80 to 85.
- N. Fabric:
1. Do not install fabric until concrete post footings have cured seven (7) days. Provide fabric of the height specified. Install fabric on the public side of the fence, with bottom no greater than 2 inches above the ground surface. Fabric shall be pulled taut to prevent sagging and provide a uniform smooth appearance. Fasten fabric to line posts at intervals not exceeding 15 inches with ties as specified.
  2. Install tension wire in one continuous length between pull posts, weaved through fence fabric at top. Tension wire shall be applied to provide a wire without visible sag between posts. Fasten fabric to tension wire at intervals not exceeding 24 inches with ties or hog rings as specified.
  3. Where it is not practicable to conform the fence to general contour of the ground, as at ditches, channels, etc., the opening beneath the fence shall be enclosed with chain link fabric and sufficiently braced to preclude access, but not to restrict the flow of water.

### 3.6 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- B. Provide swing gates at the locations and dimensions shown on the Drawings. Do not install gates until concrete post footings have cured seven (7) days.
- C. Gates shall be installed plumb, level, and secure, with full opening without interference. Hardware shall be installed and adjusted for smooth operation and lubricated where necessary.
- D. Provide concrete center drop to footing depth and suitable drop rod sleeve at center of double gate openings.

### 3.7 GATE OPERATOR INSTALLATION (IF APPLICABLE)

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Support Posts Pedestals Equipment Bases/Pads: Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.

### 3.8 GROUNDING AND BONDING

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- A. Fence Grounding: Install at maximum intervals of 1,500 feet except as follows:
- B. Fences within 100 feet of buildings, structures, walkways, and roadways: Ground at maximum intervals of 750 feet.
  - 1. Gates and Other Fence Openings: Ground fence on each side of opening.
  - 2. Bond metal gates to gate posts.
  - 3. Coordinate subparagraph below with Drawings in projects where intentional discontinuities are provided in metal fencing conductivity to localize lightning effects to the vicinity of strikes. See Evaluations.
  - 4. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
- C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.
- D. Plans and details on Electrical Drawings and requirements in Division 26 Sections may revise or illustrate application of requirement below or may require grounding that exceeds minimum requirements in IEEE C2. Fences enclosing electrical substations are often bonded to a station grounding mat.
- E. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- F. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
  - 1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
  - 2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.
- G. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- H. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

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5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- I. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

**3.9 FIELD QUALITY CONTROL**

- A. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.
  1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
  2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
  3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

**3.10 ADJUSTING**

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

**3.11 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32 3113

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SECTION 323122 – METAL LOUVER FENCING AND GATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SECTION INCLUDES

- A. Metal louver-style fence and gates.

1.3 RELATED REQUIREMENTS

- A. Section 03 3000 – Site Cast-in-Place Concrete: Post concrete fills.
- B. Section 31 2310 - Earthwork.

1.4 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section “Sustainable Design Requirements” and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  - 6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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**1.5 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- C. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2021).
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- G. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel 2020.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021.
- J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- K. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- L. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings 2013 (Reapproved 2018).
- M. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction 2020.
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- O. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing 2018.
- P. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- Q. IEEE C2 - National Electrical Safety Code 2017.
- R. NAAMM MBG 531 - Metal Bar Grating Manual 2017.
- S. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).

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- T. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- U. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- V. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

**1.6 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate installation of units with size, location, and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of work of this section; require attendance by affected installers.
- C. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

**1.7 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Design Calculations: For high wind load areas, provide calculations for fence panels and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.
- C. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
  - 2. Foundation details, concrete design mix and reinforcing schedule.
- D. Samples: For each fence material and for each color specified.
  - 1. Provide Samples 12 inches (300 mm) in length for linear materials.
  - 2. Provide Samples 12 inches (300 mm) square for sheet or plate materials.
- E. Manufacturer's Installation Instructions: Indicate installation requirements and post foundation anchor bolt templates.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines.
- I. Field Inspection Records: Provide installation inspection records that include post settings, framework, fittings and accessories, gates, and workmanship.
- J. Welding certificates.
- K. Manufacturer's Warranty.

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- L. Maintenance Data: For metal louver fences to include in maintenance manuals.

#### 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Include 10-foot (3-m) length of fence complying with requirements.
  - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at project site.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism, and theft.

#### 1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five-year period after Date of Substantial Completion.
- C. Provide five-year manufacturer warranty for louver-style steel fence.
- D. Provide 10-year warranty for factory finish against cracking, peeling, and blistering under normal use.

### PART 2 PRODUCTS

#### 2.1 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Tubing: ASTM A500/A500M, cold formed steel tubing.
- C. Bar Grating: NAAMM MBG 531.
  - 1. Bars: Hot-rolled steel strip, ASTM A1011/A1011M, Commercial Steel, Type B.
  - 2. Wire Rods: ASTM A510/A510M.
- D. Uncoated Steel Sheet: Hot-rolled steel sheet, ASTM A1011/A1011M, Structural Steel, Grade 45 (Grade 310) or cold-rolled steel sheet, ASTM A1008/A1008M, Structural Steel, Grade 50 (Grade 340), as standard with manufacturer.



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- E. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 50 (Grade 340), with G90 (Z275) coating.
- F. Castings: Either gray or malleable iron unless otherwise indicated.
  - 1. Gray Iron: ASTM A48/A48M, Class 30.
  - 2. Malleable Iron: ASTM A47/A47M.

## 2.2 COATING MATERIALS

- A. Epoxy Primer for Galvanized Steel: Complying with MPI #101 and compatible with coating specified to be applied over it.
  - 1. Products: Subject to compliance with requirements, provide product as recommended by decorative metal fence manufacturer.

## 2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 03 3000 - "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size.

## 2.4 LOUVER-STYLE STEEL FENCE

- A. Steel Louver-style Fence: Fence made from steel tubing, bars, and shapes; hot-dip galvanized.
  - 1. Basis-of-Design Products: Subject to compliance with requirements, provide "Louver-style Fence - Shadow 80" as manufacturer by AmetCo Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210 Willoughby, OH 44096; [www.Ametco.com](http://www.Ametco.com) or comparable products by one of the following:
    - a) Betafence USA LLC; Guardian.
    - b) A&T Ironworks, Inc. / OrsoGril; Talia 80.
- B. Posts: Galvanized square steel tubes.
  - 1. Fence Line Posts: 2 by 2 inches (51 by 51 mm).
  - 2. Fence End and Corner Posts: 4 by 4 inches (101 by 101 mm).
- C. Post Caps: Weld flat steel bar top caps to tubular posts.
- D. Louver-style Fence Infill: Electro-forged welded steel bar grating.
  - 1. Basis-of-Design Product: "Ametco Shadow 80".
    - a) Horizontal fixed louver bars: Formed louver shaped bars, 1-31/32 by 1/16 inch (50 by 2 mm) spaced at 1-13/16 inch (46 mm). Extend louver flange to allow 80 percent direct visual screening.
    - b) Cross Rods: 5/32-inch (4 mm) diameter rods welded perpendicular to back side of louver bars and spaced at 5-7/32 inches (133 mm).
    - c) Perimeter side support bars: 2 by 1/4 inch (51 by 6 mm) flat bars.
    - d) Panel height: As indicated on the Drawings.
    - e) Panel width: As indicated on the Drawings.
    - f) Panel Strength: Capable of supporting 600 pound load applied at midspan without deflection.

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- E. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.
- F. Fabrication: Fabricate louver-style bar grating infill into sections of sizes indicated.
  - 1. Fabricate rails with clips welded to rails for fastening to posts in field.
  - 2. Drill posts, clips, and bar grating for fasteners before finishing to maximum extent possible.
- G. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- H. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.
  - 1. Hot-dip galvanize posts and rails.
  - 2. Hot-dip galvanize rail and picket assemblies after fabrication.
  - 3. Hot-dip galvanize bar grating infill after fabrication.

## 2.5 GROUNDING MATERIALS

- A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
  - 1. Material above Finished Grade: Copper or aluminum.
  - 2. Material on or below Finished Grade: Copper.
  - 3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Grounding Connectors and Grounding Rods: Comply with UL 467.

## 2.6 STEEL FINISHES

- A. Surface Preparation: Clean surfaces according to SSPC-SP 6.
  - 1. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Powder Coating: Immediately after cleaning, apply 2-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 3 to 5 mils at 400 deg F for 20-25 minutes in accordance with ASTM B117 and ASTM D822/D822M. Comply with coating manufacturer's written instructions.
  - 1. Color and Gloss: Custom color as indicated on Metal Finish Schedule on the Drawings.
- C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that will be exposed after assembly and installation, and to concealed surfaces.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

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- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Stake locations of fence lines and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
  - 1. Construction layout and field engineering are specified in Section 01 7000 - Execution and Closeout Requirements.

### 3.3 METAL FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.
- C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1200 mm).
- D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a) Concealed Concrete: Top as indicated on drawings to allow covering with surface material. Slope top surface of concrete to drain water away from post.
  - 3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
  - 4. Space posts uniformly at spacing as indicated.

### 3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. 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.

### 3.5 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:
  - 1. Fences within 100 feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
    - a) Gates and Other Fence Openings: Ground fence on each side of opening.
      - 1) Bond metal gates to gate posts.

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- 2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- G. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence, and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

### 3.6 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- C. Post Settings: Randomly inspect three locations against design for:
  - 1. Hole diameter.
  - 2. Hole depth.
  - 3. Hole spacing.
- D. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
- E. Gates: Inspect for level, plumb, and alignment.
- F. Workmanship: Verify neat installation free of defects.

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- G. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- H. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
- I. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
- J. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

**3.7 ADJUSTING**

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

**3.8 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust and maintain gates.

END OF SECTION 323122



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SECTION 323129 – WOOD FENCES AND GATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SECTION INCLUDES

- A. Vehicular Guiderail.

1.3 RELATED REQUIREMENTS

- A. Section 03 3200 – Site Cast-in-Place Concrete: Concrete anchorage for posts.

1.4 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  - 6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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**1.5 DEFINITIONS**

- A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Timber: Lumber of 5 inches nominal or greater in least dimension.

**1.6 SUBMITTALS**

- A. Product Data: For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
- B. Shop Drawings: For each type of fence and gate assembly.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include accessories, hardware, gate operation, and operational clearances.
- C. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

**1.8 QUALITY ASSURANCE**

- A. Mockups: Build mockups to set quality standards for fabrication and installation.
  - 1. Build mockup for each type of wood fence and gate, including accessories.
    - a) Size: 10-foot (3 m) length of fence or at least two posts, whichever is shorter.

**PART 2 PRODUCTS**

**2.1 VEHICULAR GUIDERAIL**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide "Wood Guard Rail" by Walpole Woodworkers or a comparable product by one of the following:
  - 1. Atlas Companies.
  - 2. Ryther-Purdy Lumber Company, Inc.
- B. Guide Rail requirements as follows:
  - 1. Posts: 8-inches square, Western Red Cedar set at 8 feet on center.
  - 2. Rails: 4-inches by 8-inches Northern White Cedar with dadoed connection to posts.
  - 3. Fasteners: Galvanized carriage bolts and washers.
  - 4. Wood Pin: Ash pins set into counter-bored bolt holes.
  - 5. Finish: None.



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**2.2 LUMBER, GENERAL**

- A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.
  - 1. Factory mark each item with grade stamp of grading agency.
  - 2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
  - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
  - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
  - 1. Boards: 19 percent.
  - 2. Dimension Lumber: 19 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness.
  - 3. Timber. No limit.

**2.3 EXPOSED LUMBER**

- A. Dimension Lumber: Select Structural grade and the following species:
  - 1. Northern white cedar, No. 1 Common; NeLMA or NLGA.
- B. Boards:
  - 1. Northern white cedar, No. 1 Common; NeLMA or NLGA.

**2.4 TIMBER POSTS**

- A. Timber Posts: Northern white cedar, C Select; NeLMA or NLGA.

**2.5 PRESERVATIVE TREATMENT**

- A. Pressure treat boards and dimension lumber with waterborne preservative according to AWPA U1; Use Category UC3b for exterior construction not in contact with the ground and Use Category UC4a for items in contact with the ground.

**2.6 FASTENERS**

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
  - 1. Use fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329 unless otherwise indicated.
- B. Nails: ASTM F1667.
- C. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

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- D. Carbon-Steel Bolts: ASTM A307 (ASTM F568M) with ASTM A563 (ASTM A563M) hex nuts and, where indicated, flat washers all hot-dip zinc coated.
- E. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2 (ASTM F738M, Grade A1 or Grade A4); with ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4) hex nuts and, where indicated, flat washers.

**PART 3 EXECUTION**

**3.1 WOOD GUIDE RAIL INSTALLATION**

- A. Install guide rails at locations, elevations and height as indicated on the drawings.
- B. Set plumb and securely anchor according to manufacturer's instructions and the drawings.

**3.2 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.

END OF SECTION 323129

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SECTION 32 3223 - SEGMENTAL RETAINING WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wet cast concrete segmental block freestanding walls with cap.
- B. Related Sections:
  - 1. Division 02 Section "Geotechnical Report" for geotechnical report.
  - 2. Division 03 Section "Site Cast-in-Place Concrete" for segmental retaining wall footings.
  - 3. Division 04 Section "Cast Stone Masonry (Site Applications)" for cast stone wall caps.
  - 4. Division 31 Section "Earthwork" for excavation for segmental retaining walls.

1.3 PERFORMANCE REQUIREMENTS

- A. Basis of Design: Design of segmental retaining walls is based on products indicated. If comparable products of other manufacturers are proposed, provide engineering design for proposed products, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Delegated Design: Design segmental retaining walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Performance: Engineering design shall be based on the following loads and be according to NCMA's "Design Manual for Segmental Retaining Walls."
  - 1. Gravity loads due to soil pressures resulting from grades indicated.
  - 2. Superimposed loads (surcharge) indicated on Drawings.

1.4 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.

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2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Product Data: For each type of product indicated.
- C. Samples for Initial Selection: For concrete units and each type of product, ingredient, or admixture requiring color and texture selection.
- D. Samples for Verification: For each color and texture of concrete unit required. Submit 12-inch by 24-inch piece of full-size unit.
- E. Delegated-Design Submittal: For segmental retaining walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality-control reports for compliance of materials and construction with design.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For qualified professional engineer.
- B. Product Certificates: For segmental retaining wall units and soil reinforcement, from manufacturer.
1. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.
- C. Source quality-control reports.

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1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects.
  - 1. Build mockup of segmental retaining wall approximately 72 inches (1800 mm) long by not less than 36 inches (900 mm) high above finished grade at front of wall.
    - a. Include typical soil reinforcement.
    - b. Include typical base and cap or finished top construction.
    - c. Include backfill to typical finished grades at both sides of wall.
  - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to segmental retaining walls including, but not limited to, the following:
    - a. Structural load limitations.
    - b. Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.
- B. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F (71 deg C) or below 32 deg F (0 deg C), and other conditions that might damage them. Verify identification of geosynthetics before using and examine them for defects as material is placed.

PART 2 - PRODUCTS

2.1 WET CAST SEAT WALL / RETAINING WALL UNITS

- A. Wet Cast Concrete Wall Units: ASTM C 1372, Normal Weight, except that maximum water absorption shall not exceed 7 percent by weight and units shall not differ in height more than plus or minus 1/16 inch (1.6 mm) from specified dimension.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide double-sided free standing "Kodah" by Rosetta by DKI (845) 255-1044 or comparable product by the following:
    - a. "Freestanding Block Wall" with Cobblestone texture by Redi-Rock.
    - b. "Brandon" double-sided wall by Techo-Bloc.
  - 2. Provide units that comply with requirements for freeze-thaw durability.

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3. Batter: Provide units that stack without batter as indicated on the Drawings.
4. Cap Units: Dimensional Coping by Rosetta.
5. Color: Bluestone as approved by Landscape Architect.
6. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces matching face as indicated.

## 2.2 INSTALLATION MATERIALS

- A. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.
- B. Leveling Base: Comply with requirements in Division 31 Section "Earth Moving" for base material.
  1. Leveling Course: Lean concrete with a compressive strength of not more than 500 psi (3.4 MPa).
- C. Drainage Fill: Comply with requirements in Division 33 Section "Subdrainage."
- D. Reinforced-Soil Fill: ASTM D 2487; GW, GP, SW, SP, and SM soil classification groups or a combination of these groups; free of debris, waste, frozen materials, vegetation, and other deleterious matter; meeting the following gradation according to ASTM C 136: 20 to 100 percent passing No. 4 (4.75-mm) sieve, 0 to 60 percent passing No. 40 (0.425-mm) sieve, 0 to 35 percent passing No. 200 (0.075-mm) sieve, and with fine fraction having a plasticity index of less than 20.
- E. Nonreinforced-Soil Fill: Comply with requirements in Division 31 Section "Earth Moving" for satisfactory soils.
- F. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation, greater than 50 percent.
  1. Apparent Opening Size: No. 70 to 100 (0.212- to 0.150-mm) sieve, maximum; ASTM D 4751.
  2. Minimum Grab Tensile Strength: 110 lb (49.9 kg); ASTM D 4632.
  3. Minimum Weight: 4 oz./sq. yd. (132 g/sq. m).
- G. Subdrainage Pipe and Filter Fabric: Comply with requirements in Division 33 Section "Subdrainage."
- H. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as follows:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Colbond Inc.
    - b. Huesker, Inc.
    - c. Luckenhaus Technical Textiles, Inc.
    - d. Mirafi Construction Products; Ten Cate Nicolon.
    - e. Propex Fabrics Inc.; Civil Engineering Fabrics.
    - f. Strata Systems, Inc.
    - g. Synteen Technical Fabrics, Inc.

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- h. Tenax Corporation; Subsidiary of Tenax Group.
- i. Tensar Earth Technologies, Inc.
- j. Versa-Lok Retaining Wall Systems; a division of Kiltie Corporation.
- k. Webtec, Inc.

**2.3 SOURCE QUALITY CONTROL**

- A. Direct manufacturer to test and inspect each roll of soil reinforcement at the factory for minimum average roll values for geosynthetic index property tests, including the following:
  - 1. Weight.
  - 2. Roll size.
  - 3. Grab or single-rib strength.
  - 4. Aperture opening.
  - 5. Rib or yarn size.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of segmental retaining walls.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 RETAINING WALL INSTALLATION**

- A. General: Place units according to NCMA's "Segmental Retaining Wall Installation Guide" and segmental retaining wall unit manufacturer's written instructions.
  - 1. Lay units in bond pattern indicated.
  - 2. Form corners and ends by using special units.
- B. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D 698.
  - 1. Leveling Course: At Contractor's option, unreinforced lean concrete may be substituted for upper 1 to 2 inches (25 to 50 mm) of base. Place unreinforced lean concrete over leveling base 1 to 2 inches (25 to 50 mm) thick. Compact and screed concrete to a smooth, level surface.
- C. First Course: Place first course of segmental retaining wall units for full length of wall. Place units in firm contact with each other, properly aligned and level.
- D. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.
  - 1. For units with lugs designed to fit into holes in adjacent units, lay units so lugs are accurately aligned with holes, and bedding surfaces are firmly seated on beds of units below.

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2. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
3. For units with lips at bottom rear of units, slide units as far forward as possible for firm contact of lips with units below.
4. For units with pins, install pins and align units.
5. For units with clips, install clips and align units.

E. Cap Units: Place cap units and secure with cap adhesive.

### 3.3 FILL PLACEMENT

- A. General: Comply with requirements in Division 31 Section "Earth Moving," NCMA's "Segmental Retaining Wall Installation Guide," and segmental retaining wall unit manufacturer's written instructions.
- B. Fill voids between and within units with drainage fill. Place fill as each course of units is laid.
- C. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall and place and spread fills toward embankment.
  1. Compact reinforced-soil fill to not less than 95 percent maximum dry unit weight according to ASTM D 698.
    - a. In areas where only hand-operated compaction equipment is allowed, compact fills to not less than 90 percent maximum dry unit weight according to ASTM D 698.
    - b. In areas where fill height exceeds 15 feet (4.5 m), compact reinforced-soil fill that will be more than 15 feet (4.5 m) below finished grade to not less than 98 percent maximum dry unit weight according to ASTM D 698.
  2. Compact nonreinforced-soil fill to comply with Division 31 Section "Earth Moving."
- D. Place a layer of drainage fill at least 12 inches (300 mm) wide behind wall to within 12 inches (300 mm) of finished grade. Place a layer of drainage geotextile between drainage fill and soil fill.
- E. Wrap subdrainage pipe with filter fabric and place in drainage fill as indicated, sloped not less than 0.5 percent to drain.
- F. Place impervious fill over top edge of drainage fill layer.
- G. Slope grade at top of wall away from wall unless otherwise indicated. Slope grade at base of wall away from wall. Provide uniform slopes that will prevent ponding.
- H. Place soil reinforcement in horizontal joints of retaining wall where indicated and according to soil-reinforcement manufacturer's written instructions. Embed reinforcement a minimum of 8 inches (200 mm) into retaining wall and stretch tight over compacted backfill. Anchor soil reinforcement before placing fill.
  1. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement.
  2. Place geosynthetics with seams, if any, oriented perpendicular to segmental retaining walls.
  3. Do not dump fill material directly from trucks onto geosynthetics.



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4. Place at least 6 inches (150 mm) of fill over reinforcement before compacting with tracked vehicles or 4 inches (100 mm) before compacting with rubber-tired vehicles.
5. Do not turn vehicles on fill until first layer of fill is compacted and second layer is placed over each soil-reinforcement layer.

**3.4 CONSTRUCTION TOLERANCES**

- A. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet (32 mm in 3 m), 3 inches (75 mm) maximum.
- B. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 1-1/4 inches in 10 feet (32 mm in 3 m).
- C. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet (32 mm in 3 m).

**3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Comply with requirements in Division 31 Section "Earth Moving" for field quality control.
  1. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 24 inches (600 mm) of fill depth and each 50 feet (15 m) or less of segmental retaining wall length.

**3.6 ADJUSTING**

- A. Remove and replace segmental retaining wall construction of the following descriptions:
  1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if Architect approves methods and results.
  2. Segmental retaining walls that do not match approved Samples and mockups.
  3. Segmental retaining walls that do not comply with other requirements indicated.
- B. Replace units so segmental retaining wall matches approved Samples and mockups, complies with other requirements, and shows no evidence of replacement.

END OF SECTION 32 3223



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SECTION 323300 – BOLLARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Steel pipe bollard with plastic sleeve.
  - 2. Accessible Parking Signage bollard.
  - 3. Removable bollard.
- B. The Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. The Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. ASTM International (ASTM).
  - 1. ASTM A366—Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
  - 2. ASTM A500—Standard Specification for Cold-Formed Welded and Seamless Carbon Tubing in Rounds and Shapes.
  - 3. ASTM D1640—Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
  - 4. ASTM D5893—Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
- C. State of Connecticut
  - 1. State Building Code, including all Amendments, Supplements, and Errata.
- D. United States Code of Federal Regulations (CFR)
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.

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E. United States General Services Administration, Federal Standards.

1. Federal Standard No. 595—Colors Used in Government Procurement.

#### 1.4 ACTION SUBMITTALS

A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:

1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### 1.5 PERFORMANCE REQUIREMENTS

A. Bollards are to be installed as a single unit with specified dimensions and is secured in the ground.

#### 1.6 SUBMITTALS

- A. Submit Shop Drawings, manufacturer's literature, material certificates or other data indicating compliance with these Specifications.
- B. Submit testing data for concrete as required by Section 03 3200—Site Cast-in-Place Concrete.

#### 1.7 DELIVERY, STORAGE AND HANDLING

A. Supply: Bollard units of all types must be supplied by a single manufacturer having the resources to provide consistent quality in appearance and physical properties.

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- B. Materials shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging.
- C. Store units to avoid damage from moisture, abrasion, and other construction activities.

**PART 2 PRODUCTS**

**2.1 STEEL PIPE BOLLARDS WITH PLASTIC SLEEVE**

- A. Concrete filled steel pipe with plain shaft.
  - 1. Shape: Round.
  - 2. Pipe Diameter: As indicated on Drawings.
  - 3. Height above Grade: As indicated on Drawings.
  - 4. Materials:
    - a. Steel Pipe: ASTM A53/A53M, standard weight.
    - b. Factory Finish: Hot-dipped galvanized.
  - 5. Mounting: In-ground.
  - 6. Accessories: Plastic Cover.
    - a. Material: LDPE plastic injected with UV resistor fade resistant additive.
    - b. Wall Thickness: 1/4 inch.
    - c. Size: 7-inch inside diameter designed to fit over 6-inch diameter pipe.
    - d. Height: Cut to length as required by manufacturer.
    - e. Top: Domed.
    - f. Color: Black.
    - g. Manufacturer: Ideal Shield, 2525 Clark Street, Detroit, MI 48209 (866) 825-8659 or approved equal.

**2.2 ACCESSIBLE PARKING SIGNAGE BOLLARD**

- A. Hollow steel pipe with plain shaft.
- B. Shape: Square.
- C. Width: As indicated on Drawings.
- D. Height Above Grade: As indicated on Drawings.
- E. Cap: Angled steel plate.
- F. Materials:

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- a. Steel Tube: ASTM A513/A513M, standard weight.
- b. Factory Finish: hot-dip galvanized with primed finish 05 0513 - Shop-Applied Coatings for Metal.
- c. Final Finish: Field painted conforming to Section 09 9113 - Exterior Painting.
- d. Color: As indicated on metal finish schedule.
- e. Mounting: In-ground.

**2.3 REMOVABLE BOLLARDS**

A. Basis-of-Design Product: Subject to compliance with requirements, provide Removable Stainless-Steel Bollard as manufactured by Post Guard, 37525 Interchange Drive, Farmington Hills, MI 48335 (866) 737-8900 or comparable product as approved by the Landscape Architect by one of the following:

- a. BRP Enterprises, Inc.
- b. Canterbury International.
- c. Columbia Cascade Company.
- d. Creative Supply LLC
- e. Dero Bike Rack Co.
- f. DuMor Inc.
- g. FairWeather Site Furnishings; Division of Leader Manufacturing, Inc.
- h. Huntco Supply, LLC.
- i. Keystone Ridge Designs, Inc.
- j. L. A. Steelcraft.
- k. Maglin Site Furniture Inc.
- l. Thomas Steele; Division of Trilary, Inc.
- m. Urban Accessories, Inc.
- n. Victor Stanley, Inc.

B. Bollard Construction:

- a. Bollard Material: All components of the bollard are to be Schedule 40 Stainless Steel including bollard pipe, removable top, flange, and locking hole cover.
- b. Top: Removable Flat Cap.

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- c. Diameter: 6 inches diameter.
  - d. Base Mounting: Internally locking removable embedded mounting system.
  - e. Eyelets: None.
  - f. Hinged Hole Cover: To be included.
  - g. Internal Lifting Handle: To be included.
  - C. Stainless Steel Finish: Brushed Satin as indicated on the Metal Finish Schedule on the Drawings.
  - D. Lock: Easily secured with external padlock.
- 2.4 CONCRETE
- A. Concrete shall be as specified in Section 03 3200—Site-Cast-in-Place Concrete.
- 2.5 JOINT FILLER
- A. One-part, cold-applied silicone that cures to a durable, flexible, low modulus silicone rubber joint seal, ASTM D5893.
- PART 3 EXECUTION
- 3.1 INSTALLATION
- A. Install bollards at the locations indicated on the Drawings.
  - B. Install bollards level and true to the specific depths and exposures as indicated on the Drawings.
  - C. Provide temporary bracing as required to maintain desired installation until concrete has cured.
  - D. Protect newly-installed bollards from damage or movement.
- END OF SECTION 323300





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SECTION 323310 – SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

Section Includes:

1. Timber Seat Top.
2. Metal Bench.
3. Mobile Island.
4. Litter and Recycling Receptacles.

B. Related Requirements:

1. Division 03 Section "Site Cast-in-Place Concrete" for installing site furnishings cast in concrete footings.
2. Division 31 Section "Earthwork" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:

1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

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5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Product Data: For each type of product.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Samples for Initial Selection: For units with factory-applied finishes.
- E. Samples for Verification: For each type of exposed finish, not less than 6-inch- (152-mm-) long linear components and 4-inch- (102-mm-) square sheet components.
- F. Product Schedule: For site furnishings. Use same designations indicated on Drawings.
- 1.4 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For site furnishings to include in maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 TIMBER SEAT TOP**

- A. Basis-of-Design Product: Solid hardwood timber seats with mounting brackets as manufactured by Streetlife USA Inc., Philadelphia, PA (215) 247-0148 <https://streetlife.nl/us>. Subject to compliance with requirements, provide either the named product or a comparable product from one of the following:
1. Landscape Forms.
  2. Green Theory.
- B. Products Description:
1. Product Number: SOL-L5-TOP-234.
  2. Dimensions: 92 inches length by 15 inches width by 4 inches height.  
Seat Material: Recycled plastic lumber.  
Seat Material Color: "Lava Grey".
  3. Timber Slats Dimensions: 2.8 inches square (7cm square).
  4. Steel Support: Stainless steel 304 with tamper-proof attachment system.
  5. Attachment: Surface mount to wall top.
  6. Accessories: None.

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**2.2 METAL BENCH**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Model "19-9=80" Bench as manufactured by Dumor, Inc. or approved equivalent product from one of the following:
  - 1. Victor Stanley.
  - 2. Urban Accessories.
- B. Materials:
  - 1. Frame: Cast Aluminum.
  - 2. Seat and Back: 5/8-inch diameter round steel evenly spaced as parallel slats.
- C. Requirements:
  - 1. Style: Backed.
  - 2. Overall Height: 30 inches.
  - 3. Overall Length: 8 feet.
  - 4. Mounting: Surface mounted with concrete anchors.
- D. Steel Finish: Polyester powder-coated.
  - 1. Color: As indicated on Metal Finish Schedule.

**2.3 MOBILE ISLAND**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide "Drifter Mobil Green Isle" as manufactured by Streetlife USA Inc., Philadelphia, PA, (215) 247-0148 or a comparable product, as approved by the Landscape Architect:
- B. Style:
  - 1. Seat Depth: 18.9 inches.
  - 2. Seat Height: 17.4 inches.
  - 3. Upper Level Height: 31.8 inches.
  - 4. Unit Length: 112.6 inches.
  - 5. Seat and Upper Level Surface Shape: Flat.
  - 6. Arms: None.
  - 7. Back: None.
- C. Frame Material: Powder-coated steel.
- D. Seat Material: Recycled plastic lumber.
- E. Color: "Lava Grey".
- F. Mounting: Movable.
- G. Steel Finish: Hot-dip galvanized and powder-coated.
  - 1. Color: As indicated on Metal Finish Schedule.

**2.4 LITTER AND RECYCLING RECEPTACLES**

- A. Basis-of-Design Product: Provide "Poe" litter and recycling receptacles with steel slats and removable lid as manufactured by Landscape Forms Inc., (800) 521-2546 [www.landscapeforms.com](http://www.landscapeforms.com).

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B. Litter Receptacle Requirements:

1. Capacity: 34 gallons.
2. Shape: Round.
3. Diameter: 29 inches.
4. Height: 44 inches.
5. Inserts: Removable polyethylene containers for waste material.
6. Vertical Slats:
  - a. Material: 6005-T5 Aluminum extrusion.
  - b. Finish: Powder-coated.
  - c. Color: As indicated on Metal Finish Schedule.
7. Base:
  - a. Material: Ductile cast iron, ASTM A 536, Grade 65-45-12.
  - b. Finish: Powder-coated.
  - c. Color: As indicated on Metal Finish Schedule.
8. Lids:
  - a. Material: Cast 319, 356 or 413 aluminum.
  - b. Color: As indicated on Metal Finish Schedule.
  - c. Litter Receptacle: Side opening.
  - d. Recycling Receptacle: Round Opening.
  - e. Opening Shape: Rectangular, both sides.
9. Mounting: Surface.
10. Lock: Keyed with 2 brass keys.

2.5 MATERIALS

- A. Steel and Iron: Free of surface blemishes and complying with the following:
1. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
- B. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.
- C. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or non-corrodible materials; commercial quality, tamperproof, vandal and theft resistant, concealed, recessed, and capped or plugged.
1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on-grade substrate; one per leg.
- D. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.
- E. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure

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without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

- F. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.

## 2.6 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- C. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- D. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

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3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled site furnishing surfaces according to manufacturer's written instructions. Protect from damage until acceptance by Owner.

END OF SECTION 323310

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SECTION 32 3313 – SITE BICYCLE RACKS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SECTION INCLUDES

- A. Exterior bicycle racks.

1.3 RELATED REQUIREMENTS

- A. Section 03 3200 – Site Cast-in-Place Concrete: Mounting surface for bicycle racks.

1.4 REFERENCE STANDARDS

- A. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes 2021.

1.5 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- B. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Handle racks with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Exterior Bicycle Racks:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide “Model No. 83-00/S-1 Bike Rack as manufactured by DuMor, Inc., (800) 598-4018 or a comparable product by the following, as approved by the Landscape Architect:
  - 2. Bikeparking.com.
  - 3. Forms+Surfaces.

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**2.2 BICYCLE RACKS**

- A. Exterior Bicycle Racks: Device allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
  - 1. Style: Rounded square loop.
  - 2. Capacity: Two bicycles.
  - 3. Mounting, Ground: Embedment mount.
  - 4. Finish: Black powdercoat.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Examine surfaces to receive bicycle racks.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.
- C. Do not begin installation until unsatisfactory conditions are corrected.

**3.2 PREPARATION**

- A. Ensure surfaces to receive bicycle racks are clean, flat, and level.

**3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install level, plumb, square, and correctly located as indicated on drawings.
- C. In-Ground Anchor Installation:
  - 1. Prepare holes in size according to manufacturer's instructions.
  - 2. Place anchoring bolts through the holes in pipe.
  - 3. Lower rack into holes, ensuring the bottom of lower bends are at least 1-1/2 inch (38 mm) from the ground.
  - 4. Place concrete.
  - 5. Level rack before concrete sets.
  - 6. Support until dry.

**3.4 CLEANING**

- A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

**3.5 PROTECTION**

- A. Protect installed products until completion of project.



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B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION



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SECTION 329113.29 – ATHLETIC FIELD ROOT ZONE MIXING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SECTION INCLUDES

- A. The Contractor shall be responsible for removing any preexisting turf in the athletic field area per the procedure detailed in “Site Clearing-Turf Removal-Subgrade Preparation.”
- B. This work shall consist of preparing a root zone mixture consisting of existing root zone and proposed new sand and performing blending as described in the paragraph below. The root zone mix will be evaluated by using ASTM F2396 test methods. A sand sample shall be submitted to a testing agent for adherence to specifications prior to blending operations. Through the blending process that uses the blecavator machine (reverse tilling) set to varying height controls, the existing organic material and sand can also be blended on-site to a desired depth of 6 inches (152.4 mm) at the construction site.
- C. The contractor shall perform blending operations within the areas delineated on the plans. The contractor shall prepare the soil using the blecavator, which is a heavy duty contra-rotating rotor with blades that dig into the ground throwing soil, debris, and rocks against a sorting screen mounted behind the rotor for separating rocks and debris. The fine soil is deposited over the top and leveled off. The rear packer roll on the blecavator firms up the finished areas ready for seeding. Within the area delineated on plans, the contractor shall be directed by the Engineer or Engineer, to perform blending for 6 inches (152.4 mm) depths of spread sand, in order to achieve a homogeneous blend of soil composition over the entire field within the limits of the full depth renovation areas.
- D. No heavy-duty equipment and vehicular traffic shall be allowed on the prepared areas. Only low ground pressure (LGP) equipment is to be used.

1.3 RELATED REQUIREMENTS

- A. Section 31 1005 - Athletic Field Site Preparation: Turf removal and subgrade preparation.
- B. Section 32 9219 - Seeding: Seeding of athletic fields.

1.4 REFERENCE STANDARDS

- A. ASTM F2396 - Standard Guide for Construction of High-Performance Sand-Based Rootzones for Athletic Fields; 2011.

1.5 SAMPLES/TESTS

- A. The Contractor shall furnish an outline of their approach to the project no less than 10 days prior to the start of construction.

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- B. The Contractor shall furnish a Certified Laboratory Report showing the soils classification and nutrient analysis of representative samples of the sand that is proposed to be used, including the extent of lime and fertilizer required. Samples submitted for approval must be representative of the total volume to be furnished, taken in the presence of the Engineer, and delivered to a certified laboratory by the Contractor; all costs for such shall be borne by the Contractor.
- C. If the material does not conform to the above requirements, it shall be rejected and additional sources shall be found. Sampling and testing shall be accomplished as specified herein until an approved material is found, all at the Contractor's expense.
- D. To assure that materials fulfill specified requirements regarding textural analysis, organic matter content, pH, and fertility, depending on the approach, testing must be undertaken:
  - 1. Prior to blending using materials on site and supplied
  - 2. At time of delivery; on-site
  - 3. After blending
- E. For quality control, immediately following spreading on site, soil may be tested at the Engineer's discretion. Soil sampling shall also indicate if specified material was bleccavated uniformly to the minimum specified depth.

#### 1.6 NOTIFICATION

- A. The Contractor shall notify the Engineer in writing at least 10 days in advance of the time he intends furnishing root zone mix sand or amendments stating the location and amount of such deposit, the name and address of the supplier and also shall furnish such facilities, transportation and assistance as the Engineer may require for collecting and forwarding samples.
- B. Any changes to the means and methods of the athletic field construction, and/or materials, must be approved by the Engineer.
- C. Completion of work is subject to adverse climatic conditions, which could affect the date of substantial completion. Any/all delays must be communicated with the Construction Manager as soon as possible
- D. No work can progress unless testing results are approved by the Engineer.

#### 1.7 QUALITY CONTROL

- A. Root Zone Mix Sand: A one-gallon sample for every 2000 cu yds (1529 cu m) of root zone mix shall be tested by the Engineer's Testing Agent for approval. All costs shall be borne by the Contractor.
- B. Following re-installation of irrigation heads and prior to seeding, contractor shall notify the Engineer and provide the Engineer with compaction tests along the center line of the field as well as along the foul lines to ensure that the root zone mix has not been heavily compacted. Compaction test shall fall within the industry standards for fields and any areas of the field that exceed these standards shall be corrected at the contractor's expense prior to seeding.

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**1.8 QUALITY ASSURANCE**

- A. Contractor Qualifications: A qualified Contractor whose work has resulted in successful athletic field construction and performance turf establishment
- B. Contractor Experience: The Contractor must have completed at least five (5) projects per year of similar scope over the past three (3) consecutive years.
  - 1. General Experience:
    - a) Five (5) years' experience of athletic fields construction, resurfacing and/or renovations similar to scope of project over the last three (3) consecutive years
    - b) Provide reports of above said athletic fields projects as to the type of projects involved in, including but not limited to; start and end dates, adherence to target/ key performance indicators, scope of works completed along with contact persons and contact details for said clients.
    - c) Provide testimonies from previous clients, including but not limited to; quality of work, staff/employee interactions, tidiness of site, timekeeping and punctuality and overall client satisfaction levels.
  - 2. Staff/Employees:
    - a) Provide resumes for all staff/employees who will be responsible for carrying out scope of works, including but not limited to, full time and seasonal/short term employees.
    - b) Resumes will be required for all employees/staff involved in the project.
    - c) Resumes to include:
      - 1) Experience level relevant to the project needs/scope of work.
      - 2) Qualifications level relevant to the project needs/scope of work.
    - d) Must provide evidence that all staff/employees have at least three (3) years' experience of similar scope of work for project over the last three (3) consecutive years
    - e) Provide evidence of continued professional development of all/any employees involved in project for last three (3) consecutive years.
    - f) Shall have a supervisor on the site who is experienced in the construction of sports fields. Supervisor's name and experience shall be submitted to the Engineer for approval.
    - g) Shall have membership of one or more of the following Professional associations for a minimum of the last three (3) consecutive years.
      - 1) New England Sports Turf Managers Association (NESTMA)
      - 2) Sports Turf Managers Association (STMA)
  - 3. Insurance / Certifications:
    - a) Must be in possession of a suitable level of public liability insurance and any other relevant insurances required by the state and/or client.
  - 4. Equipment:
    - a) Must be in possession and provide a detailed list of a suitable level of tools/equipment/machinery and or equivalent required to carry out the scope of work for said project.
    - b) All equipment and or equivalent should be in a condition able to carry out scope of work. Any certificates proving this will be required as part of the submission.
    - c) The proposed equipment must be approved by the Engineer prior to commencing work on the Athletic Fields.
  - 5. Additional:
    - a) Provide a project plan identifying all key indicator/target points, which clearly shows an integrated approach to quality control and quality assurance.

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- b) Provide a detailed methodology of how the required works will be carried out., this should be inclusive and synced to the project plan.
- c) Is required to submit samples, test results and/or certification of all material prior to delivery to the site. All materials are to be approved by the Engineer prior to their use. These certifications shall comply with specifications and scope of project and where applicable, with any standards that may be implied.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways, and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
  - 4. Fertilizers, lime, and soil amendments must be stored in a secure, locked area, and must be protected from the elements.

#### 1.10 SITEWORK CONSTRUCTION EQUIPMENT BY USE

- A. Excavation, Earth Moving, and Grading:
  - 1. Utilize Model 550 J Crawler Dozer as manufactured by John Deere equipment or equivalent, which meets the following specifications:
    - a) Laser T Guided Capability
    - b) Tier 3/Stage 3A emissions certified engine
    - c) Net power – 85 hp. at 2200 rpm
    - d) Maximum speed (forward and reverse) 5 mph
    - e) Track gauge – 5 ft.
    - f) Length of track on ground – 7 ft. 2 in.
    - g) Ground contact area – 4128 sq. in.
    - h) Maximum ground pressure – 5.8 psi
    - i) Number of track rollers – 6
    - j) Track pitch – 6.29 in.
    - k) Track shoes, each side – 40
    - l) Standard shoe type – single grouser
    - m) Blade width – 9 ft. 7 in.
    - n) Blade height – 3 ft. 2 in.
    - o) SAE blade capacity – 2/57 cu. yd.
    - p) Lade lift height – 2 ft. 7 in.
    - q) Digging depth – 20.6 in.
    - r) Blade tilt – 1 ft. 3 in.
    - s) Ground clearance – 14 in.
    - t) SAE operating weight – 18,252 lbs.
  - 2. Utilize Model Z Axis 50 U Series Mini Excavator as manufactured by Hitachi or equivalent, which meets the following specifications:

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- a) Net power – 40 hp. at 2,500 rpm
  - b) Weight – 10,758 lbs.
  - c) Speed – 1.7 to 2.8 mph
  - d) Track – rubberized 15 in.
  - e) Maximum ground pressure – 4.49 psi
  - f) Ground clearance – 13 in.
  - g) Front grading blade width – 78 in.
  - h) Grade ability – 30"
  - i) Maximum digging reach – 236 in.
  - j) Maximum digging depth – 141 in.
  - k) Maximum cutting height – 222 in.
  - l) Maximum vertical wall – 111 in.
- B. Stripping of Existing Grass Surface:
- 1. Utilize Model FTM 2000 Koro Field Top Maker as Manufactured by Pols International, Stationsweg 36, 3214 VK Zuidland, Netherlands or equivalent that meets the following specifications:
    - a) Working width – 78 in.
    - b) Working depth – 1.75 in.
    - c) Weight – 2448 lbs.
    - d) Horsepower requirements – 70 hp.
    - e) Number of cutting blades – 64
    - f) Side conveyor extension
  - 2. Utilize Model 6425 Turf Tractor as manufactured by John Deere Equipment or equivalent, which meets the following specifications:
    - a) Engine power – 125 hp.
    - b) PTO power – 114 hp.
    - c) Wheelbase – 94.5 in.
    - d) Weight – 10,064 lbs.
    - e) Rear lift – 5,100 lbs.
    - f) Front tire – 10.00 – 16 low ground pressure high floatation turf tire
    - g) Rear tire – 16.9 – 30 low ground pressure high floatation turf tire
- C. Hauling of Stripped Material off Field:
- 1. Utilize Dircub Hydraulic Dump-box as manufactured by TYCROP Manufacturing or equivalent that meets the following specifications:
    - a) Bed size – 60 13/16" x 70 1/8' L
    - b) Unit Size – 68 1/8" W x 45 9/16" H
    - c) Weight – 956 lbs.
    - d) Payload: 3000 lbs.
    - e) Suspension – Low ground pressure (maximum 5 psi) 4 wheel4-wheel walking beam evenly distributing
  - 2. Utilize Model 4720 Turf Tractor as Manufactured by John Deere Equipment or equivalent that meets the following requirements:
    - a) Engine power – 58 hp.
    - b) PTO power – 56 hp.
    - c) Wheelbase – 71.5 in.
    - d) Weight – 3,860 lbs.
    - e) Rear lift – 2,500 lbs.
    - f) Front tire – 8.00 – 16 low ground pressure high floatation turf tire
    - g) Rear tire – 13.6 – 28 low ground pressure high floatation turf tire

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- D. Loading, Backfilling, Power Raking Specifications:
1. Utilize Model 287 Compact Track and Multi Terrain Loader as manufactured by Caterpillar Inc, or equivalent that meets the following specifications:
    - a) Net Power – 82 HP
    - b) Operating Weight – 10,275 lb.
    - c) Maximum speed (forward and reverse) – 7 mph
    - d) Length of Track on Ground – 73 in.
    - e) Ground contact area – 2,610 sq. in.
    - f) Maximum ground pressure – 3.8 psi
    - g) Ground clearance – 11 in.
    - h) Vehicle width – 77 in.
    - i) Clearance at maximum lift/dump – 94 in.
    - j) Quick connect accessory and implement capability
  2. Utilize Model MX7H Hydraulic Power Angle Mounted Grading and Blending Implement as manufactured by Harley Rake or equivalent and meets the following specifications:
    - a) Front attachment plate for track and multi terrain loader
    - b) Working width to cover multi terrain loader trucks
    - c) Aggressor pointed carbide teeth
    - d) Dual independently adjustable gauge wheels
    - e) Weight – 1050 lb.
    - f) Length – 64 in.
    - g) Width (overall) – 93 in.
    - h) Raking width – 84 in.
    - i) Raking width (full range) – 79 in.
    - j) Angle roll - 20°
    - k) Removable/reversible end plates
  3. Utilize Model TD – 460 low ground pressure large area top dresser as manufactured by Tyco Manufacturing or equivalent, which meets the following specifications:
    - a) Weight – 3,400 lbs.
    - b) Length – 167 in.
    - c) Height – 63 in.
    - d) Width – 89 in.
    - e) Hopper load capacity – 75 cu. ft.
    - f) Capability to spread wet or dry materials including soil mixes, sand, stone, gravel, Inorganic material, composted products, and wood chips.
    - g) Capability to perform as multifunctional trailer for material handling and relocation tasks with an unloading time of 30 seconds
    - h) Low ground pressure four-wheel walking beam suspension
    - i) Unlockable metering gate to float freely during bulk unloading operations
    - j) Removable metering gate for hauling construction and landscape materials
    - k) Independent control valves for adjusting the speed of floor conveyor belt and the finishing brush
    - l) 72" wide spread and distribution of material
  4. Utilize Model BV150 Ground preparation machine as manufactured by BLEC USA or equivalent which meets the following specifications:
    - a) Working width – 60 in.
    - b) Working depth – 9 in.
    - c) Gear box – single speed 540 RPM
    - d) No. of blades – 36
    - e) Overload safety – friction multi-plate clutch



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- f) Maximum working output/hr. 5300 sq. yd.
  - g) Maximum 1.5 mph working speed – 2.0 mph
  - h) 3 point3-point hitch – cat 2
  - i) Weight – 2,300 lbs.
  - j) Length – 71 in.
  - k) Height – 44 in.
  - l) Width – 82 in.
5. Utilize Model 5425 Turf Tractor as manufactured by John Deere Equipment or equivalent which meets the following specifications:
- a) Engine power – 81 hp.
  - b) PTO power – 65 hp.
  - c) Wheelbase – 85.7 in.
  - d) Weight – 7,385 lbs.
  - e) Rear lift – 3,374 lbs.
  - f) Front tire – 7.50 – 16 low ground pressure high floatation turf tire
  - g) Rear tire – 16.9 – 30 low ground pressure high floatation turf tire
- E. Finish Grading:
1. Utilize Model 106 P Compact Motorized Cross Slope Dual Laser Grader as manufactured by Laser-Grader Manufacturing or equivalent that meets the following specifications:
- a) Weight – 3,200 lbs.
  - b) Length – 11 ft. 6 in.
  - c) Height – 7 ft. 2 in.
  - d) Width (excluding blades) – 4 ft.
  - e) Front pusher blade width – 5 ft.
  - f) Mold board width – 6 ft.
  - g) Mold board height – 12 in.
  - h) Variable speed: 0 – 10 mph
  - i) Outside turning radius – 9 ft.
  - j) Inside turning radius – 5 ft.
  - k) Mold board functions –
  - l) Left and right manual raise and lower
  - m) Side shift and blade rotation
  - n) Grading tolerance - +/- 1/8 in. accuracy equipped with Trimble GCS 600 Grande Control System with two LR410 laser receivers monitored by dual LED grade displays as programmed through a CB420 control box providing the ability to calculate angle, slope, and cross slope
  - o) Trimble control package plumbed into hydraulics for “automatic” laser control
  - p) 6 wheel6-wheel drive via hydraulic wheel motors
  - q) Power steering
  - r) ROPS certified roll bar
- F. Seedbed Preparation:
1. Utilize Model 13-550 Super Rake as manufactured by Smithco or equivalent that meets the following specifications:
- a) Power – 16 hp.
  - b) Weight – 990 lbs.
  - c) Configuration – 3-wheel tricycle rear engine placement
  - d) Drive – direct drive hydrostatic
  - e) Speed – 0 – 9 mph
  - f) Tires – 10.50 x 12 turf tires

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- g) Length – 85 in.
- h) Width – 74 in.
- i) Height – 44 in.
- j) Wheelbase – 47 in.
- k) Equipped with center mounted sand cultivator
- l) Equipped with rear mounted sand rake assembly
- m) Equipped with rear mounted 6 ft. wide steel mesh drag mat

**G. Seeding:**

- 1. Utilize Model 1575 Over-seeder as manufactured by Redexim North America or equivalent that meets the following specifications:
  - a) Weight – 2,293 lbs.
  - b) Working width – 62.2 in.
  - c) Working depth: 0.19 in. – 0.78 in.
  - d) Seeding speed – 7.5 mph
  - e) Seeding row spacing – 2.9 in.
  - f) Disk quantity – 21
  - g) Seed tray capacity – 7.9 cu. ft.
  - h) Seeding density per 1,000 sq. ft.: 0.44 lbs. – 8.82 lbs.
  - i) Water fillable back roller with scraper
  - j) Individual seed planting
  - k) Twin discs to contour with ground undulations
  - l) Integrated seed spreading tray

**PART 2 PRODUCTS**

**2.1 SAND**

**A. Sand for Root Zone Mix: Conform to ASTM F2396.**

- 1. The following definitions shall apply to the work of this section.
- 2. The following size distributions of mineral particles by diameter and sieve size shall apply to the following conventional names of soil types:

CONVENTIONAL NAME	RETAINED ON U.S. SIEVE NO. (MM)	DIAMETER
VERY COARSE SAND	#18	1 TO 2
COARSE SAND	#35	0.5 TO 1
MEDIUM SAND	#60	0.25 TO 0.5
FINE SAND	#140	0.10 TO 0.25
VERY FINE SAND	#270	0.05 TO 0.10
SILT	BY HYDROMETER	0.002 TO 0.05
CLAY	BY HYDROMETER	LESS THAN 0.002

**2.2 ROOT ZONE MIX**

- A. Mixing Materials:** Mixing of the sand and existing soil mixture for the root zone, must be carried out by a mixing/blending unit conversant with industry standards. This blending unit must be calibrated to achieve the mix ration identified in this specification.

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1. As an alternative if a mix/blending unit is not available or space on site does not permit its use then the mixing/blending must be blended by an experienced operator, using suitable equipment.
- B. Physical performance Evaluation of the root zone mix will be in accordance with the guidelines set forth in ASTM F2396.

### 2.3 IMPORTED ROOT ZONE MATERIAL

- A. Imported Root Zone Material shall conform to the following:
  1. Organic Matter Content: Minimum of 3 to 5 percent.
  2. Infiltration rate shall be greater than 4 inches per hour.
  3. Soil shall not be compactable to more than 200 psi.
  4. The soils textural shall meet the following gradation:
  - 5.

Description	Size (mm)	Percent
Sand	0.05 to 2.0	96 +/- 1.0
Silt	0.002 to 0.05	2 +/- 0.5
Clay	<0.002	1 +/- 0.5
Combined silt and clay (#140 and #270) shall not exceed 10 percent. No stone greater than 1/4-inch (6 mm).		

- a. This material should be applied and blended with the existing material onsite to create a homogenous blend. This blended material would then be spread across the entire footprint of the softball/soccer field and then graded in line with the Site Grading Drawings.

## PART 3 EXECUTION

### 3.1 ROOT ZONE MIX RATIOS

- A. Upon approval of the sand component, the Contractor shall blend the components in the ratio of new sand and existing root zone to create the root zone mix required as determined by testing laboratory. This ratio of sand and organic material will be based on laboratory testing and performance guidelines established by these specifications.
- B. The root zone mix provided by the testing laboratory will establish the required mix ratio and specifications for approval or rejection by the Engineer of all quality control submittals during construction.
  1. Performance Testing: ASTM testing procedures for sand based athletic fields shall be used for performance testing.

### 3.2 PLACEMENT

- A. Root zone Mix Established by the Blending method:
  1. The existing material should be installed over the graded subbase to the correct depth using identified equipment and then "rough" graded utilizing a dual-plane laser grader.
  2. The required amount of sand should then be applied to the existing material at the correct depth and then "rough" graded utilizing a dual-plane laser grader.

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3. All sport turf areas are to be reverse tilled to a depth of 6 inches (152.4 mm) depth with a reverse till (blecavator), conventional tilling is unacceptable. Fine grading shall be accomplished with a fully automated dual-plane LGP laser grader.
4. Under no circumstances will loaded rubber-tired vehicles in excess of 1 ton be allowed on the gravel base or root zone mix prior to, during or after the spreading of the root zone mix.
5. Finish grades shall be verified by the Contractor using laser operation survey instruments with a tolerance of +/- 1/4-inch (6 mm).
6. The Contractor shall reverse till (blecavate) Root Zone Mix to the depths shown on the contract drawings, which depth shall be the minimum required depth after settlement. No compaction shall be required beyond that extent necessary to place sod.
7. Root Zone Mix shall be graded to total depth of 7 inches (178 mm), but not less than required to meet finish grades after mixing with amendments and natural settlement in such a manner as to establish a loose, friable seedbed.
8. Reinstall any removed irrigation components, visually inspect the system, stake the risers in an upright position prior to seeding.

**3.3 ADDITIVES**

- A. The Contractor shall apply Renovate Plus, Myco-Replenish and all necessary fertilizer and lime to the soil in accordance with the manufacturer and laboratory's recommendations and as required by the sodding specifications referenced elsewhere.

END OF SECTION 329113.29

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SECTION 329119.13 - TOPSOIL PLACEMENT AND GRADING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SECTION INCLUDES

- A. Testing of topsoil for use in creating amended topsoil and as an ingredient in planting soils of other sections.
- B. Placing and finished grading of amended topsoil.

1.3 RELATED REQUIREMENTS

- A. Section 31 1100 – Clearing and Grubbing: Clearing and protection of vegetation.
- B. Section 32 9300 - Plants: Placing planting soil for plantings.

1.4 UNIT PRICES

- A. Work of this Section is affected by unit prices specified in Section 01 2200 - Unit Prices.

1.5 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Amended Topsoil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- C. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- D. CEC: Cation exchange capacity.
- E. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- F. Duff Layer: A surface layer of soil, typical of forested areas, which is composed of mostly decayed leaves, twigs, and detritus.
- G. Imported Soil: Soil that is transported to Project site for use.
- H. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

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- I. **Manufactured Soil:** Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- J. **NAPT:** North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- K. **Organic Matter:** The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- L. **Planting Soil:** Amended topsoil that has been modified as specified with soil amendments and fertilizers to produce a soil mixture for use in planting beds.
- M. **RCRA Metals:** Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- N. **SSSA:** Soil Science Society of America.
- O. **Subgrade:** Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- P. **Subsoil:** Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- Q. **Surface Soil:** Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- R. **USCC:** U.S. Composting Council.

#### 1.6 PREINSTALLATION MEETINGS

- A. **Preinstallation Conference:** Conduct conference at project site.

#### 1.7 SUBMITTALS

- A. **Product Data:** For each type of product.
  - 1. Include recommendations for application and use.
  - 2. Include test data substantiating that products comply with requirements.
  - 3. Include sieve analyses for aggregate materials.
  - 4. **Material Certificates:** For each type of imported soil before delivery to the site, according to the following:
    - a) Manufacturer's qualified testing agency's certified analysis of standard products.
    - b) Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    - c) Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.
- B. **Samples:** For each bulk-supplied material, 1 quart (1 liter) volume of each in sealed containers labeled with content, source, and date obtained. Each sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

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- C. Qualification Data: For each testing agency.
- D. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" article.
- E. Field quality-control reports.

#### 1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
  - 1. Laboratories: Subject to compliance with requirements, provide testing by one of the following:
    - a) UConn Soil Nutrient Analysis Laboratory, 6 Sherman Place U-5102, University of Connecticut, Storrs, CT 06269-5102 (860) 486-4274 email: soiltest@uconn.edu.

#### 1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.
  - 1. Notify Architect seven days in advance of the dates and times when laboratory samples will be taken.
- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
  - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

#### 1.10 SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by Owner or Contractor in presence of Architect under the direction of the testing agency.
  - 1. Number and Location of Samples: Minimum of three representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
  - 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Soils".
  - 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
  - 4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

#### 1.11 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:

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1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
    - a) Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
    - b) Hydrometer Method: Report percentages of sand, silt, and clay.
  2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
  3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
  4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D698 (Standard Proctor).
- C. Chemical Testing:
1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
  2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
- D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13, including the following:
1. Percentage of organic matter.
  2. CEC, calcium percent of CEC, and magnesium percent of CEC.
  3. Soil reaction (acidity/alkalinity pH value).
  4. Buffered acidity or alkalinity.
  5. Nitrogen ppm.
  6. Phosphorous ppm.
  7. Potassium ppm.
  8. Manganese ppm.
  9. Manganese-availability ppm.
  10. Zinc ppm.
  11. Zinc availability ppm.
  12. Copper ppm.
  13. Sodium ppm [and sodium absorption ratio].
  14. Soluble-salts ppm.
  15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
  16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory amended topsoil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.



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1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. (100 sq. m) for 6-inch (150-mm) depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. (100 sq. m) for 6-inch (150-mm) depth of soil.

**1.12 DELIVERY, STORAGE, AND HANDLING**

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
  1. Do not dump or store bulk materials near structures, utilities, walkways, and pavements, or on existing turf areas or plants.
  2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  3. Do not move or handle materials when they are wet or frozen.
  4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

**PART 2 PRODUCTS**

**2.1 TOPSOILS SPECIFIED BY COMPOSITION**

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
- B. The Soil shall not contain refuse, roots larger than ¼-inch diameter, heavy, sticky, or stiff clay, stones larger than ½-inches in diameter, noxious seeds, sticks, brush, litter, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, or any substances deleterious to plant growth. The percentage of the above objects shall be controlled by source selection not by screening the soil. The Soil shall be suitable for the germination of seeds and the support of vegetative growth in line with the requirements of the project. The Soil shall not contain weed seeds in quantities that cause noticeable weed infestations in the final planting beds.
- C. Amended Topsoil: Required Properties of topsoil after amendments have been added:
  1. Friable and with sufficient structure to give good tilth and aeration.
  2. Soil reaction of pH: 6 to 7.
  3. Organic Matter Content: Minimum of 6 percent following addition of compost.
  4. No stones greater than 0.5 inches (13 mm).
  5. Infiltration Rate: Greater than 4 inches per hour.
  6. Combined silt and clay shall not exceed 40 percent.
  7. Soluble salts shall be no more than 2 mmho/cm.
  8. Soil shall not be compactable to more than 200 psi.
  9. Soils shall conform to the following gradations:

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Percentage of Main Fraction		
<u>Description</u>	<u>Size (mm)</u>	<u>Percent</u>
Sand	0.05 to 2.0	59 to 70
Silt	0.002 to 0.05	15 to 25
Clay	Less than 0.002	5 to 15
Percentage of Sand Fraction		
<u>Description</u>	<u>Size (mm)</u>	<u>Percent</u>
Very Coarse	1.0 to 2.0	12 to 14
Coarse	0.5 to 1.0	18 to 21
Medium	0.25 to 0.5	18 to 21
Fine	0.10 to 0.25	8 to 9
Very Fine	0.05 to 0.10	3 to 4

- D. On-Site Topsoil: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable amended topsoil.
1. Blend existing, on-site surface soil with soil amendments and fertilizers according to the soil analysis to produce amended topsoil:
    - a) Inorganic soil amendments as recommended by testing laboratory.
    - b) Organic soil amendments as recommended by testing laboratory.
    - c) Fertilizer as recommended by testing laboratory.
- E. Imported Topsoil: Imported, naturally formed soil from off-site sources and consisting of sandy loam soil according to USDA textures; and modified to produce viable amended topsoil.
1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and brome grass.
  2. Blend imported topsoil with soil amendments and fertilizers according to the soil analysis to produce amended topsoil:
    - a) Inorganic soil amendments as recommended by testing laboratory.
    - b) Organic soil amendments as recommended by testing laboratory.
    - c) Fertilizer as recommended by testing laboratory.

## 2.2 INORGANIC SOIL AMENDMENTS

- A. The following inorganic soil amendments shall be added to topsoil when recommended by soil analysis and as indicated on drawings to produce amended topsoil.
- B. Lime: ASTM C602, 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 a No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through a No. 60 (0.25-mm) sieve.
  2. Class: O, with a minimum of 95 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through a No. 60 (0.25-mm) sieve.
  3. Form: Provide lime in form of ground dolomitic limestone.

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- C. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through a No. 40 (0.425-mm) sieve.
- D. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural or Recycled Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 (0.30-mm) sieve.
- G. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33/C33M.

### 2.3 ORGANIC SOIL AMENDMENTS

- A. The following organic soil amendments shall be added to topsoil when recommended by soil analysis and as indicated on drawings to produce amended topsoil.
- B. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
- C. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch (13-mm) sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.
- D. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch (13-mm) sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

### 2.4 FERTILIZERS

- A. The following fertilizers shall be added to topsoil when recommended by soil analysis and as indicated on drawings to produce amended topsoil.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  - 1. Composition: 1 lb./1000 sq. ft. (0.5 kg/100 sq. m 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 testing agency.

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- 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 testing agency.
- E. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

### **PART 3 EXECUTION**

#### **3.1 GENERAL**

- A. Place amended topsoil and fertilizers according to requirements in other specification sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING**

- A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches (150 mm) and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- D. Screening: Pass unamended soil through a 2-inch (50-mm) sieve to remove large materials.

#### **3.3 PLACING AND MIXING UNAMENDED TOPSOIL OVER EXPOSED SUBGRADE**

- A. General: Apply and mix unamended soil with amendments on-site to produce required amended topsoil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended topsoil over prepared, loosened subgrade according to "Mixing" paragraph below. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.

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- C. Mixing: Spread unamended topsoil to total depth of 6 inches (150 mm), but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if topsoil or subgrade is frozen, muddy, or excessively wet.
  - 1. Amendments: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended topsoil to produce amended topsoil.
    - a) Mix lime with dry soil before mixing fertilizer.
    - b) Mix fertilizer with planting soil no more than seven days before planting.
  - 2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches (200 mm) in loose depth for material compacted by compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each blended lift of amended topsoil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698 and tested in-place except where a different compaction value is indicated on Drawings.
- E. Finish Grading: Grade amended topsoil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

#### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
  - 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698. Space tests at no less than one for each 1000 sq. ft. (100 sq. m) of in-place soil or part thereof.
- C. Soil will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

#### 3.5 PROTECTION

- A. Protection Zone: Identify protection zones according to Section 01 5639 - Temporary Tree and Plant Protection
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Vehicle traffic.
  - 4. Foot traffic.
  - 5. Erection of sheds or structures.
  - 6. Impoundment of water.
  - 7. Excavation or other digging unless otherwise indicated.

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- C. If amended topsoil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

**3.6 CLEANING**

- A. Protect areas adjacent to amended topsoil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
  - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329119.13

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SECTION 32 9219.11 – ATHLETIC FIELD SEEDING AND SODDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section Includes:
1. Seeding.
  2. Sodding of infield areas of baseball and softball fields.
  3. Hydroseeding.
  4. Erosion-control material(s).
- B. Related Sections:
1. Division 31 Section "Athletic Field Site Preparation" for turf removal and disposal.
  2. Division 31 Section "Earthwork" for excavation, filling and backfilling, and rough grading.
  3. Division 31 Section “Sediment and Erosion Controls” for erosion control measures.
  4. Division 32 Section “Athletic Field Root Zone Mixing” for root zone mix.

1.3 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Engineered Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: 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.

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- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

**1.4 PREINSTALLATION MEETINGS**

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

**1.5 INFORMATIONAL SUBMITTALS**

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
  - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.
  - 3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  - 4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  - 6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Qualification Data: For Athletic Field Contractor.
- C. 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



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percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

- A. Certification of the Sod: From sod vendor/farm/supplier for each grass seed mixture used in the production of the sod it should state the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include year and month of sowing and date of harvesting.
- B. Product Certificates: For soil fertilizers, from manufacturer.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Any changes to the means and methods of the athletic field construction, and/or materials, must be approved by the Landscape Architect.
- E. Completion of work is subject to adverse climatic conditions which could affect the date of substantial completion. Any/all delays must be communicated with the Construction Manager as soon as possible
- F. No work can progress unless testing results are approved by the Landscape Architect.

**1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of athletic field turf during a calendar year. Submit before expiration of required maintenance periods.

**1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified Athletic Field Contractor whose work has resulted in successful turf establishment as follows:

**1. General Experience:**

- a. Five (5) years' experience of athletic fields construction, resurfacing and/or renovations similar to scope of project over the last 3 consecutive years
- b. Provide reports of above said athletic fields projects as to the type of projects involved in, including but not limited to; start and end dates, adherence to target/ key performance indicators, scope of works completed along with contact persons and contact details for said clients.
- c. Provide testimonies from previous clients, including but not limited to; quality of work, staff/employee interactions, tidiness of site, timekeeping and punctuality and overall client satisfaction levels.

**2. Staff/Employees:**

- a. Provide resumes for all staff/employees who will be responsible for carrying out scope of works, including but not limited to, full time and seasonal/short term employees.
- b. Resumes will be required for all employees/staff involved in the project.

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- c. Resumes to include:
  - 1) Experience level relevant to the project needs/scope of work.
  - 2) Qualifications level relevant to the project needs/scope of work.
- d. Must provide evidence that all staff/employees have at least 3 years experience of similar scope of work for project over the last 3 consecutive years
- e. Provide evidence of continued professional development of all/any employees involved in project for last 3 consecutive years.
- f. Shall have a supervisor on the site who is experienced in the construction of sports fields. Supervisor's name and experience shall be submitted to the Landscape Architect for approval.
- g. Shall have membership of one or more of the following Professional associations for a minimum of the last 3 consecutive years:
  - 1) New England Sports Turf Managers Association (NESTMA).
  - 2) Sports Turf Managers Association (STMA).
- 3. Insurances / Certifications:
  - a. Must be in possession of a suitable level of public liability insurance and any other relevant insurances required by the state and/or client.
- 4. Equipment:
  - a. Must be in possession and provide a detailed list of a suitable level of tools/equipment/machinery and or equivalent required to carry out the scope of work for said project.
  - b. All equipment and or equivalent should be in a condition able to carry out scope of work. Any certificates proving this will be required as part of the submission.
  - c. All proposed equipment to be used for seeding shall be approved by the Landscape Architect prior to commencing work.
- 5. Additional:
  - a. Provide a project plan identifying all key indicator/target points, which clearly shows an integrated approach to quality control and quality assurance.
  - b. Provide a detailed methodology of how the required works will be carried out., this should be inclusive and synced to the project plan.
  - c. Contractor is required to submit samples, test results and/or certification of all material prior to delivery to the site. All materials are to be approved by the Landscape Architect prior to their use. These certifications shall comply with specifications and scope of project and where applicable, with any standards that may be implied.
- 6. Pesticide Applicator: State licensed, commercial.

**1.8 DELIVERY, STORAGE, AND HANDLING**

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

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- B. Sod should not be delivered to site until required for installation/laying
- C. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
  - 4. Fertilizers, lime, and soil amendments must be stored in a secure, locked area, and must be protected from the elements.

#### 1.9 FIELD CONDITIONS

- A. Seeding Restrictions: Seed during one of the following periods, if climatic and ground conditions are favorable. Coordinate seeding periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
  - 1. Spring Seeding: April 15<sup>th</sup> to June 15<sup>th</sup>.
  - 2. Fall Seeding: August 15<sup>th</sup> to September 15<sup>th</sup>.
- B. Sodding Restrictions: Sod during one of the following periods, if climatic and ground conditions are favorable. Coordinate sodding periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
  - 1. Spring Sodding: April 1<sup>st</sup> to May 15<sup>st</sup>
  - 2. Fall Sodding: September 1<sup>st</sup> to October 15<sup>st</sup>
- C. Weather Limitations: Proceed with seeding and sodding only when existing and forecasted weather conditions permit seeding and sodding to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 SEED

- A. Grass Seed: Must be certified through National Turf Grass Evaluation Program.
- B. Seed Mixtures: Seed of grass species as follows, with not less than 98 percent germination, not less than 98 percent pure seed, and not more than 0.2 percent weed seed:
  - 1. Seed Mix #1: Tall Fescue, Kentucky Blue and Ryegrass mix comprised of the following cultivars or equivalents:
    - a. 25% Amity Tall Fescue.
    - b. 25% ZigZag Tall Fescue.
    - c. 20% Mazama Kentucky Bluegrass.

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- d. 20% Metolius Perennial Ryegrass.
    - e. 10% Double Time Tetraploid Perennial Ryegrass.
  - 2. See Mix #2: Perennial Ryegrass mix comprising of the following cultivars or equivalents:
    - a. 40% Metolius Perennial Ryegrass
    - b. 40% Palmer 3 Perennial Ryegrass
    - c. 20% Double time Tetraploid Ryegrass
  - C. Evenly apply 250 lbs. of Seed Mix #1 at the rate of 4 lbs./1,000 Sq. Ft. in two directions utilizing an unequal twin disc slitting system with a maximum 3" spacing between discs towed behind a LGP turf tractor or equal.
  - D. Evenly apply 250 lbs. of Seed Mix #2 at the rate of 4 lbs./1,000 Sq. Ft. in one direction utilizing an unequal twin disc slitting system with a maximum 3" spacing between discs towed behind a LGP turf tractor or equal.
- 2.2 SOD
- A. After the preparation of the baseball and softball infield areas to be sodded has been approved by the Owner, the Contractor shall sod the areas as specified herein. The Contractor shall sod with nursery-grown High Quality Certified Kentucky Bluegrass.
  - B. Sod Composition:
    - 1. Kentucky Blue comprising of four (4) cultivars of Kentucky Blue Grass (KBG) or equivalent as follows:
      - a. 30% Mercury Kentucky Bluegrass.
      - b. 20% American Kentucky Bluegrass.
      - c. 20% Fielder Kentucky Bluegrass.
      - d. 10% Sombrero Kentucky Bluegrass.
  - C. The sod shall be machine cut at a uniform thickness of one quarter inch (1/4") +/- one eighth inch (1/8") and shall be free of weeds, diseases and other imperfections. Measurement for thickness shall exclude top growth and thatch. Sod shall be big rolls 63' x 4' wide.
  - D. Sod thatch levels shall not exceed one-half (1/2) inch.
  - E. Sod shall be uniform in color, density and thickness.
  - F. The sod shall come from a field in which the sod is grown without the use of sod establishment and reinforcements netting and shall have been mowed at a mowing height of a minimum of one and one-half (1½) inches and a maximum of two (2) inches high.
  - G. The names of the cultivars comprising the sod shall be submitted and approved by Owner before delivery to the site. The sod shall be planted within 24 hours of the time of harvest. Owner reserves the right to reject sod pieces that are damaged or show injury. These shall be lifted and replaced with new sod immediately.
  - H. Sod shall be furnished in either of the following dimensions:

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1. Required for infield turfed area of baseball field infield as well as the perimeter of the baseball and softball infield skinned area (please refer to detailed plan of seeding and sodding areas): Full "Big Roll Sod" provided in rectangular sod strips consisting of overall dimensions of forty-eight (48) inches wide by a maximum of sixty-three (63) feet long. Stored on specially fabricated heavy-duty tubes furnished by the sod supplier.
2. In rectangular sod strips measuring twelve (12) inches or sixteen (16) inches in width and from four (4) feet to six (6) feet in length, stored in rolls with the grass top side inverted so that the topsoil side is to the exterior. (Note: These smaller strips will only be acceptable for filling in smaller areas if needed, as well as for the placement around irrigation heads.)

## 2.3 PLANTING SOILS

- A. Topsoil: Amend topsoil for athletic field seed and sod areas as indicated in Division 32 Section "Root Zone Mix Preparation and Blending".

## 2.4 FERTILIZERS

- A. Nutrient application – Evenly spread soil amendment "Renovate Plus" or equal at the rate of 25 lbs./1,000 Sq. Ft. Lightly scarify and incorporate into the top 1 to 2 inches of new rootzone profile utilizing a super rake surface preparation machine or equal.
- B. Nutrient application – Evenly spread seedbed amendment "Myco-Replenish 3-3-3 SG or equal at the rate of 10 lbs./1,000 Sq. Ft.
- C. Evenly spread seedbed amendment and 4-way wetting agent "Vivax Plus Fertilizer 0-0-20 SG" or equal at the rate of 5 lbs./1,000 Sq. Ft.
- D. Nutrient application for SOD areas only – Evenly spread fertilizer and hydration molecules "0-0-20 with Cascade" or equal at the rate of 8lbs./1000 Sq. Ft. on top of the installed sod. Product shall be watered in to enable absorption and activation. The use of this product is intended to promote water movement through the existing sod thatch layer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to be seeded or sodding 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.
  5. Proceed with installation only after unsatisfactory conditions have been corrected.

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- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by 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.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

### 3.3 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix root zone mix according to Section 32 9115 "Root Zone Mix Preparation and Blending."
- B. Placing Root Zone Mix: Place and mix root zone mix in place over exposed subgrade according to Section 32 92115 "Root Zone Mix Preparation and Blending."
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create water logged soil.
- D. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### 3.4 SEEDING

- A. Evenly apply seed as specified in two (2) to three (3) directions, utilizing LGP turf tractor mounted unequal twin disc slitting system with a maximum 3-inch spacing between discs or equivalent as specified in Section 32 9115 "Root Zone Mix Preparation and Blending".
  - 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 of 3 to 4 lb./1000 sq. ft. (1.4 to 1.8 kg/92.9 sq. m).
- C. After seeding is completed and if ground conditions allow roll lightly (this is to create subtle consolidation or firming; over rolling will create a compacted rootzone which is detrimental to the overall process), and water with fine spray.
- D. The Contractor must utilize LGP turf tractor mounted with an oscillating arm broadcast applicator or equivalent to broadcast spread the following:
  - 1. Nutrient amendments – "Earthworks Micro Replenish 3-3-3 SG" or equivalent at specified rates.
  - 2. Nutrient and hydration amendment – "Precision Labs Vivax 0-0-20" or equivalent at specified rates.

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**3.5 SODDING**

- A. After the preparation of the areas to be sodded has been reviewed by the Owner, the Contractor shall sod the areas as specified herein.
- B. In accordance with the rectangular sod strips measuring twelve (12) inches or sixteen (16) inches in width and from four (4) feet to six (6) feet in length the following provisions shall apply:
  - 1. All sod shall be placed with close joints and no overlapping joints by whatever method is chosen. Sod shall be laid in strips, edge to edge with the lateral joints staggered. All minor or unavoidable openings in the sod shall be closed with sod plugs. However, sod laid with joints determined by the Owner to be too large shall be lifted and re-laid to the Owner's satisfaction at no extra cost.
- C. The sod shall be installed with the method of furnishing and installing sod, the following provisions shall apply:
  - 1. Only sod harvested with a "Sod-O-Matic" harvester, or equal, shall be permitted.
  - 2. Sod harvested shall be installed by means of the Big Roll Laying Device as manufactured by the KWMI Turf Equipment, or equal.
  - 3. The top soils shall be prepared to permit use of the tractor and laying device without causing depressions, ruts, etc., in the smooth finished surface to be sodded. Any depressions caused by the Contractor shall be remedied at no extra costs.
  - 4. The top soil shall have sufficient amount of moisture at the time of installation. This would be determined by the Contractor. The top soil conditions shall not be excessively wet or excessively dry.
  - 5. The sod shall be uniformly distributed over the prepared topsoil bed and pulled tightly against the edges of previously laid sections by the Contractor's qualified installers in a method to insure tight joints and to prevent drying of the sod at the joints.
- D. Sod shall be laid in strips, edge to edge, with lateral joints staggered.
- E. The installed sod shall abut the existing grades on the outside of the sodded areas, including the infield skinned area, so that the upper portion of the thatch line of the new sod matches the existing grades.
- F. When sodding is completed, the sod shall be consolidated using an appropriate type turf roller. If clarification of type of turf roller is need, the Landscape Architect needs to be consulted.
- G. The sod must be watered on the same working day on which it was installed. Apply a sufficient quantity of water to penetrate through the sod and into the rootzone. If necessary, the Contractor shall provide special crews after normal working hours to accomplish such watering at no extra cost to the Owner. After this initial watering, if needed, the Contractor shall be required to furnish, install and maintain a system of temporary pipe, sprinklers and service connections which are adequate to water the sod daily to maintain appropriate moisture levels which will sustain sod health and promote root development. If the sod is watered by normal rainfall or if weather conditions dictate, the Contractor may, at his discretion, eliminate or increase watering during a given week. However, such action by the Contractor shall in no way waive the Contractor's responsibility for the growth and health of the sod.

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**3.6 TURF RENOVATION**

- A. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
  - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
  - 2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Any extensive use of herbicides must be approved by the Landscape Architect.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
- I. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.
  - 1. Soil Amendment(s): according to requirements of Division 32 Section "Topsoil and Planting Mix." Apply as recommended by topsoil analysis.
  - 2. Initial Fertilizer: Commercial fertilizer or Slow-release fertilizer applied according to manufacturer's recommendations.
- J. Apply seed and protect with turf germination blankets as required for new turf.
- K. Water newly planted areas and keep moist until new turf is established.

**3.7 TURF MAINTENANCE (Inclusive of grow-in and establishment)**

- A. Maintain and establish turf (seeded and sodded areas) by utilizing proper irrigation, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. For seeded areas only; regrade, and replant bare or eroded areas to produce a uniformly smooth turf. The Contractor must provide materials and installation the same as those used in the original seeded and sodded areas.
  - 1. Fill in as necessary soil subsidence with a rootzone mix that is consistent with the existing materials, which may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.



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2. 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:**

1. Schedule watering to prevent wilting, puddling, erosion and displacement of seed.
2. Water turf with computer-controlled irrigation system if installed and operational to maintain appropriate moisture levels which will sustain sod health and promote root development. unless rainfall precipitation is adequate. If computer-controlled irrigation system is not operational the Contractor is required to furnish, install and maintain a system of temporary pipe, sprinklers and service connections which are adequate to water the turf areas daily to maintain appropriate moisture levels which will sustain turf health and vigor, and to promote root development.
3. Two times a week, the Contractor must monitor Volumetric Moisture Content (VMC) with a moisture probe such as TDR-300 or equivalent to assure that the rootzone has sufficient moisture content. As guidance the VMC should be no less than 30% to 40% areas tested. Thirty (30) designated points on the field as per the attached drawing/diagram.

**C. Grow-In Agronomic Requirements:**

1. Apply fertilizer to dry turf and water in post application.
2. Ten (10) days after seeding the Contractor must utilize LGP turf tractor mounted with an oscillating arm broadcast applicator or equivalent, to broadcast spread Lebanon Country Club 13-25-12 or equivalent at 1lb./1000 P.
3. Twenty-one (21) days after seed germination the Contractor must utilize LGP turf tractor mounted with an oscillating arm broadcast applicator or equivalent, to broadcast spread Lebanon Country Club 24-0-18 or equivalent at 1.25lb/1000 of N.
4. Forty-two (42) days after germination the Contractor must evenly apply seed as specified in one (1) direction the specific 80/20 seed blend or equivalent at 4lbs./1000, utilizing LGP turf tractor mounted seed injection implement or equivalent as specified in the site work construction equipment specifications.
5. Forty-nine (49) days after germination the Contractor must utilize LGP turf tractor mounted with an oscillating arm broadcast applicator or equivalent, to broadcast spread Earthworks Replenish 5-4-5 or equivalent at 1lb./1000 of N.
6. Product solutions supplier requirements – Must make weekly visits to assist contractor on fertility, performance turf establishment and product effectiveness.

**D. Mowing:**

1. Mow seeded areas once top growth reaches an average height of one and a half (1.5) inches. Mow to the height of one and a half (1.5) inches.
2. Mow sodded areas to maintain a height of one and a half (1.5) inches.
3. All clippings MUST be removed off site or to a designated area.
4. It is preferable that the clippings be disposed of by composting.
5. It is advisable that the initial mowing should be carried out utilizing a walk behind or pedestrian type mower.
6. Mow turf utilizing a rotary cutting action mower with new or properly sharpened blades, and a collection system.
7. Repeat mowing as growth permits but not more than three (3) times per week to maintain specified height of cut.
8. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.

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9. Do not mow when grass is wet or during adverse ground or climatic conditions.
10. Schedule initial and subsequent mowings to maintain the following grass height:
  - a. Mow to a height of one and a half (1.5) inches until bluegrass has reached the average height of one and a half (1.5) inches.
  - b. Once bluegrass has reached specified height, raise mowing height to two (2) inches.

**3.8 SATISFACTORY TURF**

- A. Seed and sod installations shall meet the following criteria as determined by Architect:
  1. Satisfactory Seeded Turf Areas: 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 3 by 3 inches.
  2. Satisfactory Sodded Turf Areas: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage of 100 percent over any 10 sq. ft. and no bare spots should be visible. Healthy root development (an average of 2.5") should be achieved. Thatch levels of no more than three quarters (3/4") of an inch shall be present.
- B. Use previously specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf complies with requirements.
- C. Substantial Completion Field Testing:
  1. Soil structural consolidation readings at the six (6) inch depth must be a minimum of one-hundred and twenty (120) psi and a maximum of One hundred and Seventy-Five (175) psi using a digital penetrometer or equivalent. The readings will be taken at THIRTY (30) designated points on the field as per the attached drawing/diagram
  2. Surface Impact Levels must be a minimum of fifty (50) Gravities to a maximum of seventy (70) Gravities using a Clegg Surface Impact Tester or equivalent. The readings will be taken at thirty (30) designated points on the field as per the attached drawing/diagram
  3. Infiltration rate of water into the rootzone must achieve a minimum of two (2) inches per hour. The reading will be taken at five (5) designated points on the field as per the attached drawing/diagram
  4. If any of the above readings are outside of the agreed tolerances, then corrective action will need to be carried out. This would be following consultation between the Landscape Architect, Landscape Architect's Representative, and Contractor.

**3.9 RESTORATION OF SETTLED GRADES**

- A. At the end, twelve months after the date of substantial completion of the soil installation work, inspect the site and restore any areas where the grades have settled beyond the elevations shown on the Drawings.

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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, walkways, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout maintenance period and remove after plantings are established.

3.11 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of Athletic Field Contractor. Maintain as required in "Turf Maintenance" Article. 3.7 (above) 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: 120 days from date of Substantial Completion.
  - 2. Sodded Turf: 120 days from date of Substantial Completion.
  - 3. When maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

END OF SECTION 32 9219



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SECTION 329219 -- SEEDING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SECTION INCLUDES

- A. Hydroseeding, mulching and fertilizer.
- B. Maintenance.

1.3 RELATED REQUIREMENTS

- A. Section 32 9119.13 - Topsoil Placement and Grading: Topsoil testing, planting soil placement and finish grading.
- B. Section 32 9223 – Sodding: Providing and installing sod within turf surfaced roadways.

1.4 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.
- C. Maintenance Contract.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

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**PART 2 PRODUCTS**

**2.1 SEED MIXTURE**

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
  - 1. Grass seed mixture shall be as indicated on the Drawings.

**2.2 SOIL MATERIALS**

- A. Amended Topsoil: As specified in Section 32 9119.13 - Topsoil Placement and Grading.

**2.3 ACCESSORIES**

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of grass.

**2.4 EROSION-CONTROL MATERIALS**

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb./sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

**2.5 PESTICIDES**

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

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**2.6 TESTS**

- A. Provide analysis of topsoil fill under provisions of Section 01 4000 and according to Section 32 9119.13 - Topsoil Placement and Grading.

**2.7 FIELD CONDITIONS**

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

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that prepared soil base is ready to receive the work of this Section.

**3.2 PREPARATION**

- A. Prepare subgrade in accordance with Section 31 2200.
- B. Place amended topsoil in accordance with Section 32 9119.13 - Topsoil Placement and Grading.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
  - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
  - 2. Protect grade stakes set by others until directed to remove them.
- D. 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.
- 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 Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

**3.3 FERTILIZING**

- A. Apply fertilizer in accordance with manufacturer's instructions and per recommendations per Section 32 9119.13 - Topsoil Placement and Grading.
- B. Apply after smooth raking of topsoil and prior to roller compaction.

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- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches (50 mm) of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

### 3.4 HYDROSEEDING

- A. Apply seeded slurry with a hydraulic seeder at a rate of 3 to 4 lbs. per 1000 sq ft (1.4 to 1.8 Kg per 1000 sq m) evenly in two intersecting directions unless indicated to apply at a heavier rate on the Drawings.
- B. Do not hydroseed area in excess of that which can be mulched on same day.
- C. Immediately following seeding, apply mulch to a thickness of 1/8 inches (3 mm). Maintain clear of shrubs and trees.
- D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches (100 mm) of soil.
- E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches (100 by 100 mm).

### 3.5 TURF RENOVATION

- A. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
  - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
  - 2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
- H. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.
  - 1. Soil Amendment(s): according to requirements of Section 32 9119.13 - Topsoil Placement and Grading. Apply as recommended by topsoil analysis.



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- 2. Initial Fertilizer: Commercial fertilizer or Slow-release fertilizer applied according to manufacturer's recommendations.
- I. Apply seed and protect with straw mulch as required for new turf.
- J. Water newly planted areas and keep moist until new turf is established.

### 3.6 PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 24 inches (600 mm). Space stakes at 12 inches.
- B. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil
- C. Cover seeded slopes where grade is 4 inches per foot (100 mm per m) or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- D. Lay fabric smoothly on surface, bury top end of each section in 6 inch (150 mm) deep excavated topsoil trench. Provide 12 inch (300 mm) overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
  - 1. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
  - 2. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Secure outside edges and overlaps at 36-inch (900 mm) intervals with stakes.
- F. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- G. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches (150 mm).

### 3.7 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner; Owner will pay for water.
- B. See Section 01 7000 - Execution Requirements, for additional requirements relating to maintenance service.
- C. Provide a separate maintenance contract for specified maintenance service.
- D. Provide maintenance of seeded areas for a minimum of three months from Date of Substantial Completion or until grass is well established and exhibits a vigorous growing condition. Continue maintenance until turf is satisfactory.
- E. Turf installations shall meet the following criteria as determined by Landscape Architect
  - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage

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exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).

- F. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of grass blade at any one mowing.
- G. Neatly trim edges and hand clip where necessary.
- H. Immediately remove clippings after mowing and trimming.
- I. Water to prevent grass and soil from drying out.
- J. Roll surface to remove minor depressions or irregularities.
- K. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
  - 1. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
  - 2. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.
- L. Immediately reseed areas that show bare spots.
- M. Protect seeded areas with warning signs during maintenance period.

### 3.8 RESTORATION OF SETTLED GRADES

- A. At the end, twelve months after the date of substantial completion of the soil installation work, inspect the site and restore any areas where the grades have settled beyond the elevations shown on the drawings.
  - 1. Lawn areas: Remove the sod using mechanical sod cutter from the settled area and add the specified top soil or planting mix. Re sod the area using the sod cut from the lawn. In the event that the sod cannot be reused, install new sod that matches the seed mix on the lawn.
  - 2. Planting Areas: Where the settlement is 3-inches or less, remove the mulch, top dress the area with the specified topsoil or planting mix and re mulch.
  - 3. Planting Areas: Where the settlement is greater than 3-inches remove the mulch and plants, add the specified topsoil or planting mix and re mulch.

### 3.9 CLEANUP

- 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. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout maintenance period and remove after plantings are established.

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- C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329219



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SECTION 329223 - SODDING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SECTION INCLUDES

- A. Fertilizing.
- B. Sod installation.
- C. Maintenance.

1.3 RELATED REQUIREMENTS

- A. Section 32 1125 – Turf Surfaced Roadways: Materials and installation of turf surfaced roadways.

1.4 DEFINITIONS

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 REFERENCE STANDARDS

- A. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding 2006.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Certificate: Certify grass species and location of sod source.
- C. Certificate: Certify fertilizer and herbicide mixture approval by authority having jurisdiction.
- D. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer; and herbicides.
- E. Maintenance Contract.

1.7 QUALITY ASSURANCE

- A. Sod Producer: Company specializing in sod production and harvesting with minimum five years' experience and certified by the State of Connecticut.

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- B. Installer Qualifications: Company approved by the sod producer.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver sod on pallets. Protect exposed roots from dehydration.
- B. Do not deliver more sod than can be laid within 24 hours.

**1.9 MAINTENANCE**

- A. Provide a separate maintenance contract for specified maintenance service.

**PART 2 PRODUCTS**

**2.1 REGULATORY REQUIREMENTS**

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of fertilizer and herbicide mixture.

**2.2 MATERIALS**

- A. Sod: TPI (SPEC), Certified Turfgrass Sod quality; cultivated grass sod; type indicated in plant schedule on Drawings; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft (100 sq m). Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
- B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
  - 1. Mix of three to six new varieties of turf-type fescues which require reduced frequency of watering, fertilization, and mowing as recommended by the sod producer.

**2.3 FERTILIZERS**

- A. Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent from natural organic sources of urea formaldehyde, phosphorous, and potassium with nitrogen, phosphorous and potassium in amounts recommended in the soil analysis per Section 32 9119.13 - Topsoil Placement and Grading.
- B. Fertilizer: Slow-release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorous and potassium in amounts recommended the soil analysis per Section 32 9119.13 - Topsoil Placement and Grading.
- C. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of grass.

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**2.4 HERBICIDES**

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

**2.5 ACCESSORIES**

- A. Wood Pegs: Softwood, sufficient size, and length to ensure anchorage of sod on slope.

**2.6 FIELD CONDITIONS**

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

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that prepared soil base is ready to receive the work of this section.

**3.2 PREPARATION**

- A. Prepare subgrade in accordance with Section 31 2200.

**3.3 FERTILIZING**

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to installation of sod.
- C. Apply fertilizer no more than 48 hours before laying sod.
- D. Mix thoroughly into upper 2 inches (50 mm) of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

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**3.4 LAYING SOD**

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod immediately after delivery to site to prevent deterioration.
- C. Lay sod smooth and tight with no open joints visible, and no overlapping; stagger end joints 12 inches (300 mm) minimum. Do not stretch or overlap sod pieces.
- D. Where new sod adjoins existing grass areas, align top surfaces.
- E. Where sod is placed adjacent to hard surfaces, such as curbs, pavements, etc., place top elevation of sod 1/2 inch (13 mm) below top of hard surface.
- F. On slopes 6 inches per foot (500 mm per m) and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet (600 mm) on center. Drive pegs flush with soil portion of sod.
- G. Water sodded areas immediately after installation. Saturate sod to 4 inches (100 mm) of soil.
- H. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities. Roll sodded areas with roller not exceeding 2000 lbs. (Roll sodded areas with roller not exceeding 900 kg.)

**3.5 MAINTENANCE**

- A. Provide maintenance at no extra cost to Owner; Owner will not pay for water.
- B. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- C. Provide a separate maintenance contract for specified maintenance service.
- D. Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.
- E. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of grass blade at any one mowing.
- F. Neatly trim edges and hand clip where necessary.
- G. Immediately remove clippings after mowing and trimming.
- H. Water to prevent grass and soil from drying out.
- I. Roll surface to remove irregularities.
- J. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- K. Immediately replace sod to areas that show deterioration or bare spots.



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- L. Protect sodded areas with warning signs during maintenance period.

**3.6 SATISFACTORY TURF**

- A. Turf installations shall be, at the end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities as determined by Landscape Architect.
- B. Use specified materials to reestablish turfgrass that does not comply with requirements and continue maintenance until turf is satisfactory.

**3.7 CLEAN UP**

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

END OF SECTION 329223

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SECTION 329300 – PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

A. Section Includes:

- 1. Plants.
- 2. Planting Soil.

B. Related Sections:

- 1. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
- 2. Division 31 Section "Clearing and Grubbing" for topsoil stripping and stockpiling, and site clearing.
- 3. Division 31 Section "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
- 4. Division 32 Section "Topsoil and Grading" for planting medium.
- 5. Division 32 Section "Turf and Grasses" for turf (lawn), hydroseeding and sod.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than sizes indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- D. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- E. Finish Grade: Elevation of finished surface of planting soil.

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- F. **Manufactured Topsoil:** Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- G. **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.
- H. **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.
- I. **Planting Area:** Areas to be planted.
- J. **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.
- K. **Plant; Plants; Plant Material:** These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- L. **Root Flare:** Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- M. **Stem Girdling Roots:** Roots that encircle the stems (trunks) of trees below the soil surface.
- N. **Subgrade:** Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. **Subsoil:** All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- P. **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 COORDINATION

- A. **Coordination with Turf Areas (Lawns):** Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
  - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

#### 1.5 PREINSTALLATION MEETINGS

- A. **Preinstallation Conference:** Conduct conference at [Project site] <Insert location>.

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**1.6 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
  - 2. Plant Photographs: Include color photographs in [digital] [3- by 5-inch (76- by 127-mm) print] format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than [20] <Insert number> plants are required, include a minimum of [three] <Insert number> photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Samples for Verification: For each of the following:
  - 1. Organic and Compost Mulch: 1-quart (1-L) volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
  - 2. Weed Control Barrier: 12 by 12 inches (300 by 300 mm).

**1.7 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
  - 1. Manufacturer's certified analysis of standard products.
  - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Sample Warranty: For special warranty.

**1.8 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

**1.9 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

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1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
  3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  4. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent 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 one gallon 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 plant growth.
    - a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m) 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. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- E. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
  2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- F. Plant Material Observation: Landscape Architect shall be given the opportunity to observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Provide transportation and accompany Landscape Architect to this location. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects

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and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

G. Preinstallation Conference: Conduct conference at Project site.

**1.10 DELIVERY, STORAGE, AND HANDLING**

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

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball.

F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

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**1.11 FIELD CONDITIONS**

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
  - 1. Spring Planting of Deciduous Plants: March 1<sup>st</sup> to May 15<sup>th</sup>
  - 2. Spring Planting of Evergreen Plants: March 1<sup>st</sup> to June 1<sup>st</sup>.
  - 3. Fall Planting of both Deciduous and Evergreen Plants: October 1<sup>st</sup> until soil becomes frozen.
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
  - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

**1.12 WARRANTY**

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



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- d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

## **PART 2 - PRODUCTS**

### **2.1 PLANT MATERIAL**

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
  - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots will be rejected.
  - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

### **2.2 SOIL MATERIALS**

- A. Amended Topsoil: As specified in Section 32 9119.13 – Topsoil Placement and Grading.

### **2.3 PLANTING SOILS**

- A. Planting Soil: Blend amended topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
  - 1. Compost: 1:3 ratio by volume of loose compost to amended topsoil.
  - 2. Fertilizer tablets: Quantity per tree or shrub pit as recommended by tablet manufacturer.

### **2.4 MULCHES**

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:

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1. Type: 100 percent shredded bark.
2. Size Range: 3 inches (76 mm) maximum, 1/2-inch (13 mm) minimum.
3. Color: Natural.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch (25-mm) sieve; soluble-salt content of 2 to 5 dS/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 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

## 2.6 PESTICIDES

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

## 2.7 MISCELLANEOUS PRODUCTS

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- B. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.
- C. Filter Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.
- D. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

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1. Size: 5-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

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

#### **3.1 CARE OF PLANTS PRIOR TO PLANTING**

- A. When plants are taken from storage to the planting site, roots of plants shall be immersed in water immediately upon opening the bundle and kept in water until planted. The Contractor shall have sufficient tanks and pails to keep roots of plants from opened bundles in water until planted. Rootball and container plants shall be immersed for a minimum of 10 minutes prior to planting. Do not remove containers or wire baskets until plant is at planting pit.

#### **3.2 PREPARATION**

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

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1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

### 3.3 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 12 inches (300 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  1. Apply approved fertilizer tablets directly to subgrade before loosening.
  2. Thoroughly blend planting soil off-site before spreading.
    - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    - b. Mix lime with dry soil before mixing fertilizer.
  3. Spread planting soil to a minimum depth of 18 inches (450 mm) as indicated on the Drawings, but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
    - a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches (100 mm) of subgrade. Spread remainder of planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at rate recommended by the manufacturer.

### 3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
  1. Excavate approximately three times as wide as ball diameter for balled and burlapped or container-grown stock.
  2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
  4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.

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5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
  6. Maintain supervision of excavations during working hours.
  7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes, 24 inches (600 mm) apart, into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

**3.5 TREE, SHRUB, AND VINE PLANTING**

- A. Only plants which have had their roots immersed in water for at least 10 minutes immediately prior to planting shall be installed. The Contractor shall have sufficient tanks and pails for immersing rootball and container plants prior to planting. Containers and wire baskets are to be removed only after plant has been immersed at the planting pit.
- B. Before planting, fill excavations with water and allow to percolate away before positioning trees and shrubs.
- C. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- D. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- E. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
1. Use planting soil for backfill.
  2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.

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5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. Set container-grown stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
  1. Use planting soil for backfill.
  2. Carefully remove root ball from container without damaging root ball or plant.
  3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
  5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- G. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

**3.6 TREE, SHRUB, AND VINE PRUNING**

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

**3.7 GROUND COVER AND PLANT PLANTING**

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

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**3.8 APPLYING COMPOST TO SURFACE OF PLANTING SOIL**

- A. Application: Apply compost 3 inches (76 mm) of compost to surface of in-place planting soil in planting beds prior to installation of weed control fabric and mulch. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet. Rake compost into top 3 inches (76 mm) of planting soil.

**3.9 PLANTING AREA MULCHING**

- A. Prior to installing weed-control barriers, incorporate a 3 to 4 inches depth of composted mulch into the top 6 inches of the planting bed.
- B. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches (150 mm) and secure seams with galvanized pins.
- C. Mulch backfilled surfaces of planting areas and other areas indicated.
  - 1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch (75-mm) average thickness, with radius around trunks or stems as indicated on the Drawings. Do not place mulch within 3 inches (75 mm) of trunks or stems.
  - 2. Organic Mulch in Planting Areas: Apply 3-inch (75-mm) average thickness of organic mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches (75 mm) of trunks or stems.

**3.10 BED EDGING**

- A. Shovel-Cut Edging: Separate mulched areas from turf areas with a 45-degree, 4- to 6-inch- (100- to 150-mm-) deep, shovel-cut edge as shown on Drawings.

**3.11 PLANT MAINTENANCE**

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

**3.12 PESTICIDE APPLICATION**

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- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

**3.13 REPAIR AND REPLACEMENT**

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.
  - 1. Submit details of proposed pruning and repairs.
  - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
  - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
  - 1. Provide new trees of same size as those being replaced for each tree of 6 inches (150 mm) or smaller in caliper size.
  - 2. Species of Replacement Trees: Same species being replaced.

**3.14 RESTORATION OF SETTLED GRADES**

- A. At the end, twelve months after the date of substantial completion of the soil installation work, inspect the site and restore any areas where the grades have settled beyond the elevations shown on the Drawings.
  - 1. Lawn areas: Remove the sod using mechanical sod cutter from the settled area and add the specified top soil or planting mix. Re sod the area using the sod cut from the lawn. In the event that the sod cannot be reused, install new sod that matches the seed mix on the lawn.
  - 2. Planting Areas: Where the settlement is 3-inches or less, remove the mulch, top dress the area with the specified topsoil or planting mix and re mulch.
  - 3. Planting Areas: Where the settlement is greater than 3-inches remove the mulch and plants, add the specified topsoil or planting mix and re mulch.

**3.15 CLEANUP AND PROTECTION**

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.



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- 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. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

**3.16 DISPOSAL**

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

**3.17 MAINTENANCE SERVICE**

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
  - 1. Maintenance Period: 12 months from date of Substantial Completion.
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
  - 1. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION 329300

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SECTION 331900 – WATER SUPPLY SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Water distribution and fire protection piping.
  - 2. Pipe fittings, valves, and valve boxes.
  - 3. Hydrants.
  - 4. Anchors and thrust blocks.
  - 5. Miscellaneous water system appurtenances.
  - 6. Connections to existing water systems.
  - 7. Disinfection and testing of new systems and appurtenances.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 COORDINATION WITH JURISDICTIONAL AUTHORITY

- A. Contractor shall notify and coordinate the work of this Section with the local authority having jurisdiction over water supply, whether public or private system owner/operator.
- B. Obtaining permits or approvals which may be required to perform the work of this section, including all costs, fees and taxes required or levied.
- C. Contractor shall obtain all required approvals for connection to, or extension of, any portion of the domestic or fire protection water systems.
- D. The closing of valves necessary for making connections with the existing water systems will be done by Contractor with the assistance of Engineer. Sufficient notice shall be given the jurisdictional authority for a planned connection. No allowance will be made for any delay in the closing of valves. A 48-hour notice shall be given to adjacent buildings/residences affected by the shutdown, and shall be done by Contractor to the satisfaction of jurisdictional authority and Engineer. Jurisdictional authority or Engineer may require the work be completed outside of normal working hours during low use time periods.

1.4 REFERENCES

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- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut.
  - 1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 818 and any supplements.
- D. ASTM International (ASTM)
  - 1. ASTM B88—Standard Specification for Seamless Copper Water Tube.
  - 2. ASTM F477—Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - 3. ASTM D3139—Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
  - 4. ASTM A536—Ductile Iron Castings.
  - 5. ASTM D1557—Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- E. American National Standards Institute (ANSI)
  - 1. ANSI A21.50—Thickness Design of Ductile-Iron Pipe
  - 2. ANSI A21.51—Ductile-Iron Pipe, Centrifugally Cast, for Water
  - 3. ANSI A21.4—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
  - 4. ANSI A21.10—Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids
  - 5. ANSI 61—Drinking Water System Components—Health Effects
- F. American Water Works Association (AWWA)
  - 1. AWWA C104—Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
  - 2. AWWA C110—Standard for Ductile-Iron and Gray-Iron Fittings.
  - 3. AWWA C111—Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - 4. AWWA C150—Standard for Thickness Design of Ductile-Iron Pipe.
  - 5. AWWA C151—Standard for Ductile-Iron Pipe, Centrifugally Cast.
  - 6. AWWA C207—Standards for Steel Pipe Flanges for Waterworks Service—Sizes 4 In. through 144 In. (100 mm Through 3,600 mm).
  - 7. AWWA C502—Standard for Dry-Barrel Fire Hydrants.

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8. AWWA C504—Standard for Rubber-Seated Butterfly Valves.
9. AWWA C509—Standard for Resilient-Seated Gate Valves for Water Supply Service.
10. AWWA C550—Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.
11. AWWA C651—Disinfecting Water Mains.
12. AWWA C900—Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In.–12 In. (100 mm–300 mm), for Water Transmission and Distribution.
13. AWWA C800—Standard for Underground Service Line Valves and Fittings.

G. State of Connecticut

1. State Building Code, including all Amendments, Supplements, and Errata.

H. Local Jurisdictional Authority

1. Comply with standards of the Local Jurisdictional Authority. Should this Specification differ from those standards, the standards of the Local Jurisdictional Authority will govern.

1.5 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.
- B. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- C. Maintain all temporary facilities and controls in proper and safe condition throughout the progress of the work.

1.6 COORDINATION WITH JURISDICTIONAL AUTHORITY

- A. Contractor shall notify and coordinate the work of this Section with the local authority having jurisdiction over water supply, whether public or private system owner/operator.
- B. Contractor shall obtain all required approvals for connection to, or extension of, any portion of the domestic or fire protection water systems.
- C. Service Interruption: Provide Jurisdictional Authority five (5) days advanced notice for any planned interruption associated with the work. Comply with customer notification requirements of the Jurisdictional Authority.
- D. Jurisdictional Authority may require the work be completed outside of normal working hours during low use time periods.

1.7 SAFETY

- A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable

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codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.

- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to completely construct the excavation support system, permanent or temporary, including sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping and benching. All of the proper materials and all equipment necessary to protect employees in excavations against cave-ins shall be furnished and installed.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate.

#### 1.8 SUBMITTALS

- A. Copies of all permits and/or approvals from Jurisdictional Authority.
- B. Shop Drawings:
  - 1. Submit shop drawings, descriptive literature, or both, showing pipe materials and appurtenances to be furnished. Shop Drawings shall be submitted to Engineer for approval prior to ordering materials.
  - 2. Shop drawings showing the configuration, dimensions, layout, and spacing of major and minor components such as pipe, joints, restraints, valves, and other proposed details of assembly. Show in large-scale details any unique assembly, and/or installation requirements.
- C. Copies of manufacturer-provided installation instructions, operation instructions, and maintenance material for all equipment furnished under this Section.
- D. Manufacturer's warranties and associated warranty registration data in Owner's name. Submit two (2) copies of each warranty to Engineer in the manufacture's/supplier's standard form or if there is no standard form available, in a form specified by Engineer.
- E. As-Built Drawings.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Storage of pipe, fittings, valves, hydrants and other water line appurtenances on the site shall be in accordance with the manufacturer's recommendations, subject to the approval of Engineer.
- B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, fittings, valves, hydrants, and other water line appurtenances. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to pipe and fitting coatings shall be repaired as directed by Engineer.

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- C. Pipe, fittings, valves, hydrants and other water system appurtenances which are defective from any cause, including damage caused by handling, and determined by Engineer as non-repairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner.
- D. Pipe, and all water system appurtenances that are damaged or disturbed through any cause prior to acceptance of the work shall be repaired, realigned or replaced as required by Engineer at no additional cost to the Owner.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. The drawings are diagrammatic only and are intended to indicate the extent, but not all details, of the system, which shall be constructed. All materials and fittings are not shown; but Contractor shall furnish and install all materials and fittings required for the complete system.

### **2.2 DUCTILE IRON PIPE**

- A. Centrifugally-cast ductile iron pipe, AWWA C151/A21.51, thickness Class 52, AWWA C150/A21.50. Pipe shall be furnished in 18-foot or 20-foot nominal lengths, unless otherwise required by Jurisdictional Authority standards.
- B. Pipes shall be cement-mortar lined in accordance with ANSI A21.4-03/AWWA C104, except that the cement lining shall be double thickness.
- C. The exterior of all pipe shall be factory coated, with a double coat of asphaltic material conforming to ANSI A21.51-02/AWWA C151. The interior of all pipe shall have a seal coat of bituminous material applied over the cement lining in accordance with ANSI A21.4-03/AWWA C104.

### **2.3 DUCTILE IRON PIPE FITTINGS**

- A. Ductile iron pipe fittings shall have a pressure rating of 350 psi and shall conform to AWWA C110/ANSI A21.10-03. All fitting shall be compatible with pipe.
- B. The type of fittings for pipe and valve connections shall be determined by Contractor in accordance with the requirements shown on the Drawings prior to ordering the fittings.
- C. Fittings shall be cement-mortar lined and coated as specified for pipe.

### **2.4 DUCTILE IRON PIPE COUPLINGS**

- A. Couplings and accessories shall be pressure rated at least equal to that of the pipe. Couplings shall be Dresser Style 153, Smith Blair 441 style, Rapidfit by Cascade Waterworks, or approved equal. Couplings shall be provided with corrosion resistant nuts and bolts. The interior of the coupling shall be epoxy-coated. Epoxy coating shall conform to AWWA C550-01.
- B. Transition couplings for joining pipe of different diameters shall be provided with corrosion resistant nuts and bolts.
- C. After assembly, all exterior surfaces including the bolts and nuts shall be completely coated with two coats of a heavy-duty protective asphaltic coating.

### **2.5 JOINTS FOR DUCTILE IRON PIPE**

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- A. Joints shall be mechanical joints, ANSI A21.11-00/AWWA C111-80. Mechanical joints shall be provided with required gaskets, lubricants and accessories conforming to ANSI A21.11-00/AWWA C111-80.
- B. Restrainers shall be MEGALUG by EBBA Iron, MJ Field Lok Gasket by U.S. Pipe & Foundry, Allgrip 3600 by Star Pipe Products, or approved equal.

**2.6 GATE VALVES**

- A. Gate valves shall be resilient seated conforming to the requirements of AWWA C509-01 and the requirements of the local water authority.
- B. Gate valves shall be cast iron body, bronze mounted, double disk, non-rising stem, O-ring type stuffing box.
- C. Gate valves shall open to the left (counter clockwise) and shall be mechanical joint type.
- D. Bolts, studs and nuts shall be made from a corrosion-resistant material such as low-zinc bronze, nickel copper alloy, or stainless steel.
- E. The operating nut shall be 2 inches square at the base, tapering to  $1\frac{15}{16}$  inches square at the top.

**2.7 BUTTERFLY VALVES**

- A. Butterfly valves are generally used on pipe 16 inches and greater in diameter, and shall be installed in accordance with the standard practices of the Jurisdictional Authority.
- B. Butterfly valves shall be pressure Class 150B mechanical joint end with ductile iron body conforming to ASTM A536-84, Grade 65-45-R and stainless steel body seat, all in accordance with ANSI F1433-97/AWWA C504-00 Rubber-Seated Butterfly Valves.

**2.8 VALVE BOXES**

- A. Each gate valve shall be provided with a valve box and cover.
- B. Valve boxes shall be of the adjustable, telescoping, heavy-pattern type designed and constructed to prevent the direct transmission of traffic loads to the pipe or valve.
- C. Valve boxes shall be cast iron, asphalt coated with cast iron covers. The smallest inside diameter of the shaft shall not be less than 5¼ inches. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve. Provisions shall be made for adjustment through at least 6-inches vertically while retaining a lap of at least 4 inches between sections.
- D. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. Unless otherwise required by the Jurisdictional Authority, the word "WATER" shall be cast in the top surface of the cover.

**2.9 HYDRANTS**

- A. Hydrants: AWWA C502.
  - 1. Type of Thread: National Standard.

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2. Number of Outlets: 2 at 2½-inch hose connections and 1 at 4½-inch steamer connection.
3. Diameter of Opening: 4½ inch.
4. Size and Type of Inlet Connection: 6-inch mechanical joint
5. Direction of Opening: Open left.
6. Depth of cover: 5' feet minimum.
7. Size and Shape of Operating Nut: Pentagonal.
8. Bolts and nuts: corrosion-resistant material.

B. Coatings: Two coats of primer; final finish color as required by the Jurisdictional Authority.

#### 2.10 TAPPING SLEEVE AND VALVE

- A. Tapping sleeves: AWWA C223, bolted-sleeve type with mechanical joint connection to the existing water pipe and flanged end outlets for connecting the tapping valves. Tapping sleeves shall be suitable for a working water pressure of 200 psi and outlet flanges shall conform to the 125-pound American Standard with Cor-Ten or cadmium plated cast iron nuts and bolts.

#### 2.11 THRUST BLOCKS

- A. Thrust blocks shall be installed in accordance with the details shown on the Drawings and/or as required by the Jurisdictional Authority.
- B. Concrete: Minimum 28-day compressive strength of 3,000 psi.
- C. In certain areas, thrust blocks cannot be used because of the density of other utilities and inability to construct thrust blocks bearing against "undisturbed soil". In such case, restrained joints shall be used at that location.

#### 2.12 CORPORATION STOPS AND CURB STOPS

- A. Corporation stops: ball type corporation valves threaded to a receive compression-type fitting as manufactured by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equal.
- B. Curb stops: ball valve threaded to receive compression-type fittings by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equal.
- C. Stops shall be sized to receive the service tubing without the use of enlargement/reduction fittings.

#### 2.13 SERVICE BOXES

- A. Service boxes shall be cast iron improved extension type with arch pattern base. Covers shall be held in place with bronze bolts and the word "WATER" shall be cast into the top surface of the cover. Service box shafts shall have a minimum inside diameter of 2½ inches. Service boxes shall be as manufactured by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equivalent.

#### 2.14 WATER SERVICE



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- A. Services, two inches or smaller: Copper water tubing, Type K, ASTM B88 and ANSI Standard 61 for underground water service.
  - 1. Joints: Three part compression couplings or an approved equal.
- B. Water Service Fittings: Fittings, couplings, adapters, check valves and service saddles shall be in conformance with AWWA C800.
- C. Services, 3 inches and greater: Ductile iron pipe or as otherwise required by the Jurisdictional Authority.

**2.15 METER PITS/VAULTS**

- A. As required by Jurisdictional Authority.

**2.16 BACKFLOW PREVENTERS**

- A. As required by Jurisdictional Authority.

**2.17 PRESSURE REDUCING VALVES**

- A. As required by Jurisdictional Authority.

**2.18 METERS**

- A. As required by Jurisdictional Authority.

**2.19 BEDDING**

- A. Unless otherwise indicated, bedding shall consist of screened gravel, maximum size  $\frac{3}{4}$  inches and minimum size  $\frac{3}{8}$  inches.
- B. When clay, wet, soft or silty soil conditions prevail,  $\frac{3}{4}$ -inch crushed stone shall be used for bedding.

**2.20 PIPE AND APPURTENANCE ENCASEMENT**

- A. Encasement shall be polyethylene in accordance with AWWA ANSI-AWWA C105/A21.5-99(10). Polyethylene encasement shall be v-bio enhanced polyethylene encasement style only and consist of three co-extruded layers of linear low-density polyethylene (LLDPE) film that are fused into one.

**PART 3 EXECUTION**

**3.1 GENERAL**

- A. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.
- B. All water pipes, fittings, valves, hydrants and other appurtenances shall be installed at the locations as shown on the Drawings and/or directed by Engineer.

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- C. The proposed location and vertical alignment may be altered to avoid conflicts with existing and proposed utilities, as approved by Engineer.

**3.2 LAYING DUCTILE IRON PIPE AND FITTINGS**

- A. Ductile iron pipe and fittings shall be installed in accordance with the requirements of AWWA C600.
- B. Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 31 2310—Earthwork.
- C. All pipe shall be clean before laying. When installation is stopped for any reason, the open ends of the pipe shall be closed by watertight plugs or other approved means. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe has been eliminated.
- D. Fittings, in addition to those shown on the Drawings, shall be provided if required to avoid utility conflicts.
- E. When cutting of pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.
- F. Maximum allowable deflection for pipe laid without fittings shall not exceed the allowable amount established by the pipe manufacturer and shall not exceed those shown in AWWA C600.
- G. The pipe shall be laid with a minimum cover of 4½ feet (4.5 ft) below finished grade, unless otherwise required by the Municipality or directed by Engineer.

**3.3 JOINTING DUCTILE IRON PIPE, PUSH-ON TYPE**

- A. Push-on joints shall be made in strict accordance with the manufacturer's instructions. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surface cleaned and lubricated using the pipe manufacturer's suggested methods and materials. The plain end of the pipe to be laid shall be inserted in alignment with the bell of the pipe to which it is to be jointed and pushed home with a jack or by other means. After joining the pipe, a metal feeler gauge shall be used to make certain that the rubber gasket is correctly located and has not been twisted or otherwise displaced.

**3.4 JOINTING MECHANICAL JOINT PIPE AND FITTINGS**

- A. Mechanical joints shall be made in strict accordance with the manufacturer's instructions. Mechanical joints shall be made by first cleaning the surfaces against which the gaskets will come in contact with a wire brush. The gasket, bell and spigot shall be lubricated by washing with soapy water just prior to assembling the joint. After the nuts have been made up finger tight, the bottom nut, then top and then diametrically opposite nuts shall be progressively tightened. Bolts shall be tightened to the torques listed:

Bolt Size (Inches)	Range of Torque (Foot-Pounds)
$\frac{5}{8}$	45–60
$\frac{3}{4}$	75–90
1	85–100

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- B. After installation, a heavy bitumastic coating shall be applied to all bolts and nuts.
- C. Restraining device shall be ductile iron and shall have dimensions such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI A21.53-00/AWWA C153 latest revision.

**3.5 CONCRETE THRUST BLOCKS**

- A. Where pipes change horizontal and vertical direction, at hydrants, tees and other fittings, and wherever abnormal thrust forces may be developed, the Contractor shall construct thrust and anchor blocks as detailed on the Drawings. They shall be concrete, of minimum dimensions as detailed on the drawings or of adequate additional size to suit actual conditions to withstand pressures anticipated, and shall be founded in undisturbed soil.
- B. Concrete for thrust blocks shall have a minimum 28-day compressive strength of 3,000 psi.
- C. Fittings, which do not use thrust blocks resting against natural occurring material with passive resistance pressure of 1,500 psf, shall be installed with a restrained joint system as specified in Article 3.7.

**3.6 RESTRAINED JOINTS**

- A. Restrained joints shall be installed at bends, reducers, tees, valves, dead ends, and hydrants. The minimum length of pipe to be restrained on either side of the joint shall be as shown on the table below. The fittings of the new piping shall be for restrained joints, as marked on the Drawings.

Number of Joints to Restrain  
on Either Side of Fitting

Fitting Type	Number of Joints to Restrain on either Side of Fitting (Based on 18-foot pipe length)
90 Degree bend	3
45 Degree bend	2
22 ½ degree bend	2
Tee, Branch	3
Tee, Run	2

- B. No restraining is required in the direction of the existing pipe if only a short length of it is exposed in the trench for making a connection.
- C. Restrained joint assemblies for push-on pipe and fittings shall be made in strict accordance with the manufacturer's recommended installation procedures.
- D. Restrained joint assemblies for mechanical joint pipe shall be EBAA Iron MEGALUG, Cascade Waterworks Rapidfit, U.S Pipe Co. MJ Field Lok, or approved equivalent.

**3.7 WATER / SANITARY SEWER SEPARATION**

- A. When a sewer pipe crosses above or below a water pipe, Contractor shall comply with these following procedures:

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1. Relation to Water Mains

- a. Horizontal Separation: Whenever possible, sewers shall be laid below, and at a minimum at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet, but no closer than 2 feet, to a water main if:
  - 1) It is laid in a separate trench, or
  - 2) It is laid in the same trench with the water main located at one side on a bench of undistributed earth, and
  - 3) In either case, the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.
- b. Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.
- c. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe, or other equivalent based on watertightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure watertightness, or both pipes shall be encased in concrete.

3.8 GATE VALVES AND BOXES

- A. Valves shall be set in firmly compacted and shaped soil. Where the soil in the trench subgrade is found to be soft, loose, freshly filled earth, unstable or unsuitable as a base, the unsuitable material shall be excavated to such additional depth and width as required. The excavated area shall be backfilled with gravel or crushed stone, compacted and shaped.
- B. Valve boxes shall be set centered and plumb over the operating nuts of all valves. The top of each valve box shall be set to finished grade with at least 10 inches of overlap remaining between the upper sections for vertical adjustment. Minimum overlap for lower, extension pieces shall be 4 inches.
- C. Boxes shall be adequately supported during backfilling to maintain vertical alignment.

3.9 TAPPING SLEEVES AND GATE VALVES

- A. Installation shall be made under pressure and the flow of water through the existing pipe shall be maintained at all times. The diameter of the tap shall be a minimum of ¼ inch less than the inside diameter of the branch line.
- B. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves, and under supervision of qualified personnel furnished by the manufacturer. The tapping machine shall be furnished by the Contractor.

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- C. Contractor shall determine the location of the existing pipe to be tapped to confirm that interference will not be encountered from existing utilities or a joint or a fitting. No tap shall be made closer than 3 feet from a pipe joint.
- D. Pipe upon which tapping sleeve is to be installed shall be thoroughly cleaned of all foreign matter with scraping tools and wire brushes to a minimum of six inches beyond each side of the sleeve. The cleaned area shall be washed with a hypochlorite solution. The interior of tapping valve shall also be washed with hypochlorite solution.
- E. Tapping sleeves and valves with boxes shall be set vertically and squarely centered on the pipe to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks shall be provided behind all tapping sleeves. the supporting earth around and under the valve and sleeve shall be compacted. After completing the tap, the valve shall be flushed to ensure that the valve set is clean.
- F. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeve together shall be heavily coated with two coats of bituminous paint.

### 3.10 HYDRANTS

- A. Hydrants shall be installed at the locations and in conformance with the details shown on the drawings.
- B. Each hydrant shall be set vertically and be properly braced. Hydrants shall be installed with thrust blocks or restrained joints as specified in Articles 3.6 and 3.7. Care shall be taken to ensure that thrust block concrete does not plug the drain ports.

### 3.11 WATER SERVICES

- A. Service Pipe: Care shall be exercised in placing and laying of services to prevent kinks or sharp bends and contact with sharp stones or ledge which would damage to the pipe. At least 6 inches of sand shall be placed adjacent to, under, and above the pipe, and no stone larger than 2 inches shall be placed over the pipe until the depth of backfill above the pipe is in excess of 1 foot.
- B. Corporation Stop: Taps to the pipe shall be threaded and shall be made at the horizontal diameter of the main. The tap shall be made by means of a tapping machine manufactured for this purpose and supplied by the Contractor. The tap and drill shall be kept sharp and shall have threads matching those of the stop. Corporation stop threads shall be coated with sealing compound and the stop screwed firmly into the water with the key upward and the inlet end projecting at least 1/8-inch beyond the inside face of the pipe. The corporation stop shall be left in the on (open) position after installation of the service pipe.
- C. Curb Stop and Curb Boxes shall be of a size equal to the size of the service pipe and shall be installed in the locations shown on the drawings, or as ordered by Engineer. The boxes shall be set in a vertical position and flush with the proposed finish grade.
- D. Ductile Iron Service Pipe: ductile iron service pipe connections to the water main shall be made with tee fittings or tapping sleeves.

### 3.12 POLYETHYLENE ENCASEMENT

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- A. Installation of polyethylene encasement shall be in accordance with the recommended procedures contained in ANSI A21.5-99/AWWA C105 and when directed by Engineer Water Department or Engineer.
- B. Care shall be taken during backfilling to prevent damage to polyethylene wrap. backfilling shall be in accordance with AWWA C600-99.

**3.13 PRESSURE TESTING**

- A. Hydrostatic and leakage test shall be conducted in accordance with AWWA Standard C600-99 and C900-97, and as directed by Engineer. Testing shall be conducted by a certified Independent Water Testing Company.
- B. Conduct pipe tests after concrete thrust blocks have cured to the required 3000-psi strength. Fill pipe 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.
- C. Prior to pressure testing, the entire pipe section shall be flushed to remove any rocks or debris, which may have inadvertently entered the pipe during construction.
- D. Once the pipe section has been filled at normal pressure and all entrapped air removed, the Contractor shall raise the pressure to 150 psi or two times the operating pressure (whichever is greater) by a special pressure pump, taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumping into the pipe. This pressure shall be maintained for a minimum of 2 hours, during which time the line shall be checked for leaks. Measured rate of water leakage shall not exceed the allowable leakage listed below.

Maximum Allowable Leakage

Test Pressure (psi)	Nominal Pipe Diameter (inches)	Allowable Leakage (gallons per hour per 1,000 feet of pipeline)
PART 1 150	PART 2 4	PART 3 0.36
PART 4 150	PART 5 6	PART 6 0.55
PART 7 150	PART 8 8	PART 9 0.74
PART 10 150	PART 11 10	PART 12 0.92
PART 13 150	PART 14 12	PART 15 1.10
PART 16 150	PART 17 16	PART 18 1.47

- A. Interior piping in vaults, buildings, etc. shall have zero leakage.
- B. Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair them. Pipe will be accepted only when leakage is zero, or less than the allowable amount. Approval does not absolve the Contractor from responsibility if leaks develop later within the period of warranty.

**18.2 DISINFECTION**

- A. Before being placed in service, all new water pipe shall be chlorinated in accordance with AWWA C651-99 Standard for Disinfecting Water Mains or Engineer requirements/regulations, whichever is the more stringent.

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- B. The location of the chlorination and sampling points will be determined by the jurisdictional authority in the field. Taps for chlorination and sampling shall be installed by Contractor. Contractor shall uncover and backfill the taps as required.
- C. The pipe section being disinfected shall be flushed to remove discolored water and sediment from the pipe. a 25-mg/l chlorine solution in approved dosages shall be inserted through a tap at one end while water is being withdrawn at the other end of the pipe section. The chlorine concentration in the water in the pipe shall be maintained at a minimum 25-mg/l available chlorine during filling. To assure that this concentration is maintained, the chlorine residual shall be measured at regular intervals in accordance with procedures described in Standard Methods and AWWA M12, Simplified Procedure for Water Examination [Section K].
- D. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the pipe supplying the water. Chlorine application shall not cease until the entire pipe section is filled with chlorine solution. The chlorinated water shall be retained in the pipe for at least a twenty-four hour period. the treated water shall contain chlorine residual throughout the length of the pipe section as indicated in AWWA C651-99.
- E. Following the chlorination period, all treated water shall be flushed from the pipe section and replaced with water from the distribution system. Prior to disposal of treated water the Contractor shall check with local authorities to determine if the discharge will cause damage to the receiving body or sewer and, if required, the Contractor shall neutralize the chlorinated water in accordance with AWWA recommendations. Bacteriological sampling and analysis of the replacement water may then be made by the Contractor in full accordance with AWWA C651-99. A minimum of three samples shall be taken by the Contractor at locations directed by Engineer along the length of water pipe being chlorinated and sent to a State approved private laboratory for analyses. The Contractor shall rechlorinate if the samples show presence of coliform, and the pipe section shall not be placed in service until all of the repeat samples show no presence of coliform.
- F. Furnish two copies of a Certificate of Disinfection Report to Engineer and one copy to Engineer.
- G. Contractor shall pay all costs for all testing, flushing, chlorinating, laboratory analyses, sampling, water supply and municipal charges.

**18.3 AS-BUILT DRAWINGS**

- A. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relive Contractor from satisfying the requirements of local permitting authorities.
- B. As work progresses, record the following on two (2) sets of Drawings:
- C. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.
- D. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
- E. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.

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- F. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.
- G. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

**18.4 CLEAN UP**

- A. Contractor shall remove all debris, residuals, and materials at the conclusion of the work.

**END OF SECTION 331900**





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SECTION 333100 – SANITARY SEWERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section Includes:
  - 1. Installation of sanitary sewage pipe and fittings.
  - 2. Installation of sanitary specials, connection chimneys, laterals, outlets, and joint materials.
  - 3. Installation of sanitary sewer manholes.
  - 4. Installation of grease traps.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.
- D. Contractor is solely responsible for obtaining permits or approvals which may be required to perform the work of this section, including all costs, fees and taxes required or levied. Notify and obtain such permits or approvals from all agencies having jurisdiction prior to starting work.

1.3 REFERENCE STANDARDS

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM).
  - 1. ASTM A47/A47M—Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process.
  - 2. ASTM A48—Standard Specification for Gray Iron Castings.
  - 3. ASTM A123/A123M—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 4. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - 5. ASTM A536—Standard Specification for Ductile Iron Castings.

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6. ASTM A563—Standard Specification for Carbon and Alloy Steel Nuts.
7. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
8. ASTM A74—Standard Specification for Cast Iron Soil Pipe and Fittings.
9. ASTM A746—Standard Specification for Ductile Iron Gravity Sewer Pipe.
10. ASTM C12—Standard Practice for Installing Vitrified Clay Pipe Lines.
11. ASTM C14—Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
12. ASTM C55—Standard Specification for Concrete Building Brick.
13. ASTM C76—Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
14. ASTM C94—Standard Specification for Ready-Mixed Concrete.
15. ASTM C139—Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
16. ASTM C150—Standard Specification for Portland Cement.
17. ASTM C207—Standard Specification for Hydrated Lime for Masonry Purposes.
18. ASTM C270—Standard Specification for Mortar for Unit Masonry.
19. ASTM C387—Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
20. ASTM C425—Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
21. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
22. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
23. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
24. ASTM C507—Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
25. ASTM C564—Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
26. ASTM C700—Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
27. ASTM C1628—Standard Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets.
28. ASTM C828—Low-Pressure Air Test of Vitrified Clay Pipe Lines.

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29. ASTM C877—Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
30. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
31. ASTM C923—Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
32. ASTM C924—Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
33. ASTM C969—Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
34. ASTM C972—Compression-Recovery of Tape Sealant.
35. ASTM C990—Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.
36. ASTM D412—Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
37. ASTM D624—Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
38. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
39. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120.
40. ASTM D2235—Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
41. ASTM D2241—Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
42. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
43. ASTM D2412—Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
44. ASTM D2464—Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
45. ASTM D2466—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
46. ASTM D2467—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
47. ASTM D2680—Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
48. AASTM D2751—Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

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49. ASTM D2996—Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
50. ASTM D2997—Centrifugally Cast “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
51. ASTM D3034—Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
52. ASTM D3139—Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
53. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
54. ASTM D3262—“Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
55. ASTM D3350—Polyethylene Plastics Pipe and Fittings Materials.
56. ASTM D3753—Glass-Fiber-Reinforced Polyester Manholes and Wetwells.
57. ASTM D3840—“Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications.
58. ASTM D4101—Standard Specification for Polypropylene Injection and Extrusion Materials.
59. ASTM D4161—“Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
60. ASTM D4396—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications.
61. ASTM F402—Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
62. ASTM F405—Corrugated Polyethylene (PE) Tubing and Fittings.
63. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
64. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
65. ASTM F714—Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
66. ASTM F758—Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.
67. ASTM F794—Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
68. ASTM F894—Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.
69. ASTM F949—Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings.

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- 70. ASTM F1336—Standard Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.
- 71. ASTM F1803—Standard Specification for Poly (Vinyl Chloride)(PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter.
- D. American Water Works Association (AWWA).
  - 1. “PVC Pipe—Design and Installation,” M23 (latest edition. and applicable supplements thereto).
  - 2. “Concrete Pressure Pipe,” M9 (latest edition and applicable supplements thereto).
  - 3. ANSI/AWWA C104/A21.4—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - 4. ANSI/AWWA C105/A21.5—Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - 5. ANSI/AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings for Water.
  - 6. ANSI/AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - 7. ANSI/AWWA C150/A21.50—Thickness Design of Ductile-Iron Pipe.
  - 8. ANSI/AWWA C151/A21.51—Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
  - 9. ANSI/AWWA C153/A21.53—Ductile-Iron Compact Fittings for Water Service.
  - 10. ANSI/AWWA C600—Installation of Ductile-Iron Water Mains and Their Appurtenances.
- E. American Concrete Pipe Association (ACPA).
  - 1. ACPA 01-103—Concrete Pipe and Box Culvert Installation (latest revision and applicable supplements thereto).
- F. UNI-BELL PVC PIPE ASSOCIATION (UBPPA).
  - 1. UBPPA UNI-B-6 (1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.
- G. American Association of State Highway and Transportation Officials (AASHTO).
  - 1. Standard Specifications for HS-20, Highway Loading (AASHTO H-20).

**1.4 SUBMITTALS**

- A. Submit to Engineer for his approval manufacturer's name with details of the pipe, fittings, and joint offered before ordering. Engineer reserves the right to have the manufacturer submit to them a printed certified set of material specifications certifying to the manufacturer's conformity with this Section.
- B. Product data for all materials provided under this Section.
- C. Prior to ordering material, submit shop drawings and descriptive literature showing dimensions, joint and other details of all materials to be furnished under this Section. Such shop drawings

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shall include, but not necessarily be limited to, joint and other details for precast manholes, manhole frames and covers, and flexible joint sealant for manholes.

- D. Samples of each size and type of pipe to be utilized. No pipe shall be ordered or delivered until Engineer has approved the pipe material.
- E. As-Built Drawings
  - 1. Submit two (2) copies of As-Built Drawings upon completion and acceptance of work.
  - 2. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall include a minimum of three (3) ties showing the distance to each catch basin and manhole, and the location of service connections measured from fixed permanent objects. As-Built drawings shall also contain any additional information required by Engineer.

#### 1.5 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- C. Sample pipe for testing, when requested by Engineer, shall be furnished by Contractor in sufficient numbers. The Contractor and/or the pipe manufacturer shall make the facilities and services for making the load tests available.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage
  - 1. Manufacturer shall package the pipe in a manner designed to deliver the pipe to the Project Site neatly, intact, and without physical damage. Transportation carrier shall use an appropriate method to ensure the pipe is properly supported, stacked, and restrained during transport. Inspect materials delivered to site for damage; store with minimum of handling.
  - 2. Unloading of the pipe should be controlled so as not to collide with the other pipe sections or fittings, and care should be taken to avoid chipping or spalling, especially to the spigots and bells. For manhole sections, cone sections, bases, fittings and other precast appurtenances, utilize lifting holes or lifting eyes provided.
  - 3. In cold weather conditions, use caution to prevent impact damage. Handling methods considered acceptable for warm weather may be unacceptable during cold weather.
  - 4. Storage:
    - a. Store materials on site in enclosures or under protective coverings. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
    - b. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging.

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- c. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials under cover out of direct sunlight. Provide additional storage measures in accordance with the manufacturer's recommendations. Discard materials if storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.
- d. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- e. Cement, Aggregate, and Reinforcement: As specified in Section 033200—Site Cast-in-Place Concrete.
- f. Store manhole units in an upright position.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Products furnished under this Section which are damaged or found defective in any way prior to being set in place and final acceptance, may be rejected. Engineer may reject an entire lot of pipe should the sample pipe from such lot fail to meet requirements.

### **2.2 CONCRETE GRAVITY PIPE**

- A. Reinforced concrete pipe, ASTM C76, Class III or Class IV, Wall B or Wall C.
  - 1. Class III pipe shall be used unless otherwise indicated.
  - 2. Class IV pipe shall be used when depth of soil cover is less than 12 inches. Depth of cover shall not be considered to include pavements or similar surficial finishes.
  - 3. Wall B pipe shall be used for all pipe sizes less than 24", where depth is less than 16 feet.
  - 4. Wall C pipe shall be used for pipe sizes 24" and larger at any depth and for all pipe sizes where depth is 16 to 25 feet.
- B. Fittings and specials shall conform to the applicable requirements specified for the pipe.
- C. Gaskets and pipe ends for rubber gasket joint: ASTM C443. Gaskets shall be suitable for use with sewage.

### **2.3 CONCRETE PRESSURE PIPE**

- A. Concrete pipe, ASTM C361. Pipe shall be designed for hydrostatic head of **[100] [125]** feet and external loading sufficient for the earth cover indicated on the drawings. Circular pipe with elliptical reinforcement shall have a readily visible line at least 12 inches long painted or otherwise applied on the inside and outside of the pipe at each end so that when the pipe is laid in the proper position, the line will be at the center of the top of the pipe.
- B. Fittings and specials shall conform to the applicable requirements specified for the pipe, AWWA C302.
- C. Gaskets: ASTM C361, suitable for use with sewage.

### **2.4 POLYVINYL CHLORIDE (PVC) GRAVITY PIPE**



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- A. Pipe, 4-inch to 15-inch diameter: ASTM D3034, SDR-35. Integral bell gasket joints with factory-installed retained integral gaskets. Minimum pipe stiffness of 46 psi, ASTM D3412.
- B. Pipe, 18-inch to 36-inch diameter: ASTM F679. Integral bell gasket joints with factory-installed retained integral gaskets. Minimum pipe stiffness of 46 psi, ASTM D3412.
- C. PVC Cell classification: 12454 or 12364, ASTM D1784.
- D. Markings
  - 1. Manufacturer's name or trademark.
  - 2. The standard to which it conforms/ASTM Designation.
  - 3. Pipe size.
  - 4. Material designation code/PVC cell classification.
  - 5. SDR number or schedule number.
- E. Joints
  - 1. Joints: ASTM D3212, gasketed, bell-and-spigot, push-on type.
  - 2. Gaskets: ASTM F477. Gaskets shall be part of a complete pipe section, factory-installed or field-installed per pipe manufacturer's requirements. Lubricant shall be as recommended by the pipe manufacturer.
- F. Fittings: SDR-35, ASTM D3034 and ASTM F1336, specifications to match pipe.
- G. Waterstops: Elastomeric PVC, sized for outside diameter of pipe.
- H. No single piece of pipe shall be laid on any project covered by these specifications unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed  $\frac{1}{16}$  inch per foot of length. If the deviation from straightness exceeds this requirement, then the particular piece of pipe shall be rejected.

## 2.5 PVC FORCE MAIN PIPE

- A. Polyvinyl Chloride (PVC) Sanitary Sewer Force Main pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454-A or 12454-B per ASTM D1784.
- B. All pipes shall be suitable for use as a pressure conduit for sanitary sewage.
- C. Pipe shall be either SDR-14 (200 psi) meeting the requirements of AWWA C900 or Schedule 80 meeting the requirements of ASTM D1785.
- D. Fittings shall be gasketed joint meeting the requirements of ASTM D3139, and the joint gasket shall conform to ASTM F477.
- E. Force main pipe shall be a minimum of 3-inch diameter.

## 2.6 DUCTILE IRON PIPE

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- A. Ductile Iron Pipe: ASTM A746 and ANSI/AWWA C151/A21.51. Thickness Class 52, ANSI/AWWA C150/A21.50, unless indicated otherwise on the Drawings or directed otherwise by Engineer.
  - 1. Push-on joints, except as otherwise specified. Mechanical joints shall only be used where indicated. Push-on joint pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to ANSI/AWWA C111/A21.11.
  - 2. Mechanical joint requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to ANSI/AWWA C111/A21.11.
  - 3. Cement Lining: Double Thickness, ANSI/AWWA C 104/A 21.4.
  - 4. Corrosion Control: Polyethylene wrap in tube or sheet form, ANSI/AWWA C105/A21.5.
- B. Fittings
  - 1. Bituminous coated inside and outside, furnished complete with necessary accessories including plain rubber gaskets, ductile-iron glands, bolts and nuts. Fittings shall have strength at least equivalent to that of the pipe and shall be installed as called-for on the Drawings or required to complete the work.
  - 2. Flanged Fittings: ANSI/AWWA C110/A21.10, flange drilling 125.
  - 3. Mechanical Joint Fittings: ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 where applicable.
- C. Tees for capped outlets shall be installed and capped where called for on the Contract Drawings or as ordered by Engineer.
- D. All cuttings of ductile iron pipe shall be done with a pipe cutter or saw (not by chisel or other unapproved methods) at 90 degrees to the pipe. All cut edges shall be smoothed by filing/grinding.

**2.7 JOINT LUBRICANT**

- A. As specified by pipe manufacturer, ANSI/AWWA C111/A21.11.

**2.8 CONCRETE MANHOLE**

- A. Reinforced precast concrete base, riser, and top: ASTM C478. Sections shall consist of smooth circular sections in standard nominal inside diameters, type and dimensions as indicated on the Drawings. All components shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities.
  - 1. Diameter: 48 inches unless otherwise indicated.
  - 2. Concrete: 4,000 psi minimum.
  - 3. Top Section: Concentric-cone type, unless eccentric-cone or flat-slab-top type is indicated. Cones shall have the same wall thickness and reinforcement as riser sections. If required or called-for, flat slab shall be a minimum of 8 inches thick designed to carry AASHTO H-20 loading with one foot cover and conform to ASTM C478.
  - 4. Bottom: Bottoms shall be integrally cast unless specialty bases ("Dog-House") at points of connection to existing sewer mains are indicated on the Drawings or otherwise proposed for

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use. Unless indicated on the Drawings, any special bases or riser used must be detailed in shop drawings and submitted for approval.

5. External damp-proofing: Asphalt, ASTM D449, Type A.
  6. [Internal waterproofing: Where required, 60-mil polyvinylchloride or polyethelene sheet with webs or ribs to mechanically lock the sheet to the manhole wall. Joint strips shall be ribless and shall be a minimum of 4 inches wide.]
  7. Openings or “knockouts” in precast units shall be located as shown on the Drawings and to accommodate the inflow and outflow pipe orientation required. Openings shall sized sufficiently to permit passage of the largest outside dimension of pipe or fittings. Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.
- B. Gaskets for joints between manhole sections: Butyl rubber, ASTM C443.
- C. Grade Rings: ASTM C478, precast reinforced concrete, 1-inch to 4-inch thickness, diameter to match manhole and frame.
- D. [Frame and Cover: Ductile Cast Iron, ASTM A536, Grade 60-40-18.]
- E. [Frame and Cover: Grey Cast Iron, ASTM A48, Class 35B.]
1. Cover: 26 inch diameter, non-vented with non-penetrating pickholes. Unless otherwise detailed or indicated, covers shall be cast with 1½ inch wide, raised letters, indicating “SANITARY SEWER”.
  2. Frame and cover shall be supplied as a pair from the same manufacturer. Castings shall be of tough, even-grained iron, free from scale, lumps, blisters, sand-holes and other injurious defects, and of the size and type shown on the drawings. Frames and covers shall have machined bearing surfaces to seat firmly and prevent rocking and rattling under traffic loads. Before leaving the foundry, castings shall be thoroughly cleaned, subjected to hammer tests for soundness and given two coats of coal tar pitch varnish.
- F. Resilient connectors for joints between manhole and pipes entering manhole: Continuous boot of ¾ inch minimum thickness neoprene, ASTM C923 or ASTM C990. Boots shall be either cast into the manhole wall or installed into a cored opening using internal compression rings. Installed boot shall result in a water-tight connection meeting the performance requirements of ASTM C443.
- G. Steps: ASTM C478 and OSHA 29 CFR 1910.27, drop front or equivalent. Steps shall be nine inches in depth and at least twelve inches in width with an abrasive step surface.
1. [Cast Aluminum Alloy: Aluminum alloy, 6061-T6, tensile 38,000 psi, yield 35,000 psi. Drop front design with upturned embedded ends. All parts of aluminum steps to be embedded in concrete or masonry shall be coated with bituminous paint or zinc chromate primer.]
  2. [Composite Plastic-Steel: One-half (½) inch deformed steel reinforcing rod, ASTM A615, Grade 60, encapsulated in a co-polymer polypropylene plastic, ASTM D2146, Type II, Grade 16906.]
  3. Steps shall be placed in vertical alignment as indicated on the Drawings. Steps shall be uniformly spaced not more than sixteen inches (16”) on center, including the spacing between the top step and the manhole cover. Steps shall be embedded in the wall a minimum distance

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of 4 inches in either cast or drilled holes. Steps shall not be driven or vibrated into fresh concrete and shall withstand a pullout resistance of 2,000 lbs when tested in accordance with ASTM C497. Each step shall project a minimum of 5 inches from the wall measured from the point of embedment.

**2.9 DROP MANHOLE**

- A. Provide Concrete Manhole as specified herein.
- B. Drop inlet shall be constructed with ductile iron gravity sewer pipe laid in undisturbed soil in conformance with ASTM A746-82. Adapt to PVC with Fernco coupling or approved equivalent.
- C. Vertical drop pipe shall be 8", 10", or 12" maximum SDR 35 PVC with 90-degree short bend radius shall conform to ASTM D3034.
- D. Vertical drop pipe shall be anchored a minimum of every 4 feet with  $\frac{1}{8}$ " x  $1\frac{1}{2}$ " type 304 stainless steel pipe straps set as ordered with lag bolts and shields.

**2.10 MORTAR**

- A. Mortar: ASTM C270/ASTM C387.
  - 1. Portland Cement: ASTM C150, Type I.
  - 2. Sand: ASTM C144.
  - 3. Hydrated Lime: ASTM C207.
  - 4. Water: Potable.
  - 5. Mix proportions for manhole rims and covers: 1 part portland cement, 2 parts sand, and  $\frac{1}{4}$  part hydrated lime by dry volume. Hydrated lime shall not exceed 10 percent by weight of the total dry mix. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed  $5\frac{1}{2}$  gallons of water per sack of cement.
  - 6. Mix Proportions for invert construction: 1 part portland cement and 2 parts sand by volume. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed  $5\frac{1}{2}$  gallons of water per sack of cement.

**2.11 THRUST BLOCKS**

- A. Provide concrete thrust blocks for pipe anchorage sized and positioned as indicated on the Drawings or as otherwise required.
- B. Concrete: ASTM C94, minimum compressive strength of 2,000 psi at 28 days.

**2.12 GREASE TRAP**

- A. Precast concrete or fiberglass of the configuration and dimensions shown on the Drawings.
- B. Units shall be as manufactured by United Concrete Products, Inc. (Yalesville, CT); Rotondo Precast (Rehoboth, MA); Sparkling Clear Industries (Houston, TX), or approved equal.
- C. Concrete units

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1. All components shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities.
  2. H-20 loading with one foot of cover, manhole riser with frame and cones, plus the weight of the soil above.
  3. Anchorage system for high groundwater/buoyancy.
  4. Joints: Butyl rubber gasket joints, ASTM C990.
- D. Fiberglass Units
1. Glass-fiber construction that uses a thixotropic polyester resin specifically for the manufacturer of reinforced products. The material shall be inert, non-corrosive and impervious to retained wastes.
  2. H-20 loading with one foot of cover, manhole riser with frame and cover, plus the weight of soil above.
  3. Anchorage system for high groundwater/buoyancy.
- E. Unit manufacturer shall provide cleanout, sample and ventilation ports and a grease level monitoring and alarm system.

## 2.13 BEDDING

- A. Pipes: Unless otherwise indicated or directed by Engineer, screened gravel, maximum size  $\frac{3}{4}$  inches and minimum size  $\frac{3}{8}$  inches consisting of clean, hard, and durable fragments. No limestone shall be permitted.
- B. Manholes: Screened Gravel or Crushed Stone, well graded in size from  $\frac{3}{4}$  inch to  $\frac{3}{8}$  inch consisting of clean, hard, and durable fragments. No limestone shall be permitted.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. Depending upon pipe type, comply with ASTM C1479, ASTM D2321, and pipe manufacturer's requirements for installation.
- B. Inspect each pipe, fitting or other material before and after installation; replace those found defective and remove from Project Site.
- C. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry or hoist, do not drag, pipe to trench. Provide proper facilities for lowering sections of pipe, manholes or other appurtenances into trenches and excavations without damage.
- D. Wyes, tees and bends and adapters may not be explicitly indicated on the drawings but shall be installed as required to route pipe as indicated. Plans for such fittings showing cross sectional views with dimensions shall be provided by Contractor to Engineer for approval prior to use.
- E. Dry conditions shall be maintained at all times and under no circumstances shall pipe be laid or appurtenances installed in water.

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**3.2 EARTHWORK**

- A. Excavation, the type of materials to be used in bedding and backfilling, and the method of placement shall conform to the requirements of Section 31 2310—Earthwork and the details shown on the Drawings.
- B. Excavation for cover:
  - 1. Under Roads and similar areas: Unless shown on the Drawings or otherwise specified, three (3) feet six (6) inches.
  - 2. Landscape and grass areas: Unless shown on the Drawings or otherwise specified, four (4) feet.
- C. Trenches should be excavated to the dimensions and grade specified on the Drawings or as ordered by engineer. The width of the trenches should be kept to the minimum required for installation of pipe sections.
  - 1. Maximum trench width in soil: 1.25 times outside pipe diameter, in inches, plus one (1) foot measured at the springline of the pipe.
  - 2. Maximum trench width in rock: Four (4) feet plus outside pipe diameter measured at the springline of the pipe.
- D. The bottom of trenches shall be sufficiently graded to ensure uniform bearing for the full length of all pipes.
- E. Backfill, with approved materials, and properly compact the following:
  - 1. Over excavated areas
  - 2. Soft, unstable, or unsuitable material.
- F. Trenches shall be maintained in a safe condition at all times. Contractor shall furnish and employ such stay braces, sheeting, shoring, pumps, etc., as may be necessary for the proper completion of work, the protection of property and the safety of the public, employees of Contractor, Local Public Agencies, the Engineer, or the State; all in accordance with the current regulations of the Applicable Safety Code and pertinent local ordinances and regulations.
- G. Contractor shall be entirely and solely responsible for the adequacy and sufficiency of all supports and of all sheeting, bracing shoring, underpinning, cofferdamming, etc. The Contractor shall assume the entire and sole liability for damages on account of injury to persons or damage to adjacent pavements and public and private property (including but not limited to, the Work under construction, existing buildings, facilities, etc.) which injury or damage results directly from Contractor's failure to install or to leave in place adequate and sufficient supports, sheeting, bracing, underpinning, cofferdamming, etc.
- H. When blasting is required for the rock excavation, adequate provisions for safety shall be provided and such work shall be performed in compliance with applicable local requirements.
- I. Backfill: Trenches shall be backfilled only after pipe has been inspected and approved and locations of pipes and appurtenances have been recorded.

**3.3 COORDINATION WITH OTHER UTILITIES**

- A. Verify clearances for other utilities as required prior to proceeding with the work.

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**B. Crossing Water and Sewer Lines**

1. Crossings shall be as close to perpendicular as possible.
2. Separation: Minimum 18-inch vertical separation.
3. Sewer line crossing below water line
  - a. Unless approved by Engineer, sewer lines shall cross beneath water lines.
  - b. Ensure adequate support for water line to avoid deflection or damage.
  - c. Lay sewer pipe so that no joint in the sewer line will be closer than three (3) feet, horizontal distance, to the water line.
  - d. Provide screened gravel or crushed stone at the crossing as indicated on the Drawings.
  - e. Pressure Sewer Lines
    - 1) Separation: minimum two (2) feet separation.
    - 2) All portions of the pressure line within 10-feet of the water line shall be concrete-encased or enclosed in a continuous sleeve.
4. Sewer line above water line
  - a. Pressure lines shall not be installed above water lines.
  - b. Provide adequate support for the sewer pipe to maintain line and grade and prevent loading of the water line.
  - c. Lay sewer pipe so that no joint in the sewer line will be closer than three (3) feet, horizontal distance, to the water line.
  - d. For a distance of 10-feet on each side of the crossing, provide either gasketed PVC pressure pipe or a minimum of six (6) inches of concrete encasement.
5. Unusual conditions: When conditions prevent the minimum vertical separation indicated above for any type of crossing, obtain Engineer's approval prior to proceeding.
  - a. Comply with the following minimum requirements:
    - 1) Provide sewer pipe meeting AWWA standards for potable water conveyance for a distance of 10-feet on each side of the crossing. Pressure test this segment in-place per AWWA standards without leakage prior to backfilling; or
    - 2) Encase the lower pipe in a minimum of six (6) inches of concrete for a distance of 10-feet on each side of the crossing.

**C. Parallel Water and Sewer Lines**

1. Normal conditions: Sanitary piping or manholes shall be laid at least ten (10) feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.

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2. Unusual conditions: When conditions prevent a horizontal separation of ten (10) feet, the sanitary piping or manhole may be laid closer to a water line provided that:
  - a. The top (crown) of the sanitary piping shall be at least 18 inches below the bottom (invert) of the water main.
  - b. Where this separation cannot be obtained, provide sanitary pipe meeting AWWA standards for potable water conveyance pressure tested in place without leakage prior to backfilling.
  - c. Sewer manholes shall be of watertight construction and tested in place.
- D. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

### 3.4 PIPE INSTALLATION

- A. All pipe shall be installed per the recommendations of the pipe manufacturer, unless otherwise specified.
- B. Clean and dry surfaces receiving lubricants, cements, or adhesives. Affix gaskets to pipe not more than 24 hours prior to the installation of the pipe. Protect gaskets from sun, blowing dust, and other deleterious agents at all times. Before installation of the pipe, inspect gaskets and remove and replace loose or improperly affixed gaskets. Align each pipe section with the previously installed pipe section, and pull the joint together.
- C. Commencing at the lowest point in the system, the pipe and fittings shall be carefully laid true to line and grade with the bell or groove-end upgrade.
- D. A stopper shall be kept in the pipe mouth when the pipe laying is not in progress.
- E. The ends of pipe, which enter masonry, shall be neatly cut to fit the inner face of the masonry.
  1. The upper surface of the screened gravel shall be shaped as necessary to provide proper grade for the pipe to be laid thereon, bell holes shall be made in the screened gravel so the pipe shall be supported on its barrel portion only, and the pipe laid thereon to line and grade in the manner described in these Specifications.
- F. When the pipe is properly positioned, screened gravel, unless otherwise required by the drawings or Engineer, shall be pulled or scraped up against the pipe and rammed into place along the barrel of the pipe only, to firmly hold the pipe in position. Care shall be taken during these operations to assure that the pipe is not disturbed.
- G. Screened Gravel Haunching and Sand Stop:
  1. All pipe and laterals connected thereto, shall be haunched with bedding from the foundation to a point at least to the top of the pipe and to this same elevation out to the trench wall. Care shall be taken when placing bedding in haunching, to assure that the pipe is not disturbed.
  2. Contractor shall use any means necessary to assure firm compaction of haunching and adequate side support for the pipe.
  3. Contractor shall provide and install a filter fabric sand stop per Section 02290 for the full trench width for all sanitary sewer mains and laterals. Filter fabric shall be placed on top of the



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screened gravel prior to placement of 12" gravel/sand cushion. All costs for furnishing and placing of the filter fabric shall be included in the price bid per foot of pipe of all sizes.

- H. Backfill trenches from the top of the screened gravel haunching and sand stop to 12" above the top of pipe with firmly compacted sand or fine gravel or other suitable material exercising care so as not to damage or disturb the pipe.
- I. Backfill from 12" above the top of pipe to top of trench with bank run gravel, sand, or other approved material in roadway areas, otherwise suitable existing material may be used if approved by Engineer.
- J. Fill on both sides of pipe and up to a depth of 12 inches over top of pipe shall be placed carefully by hand in layers, 6 inches thick, and each layer will be tamped and compacted before the next layer is placed. Care must be taken that the fill is compact and tight under the lower half of the pipe. Remaining backfill shall be placed in layers of not more than 12 inches in depth after compaction and shall be thoroughly compacted by means of mechanical rammers or vibrators or by pneumatic tampers. Hand tampers shall be used only around the pipe as approved by Engineer. All voids along sides of trench, behind sheeting, under bracing or other objects, shall be completely and carefully filled, using such fine materials, hand labor and tools as may be necessary. All backfill materials shall be compacted to a minimum of 95% of the maximum dry density as determined by AASHTO T-180 Method D or as directed by Engineer.
- K. At Engineer's discretion, the Contractor may compact the backfill from 12 inches over the pipe to finish grade by means of a Ho-Pac. Engineer shall also have the right to approve or disapprove the compaction equipment to be used and also the height of backfill to be compacted in one lift.
- L. Backfill, screened gravel foundation and haunching shall be provided and installed as shown on the typical trench cross-section shown on the Drawings.

### 3.5 SPECIAL REQUIREMENTS

- A. The following subarticles supplement execution requirements set forth in Article 3.4.
- B. Installation of PVC Plastic Piping
  - 1. Install pipe and fittings in accordance with Article 3.4 and ASTM D2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

### 3.6 MANHOLE INSTALLATION

- A. Furnish complete manhole assemblies conforming to the Drawings and as specified herein.
- B. Precast reinforced concrete manhole sections shall be set so as to be vertical and with section in true alignment. Joints of the base and precast section shall be formed and sealed with "O" ring type rubber gaskets. Joints shall be painted with mortar and exterior joints thoroughly tooled so as to be slightly concave with a hard polished surface free from drying cracks. Interior joints shall be tooled flush in a similar manner. Mortar shall be as specified herein for brick masonry.
- C. All holes in sections, used for their handling, shall be thoroughly plugged with mortar. Finish smooth and flush with adjoining surfaces.

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- D. The manufacturer shall provide waterstops acceptable to Engineer, which shall be applied to the outside of the plastic pipe where the pipe is to be enclosed in any structure where concrete or mortar is used to prevent leakage along the outer wall of the barrel of the pipe.
- E. Manhole frames shall be set with the tops conforming accurately to the grade of or finished ground surface or as indicated on the plans or directed. Adjust to grade with clay bricks and mortar, not to exceed five brick courses. Frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring or mortar extending to the outer edge of the masonry shall be placed all around the bottom flange and have a slight slope to shed water away from the frame.
- F. Manhole covers shall be left in place in the frames on completion of other work at the manholes.

### 3.7 GREASE TRAP

- A. Grease traps shall be installed in accordance with the manufacturer's recommendations.
- B. The unit shall be placed on a minimum of 12 inches of compacted gravel on compacted subgrade.
- C. The joints of field-assembled sections shall be waterproof.
- D. Manhole riser sections, frames and covers shall be installed as required and detailed.

### 3.8 FIELD PERFORMANCE TESTS

- A. Joints shall sustain a maximum limit of 50 gallons per inch of diameter per foot per day per mile when field tested by actual infiltration conditions. All sanitary sewers which lie between 25 feet and 75 feet of a water supply well shall not exceed a leakage of 25 gallons per day per inch diameter of pipe per mile of sewer.
- B. These requirements will be met for every section (between manholes) of pipe; it is not a cumulative average over several sections of pipe. The low pressure air test as described in these specifications will be required for all sanitary sewer installations.

### 3.9 LEAKAGE TESTS FOR SEWER MANHOLES

- A. General: Leakage tests shall be made and observed by Engineer on each manhole. The test shall be an exfiltration test or vacuum test, made as described below.
- B. Preparation for Test: After the manhole has been assembled in place, all lifting holes and those exterior joints within 6 feet of the ground surface shall be filled and pointed with an approved non-shrinking mortar. The test shall be made prior to placing the self and invert and before filling and pointing the horizontal joints below the 6-foot depth line. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out.
- C. Test Procedure: The manhole shall then be filled with water to the top of the cone section. If the excavation has not been backfilled and observations indicate no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily water-tight. If the test as described above is satisfactory, as determined by Engineer, or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes to allow for absorption. At the end of this

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period, the manhole shall be refilled to the top of the cone, if necessary, and the measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period. If the test fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by Engineer to bring the leakage within the allowable rate of 1 gallon per vertical foot per day. Leakage due to a defective section of joint, or exceeding the 3 gallon per vertical foot per day, shall be cause for the rejection of the manhole. It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as directed by Engineer. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.

- D. Backfilling: The test may be conducted either before or after backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at their own risk and it shall be incumbent upon the Contractor to determine the reason for any failure of the test. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc., i.e., it will be assumed that all loss of water during the test is a result of leaks through the concrete. Furthermore, the Contractor shall take any steps necessary to assure Engineer that the water table is below the bottom of the manhole throughout the test.
- E. Infiltration Test: If the groundwater table is above the highest joint in the manhole, and if there is no leakage into the manhole as determined by Engineer, such a test can be used to evaluate the water-tightness of the manhole. However, if Engineer is not satisfied, the Contractor shall lower the water table and carry out the test as described herein before.
- F. Vacuum Testing
  - 1. The vacuum testing system shall be a unit as supplied by P.A. Glazier, Inc.—Worcester, MA 01613 (508) 755-3849, Cherne Industries, Inc.—Minneapolis, MN 55436 (800-843-7584); IEQ industries—Ada, MI 49307 (800-544-9053), or approved equivalent.
  - 2. The testing shall be done immediately after assembly of the manhole and before backfilling. A 60 lb-in torque wrench shall be used to tighten the external clamps that secure the test cover to the top of the manhole. All lift holes shall be plugged with an approved non-shrink grout. No grout will be placed in the horizontal joints before testing. All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.
  - 3. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass the test if the time is greater than 60 seconds for a 48"-diameter manhole, 75 seconds for a 60" manhole, and 90 seconds for a 72" manhole.
  - 4. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn or the test shall be stopped, repairs made and all steps of the test repeated. Re-testing shall proceed until a satisfactory test is obtained.

### 3.10 SEWER PIPE JOINT TESTING

- A. The main sewer line and laterals shall be tested for leakage by the use of low-pressure air as approved by Engineer. The test length shall not exceed one length of pipe between two structures. Air test procedures may be dangerous and the Contractor shall take all necessary precautions to prevent blowouts.

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**B. Pneumatic Plugs**

1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.
2. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
3. All air used shall pass through a single control panel.
4. Three individual hoses shall be used for the following connections:
  - a. From control panel to pneumatic plugs for inflation;
  - b. From control panel to sealed line for introducing the low pressure air;
  - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

**C. The following testing procedures shall be explicitly followed:**

1. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
2. After the pipe has been backfilled and cleaned, pneumatic plugs shall be placed in the line at each manhole and inflated to 25 psi. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psi greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.
3. After the stabilization period (3.5 psi minimum pressure in the pipe), the portion of pipe tested shall be acceptable if the time required in minutes for the pressure to decrease from 3.5 to 3.0 psi (greater than the average back pressure of any ground water that may be over the pipe) is not less than the time indicated in the following table:

Minimum Pressure Drop Time

Pipe Size (in.)	Time (sec)
4	0.190L
6	0.427L
8	0.760L
10	1.187L
12	1.709L
15	2.671L

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- D. Correction of Defective Work: If leakage exceeds the specified amount, the Contractor shall make the necessary repairs or replacements required to permanently reduce the leakage to within the specified limit, and the tests shall be repeated until the leakage requirement is met.
- E. Compliance with Agency Requirements: In the event of conflict between the leakage test requirements specified herein with the leakage test requirements of agencies having jurisdiction over all or any portion of the sewer system installed under this Contract, the more restrictive requirements shall govern.

**3.11 CLEANING AND REPAIR**

- A. The Contractor shall clean the entire sewer system of all debris and obstructions. This cleaning shall include, the removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing sewers, storm drains and or streams.
- B. All work of cleaning and repair shall be performed at no additional cost to Owner.

**3.12 FINAL INSPECTION**

- A. Upon completion of the work, and before final acceptance by Engineer, the entire sewer system shall be subjected to a final inspection in the presence of Engineer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, leakage tests and other requirements have been met.

**3.13 AS-BUILT DRAWINGS**

- A. As work progresses, record on one set of plans all changes and deviations from the Contract Drawings in size, line, and grade. Make sufficient measurements to accurately locate the completed work. Record the locations of any uncharted locations of utilities encountered during installation of the sewer. Deliver the final As-Built drawings to Engineer.
- B. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relieve Contractor from satisfying the requirements of local permitting authorities.
- C. As work progresses, record the following on two (2) sets of Drawings:
  - 1. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.
  - 2. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
- D. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.
- E. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.

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- F. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

END OF SECTION 333100



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SECTION 33400 – STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section Includes:
  - 1. Installation of new storm drain pipe, manholes and catch basins.
  - 2. Connection of exterior building roof drains and perimeter drains.
  - 3. Installation of under-drains.
  - 4. Installation of stormwater treatment units.
  - 5. Installation of stormwater detention units.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.
- D. Contractor is solely responsible for obtaining permits or approvals which may be required to perform the work of this section, including all costs, fees and taxes required or levied. Notify and obtain such permits or approvals from all agencies having jurisdiction prior to starting work.

1.3 REFERENCE STANDARDS

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR)
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM)
  - 1. ASTM A36—Standard Specification for Carbon Structural Steel.
  - 2. ASTM A48—Standard Specification for Gray Iron Castings.
  - 3. ASTM A123—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 4. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - 5. ASTM A536—Standard Specification for Ductile Iron Castings.



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6. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
7. ASTM C12—Standard Practice for Installing Vitrified Clay Pipe Lines.
8. ASTM C14—Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
9. ASTM C55—Standard Specification for Concrete Building Brick.
10. ASTM C76—Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
11. ASTM C94—Standard Specification for Ready-Mixed Concrete.
12. ASTM C139—Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
13. ASTM C150—Standard Specification for Portland Cement.
14. ASTM C207—Standard Specification for Hydrated Lime for Masonry Purposes.
15. ASTM C270—Standard Specification for Mortar for Unit Masonry.
16. ASTM C387—Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
17. ASTM C425—Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
18. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
19. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
20. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
21. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
22. ASTM C507—Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
23. ASTM C564—Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
24. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
25. ASTM C700—Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
26. ASTM C877—Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.

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27. ASTM C890—Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
28. ASTM C913—Standard Specification for Precast Concrete Water and Wastewater Structures.
29. ASTM C923—Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
30. ASTM C990—Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.
31. ASTM C1479—Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
32. ASTM C 1628—Standard Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets.
33. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
34. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120.
35. ASTM D2235—Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
36. ASTM D2241—Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
37. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
38. ASTM D2412—Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
39. ASTM D2466—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
40. ASTM D2467—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
41. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
42. ASTM D2855—Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
43. ASTM D2665—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
44. ASTM D2729—Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
45. ASTM D2855—Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

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46. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
  47. ASTM D3350—Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
  48. ASTM D4396—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications.
  49. ASTM F402—Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
  50. ASTM F405—Corrugated Polyethylene (PE) Tubing and Fittings.
  51. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  52. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
  53. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
  54. ASTM F714—Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
  55. ASTM F758—Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.
  56. ASTM F894—Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.
  57. ASTM F1803—Standard Specification for Poly (Vinyl Chloride)(PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter.
  58. ASTM F2306—Standard Specification for 12 to 60 inch [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
  59. ASTM F2648—Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.
- D. American Concrete Pipe Association (ACPA).
1. ACPA 01-103—Concrete Pipe and Box Culvert Installation (latest revision and applicable supplements thereto).
- E. American Association of State High and Transportation Officials (AASHTO).
1. AASHTO H20—Standard Specifications for HS-20, Highway Loading.
  2. AASHTO M105—Standard Specification for Gray Iron Castings.
  3. AASHTO M198—Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

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- 4. AASHTO M252—Standard Specification for Corrugated Polyethylene Drainage Pipe.
- 5. AASHTO M294—Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter.
- F. Corrugated Polyethylene Pipe Association (CPPA), division of the Plastics Pipe Institute (PPI).
  - 1. Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings (latest revision and applicable supplements thereto).
- G. State of Connecticut Department of Transportation (ConnDOT)
  - 1. Standard Specifications for Roads, Bridges, Facilities, and Incidental Construction, Form 818 and any supplements.

#### 1.4 SUBMITTALS

- A. Shop Drawings:
  - 1. Submit shop drawings, descriptive literature, or both, showing pipe materials and appurtenances to be furnished. Shop drawings shall be submitted to Engineer for approval prior to ordering materials.
  - 2. Shop drawings showing the configuration, dimensions, layout, and spacing of major and minor components such as chambers, treatment units, pipe, joints, couplings, restraints, and other proposed details of assembly. Show in large-scale details any unique assembly, pipe/pipe transitions, pipe/structure transitions, and/or installation requirements.
- B. Copies of manufacturer-provided installation instructions, operation instructions, and maintenance material for all equipment furnished under this Section.
- C. Manufacturer's warranties and associated warranty registration data in Owner's name. Submit two (2) copies of each warranty to Engineer in the manufacture/supplier standard form or if there is no standard form available, in a form specified by Engineer.
- D. As-Built Drawings.

#### 1.5 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- C. Sample pipe for testing, when requested by Engineer, shall be furnished by Contractor in sufficient numbers. The Contractor and/or the pipe manufacturer shall make the facilities and services for making the load tests available.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage

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1. Manufacturer shall package the pipe and other drainage materials in a manner designed to deliver the pipe to the Project Site neatly, intact, and without physical damage. Transportation carrier shall use an appropriate method to ensure the pipe is properly supported, stacked, and restrained during transport. Inspect materials delivered to site for damage; store with minimum of handling.
2. Unloading of the pipe and other drainage materials should be controlled so as not to collide with the other pipe sections or fittings, and care should be taken to avoid chipping or spalling, especially to the spigots and bells. For manhole sections, cone sections, bases, fittings and other precast appurtenances, utilize lifting holes or lifting eyes provided.
3. In cold weather conditions, use caution to prevent impact damage. Handling methods considered acceptable for warm weather may be unacceptable during cold weather.
4. Storage:
  - a. Store materials on site in enclosures or under protective coverings. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
  - b. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging.
  - c. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials under cover out of direct sunlight. Provide additional storage measures in accordance with the manufacturer's recommendations. Discard materials if storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.
  - d. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
  - e. Cement, Aggregate, and Reinforcement: As specified in Section 033200—Site Cast-in-Place Concrete.
  - f. Store manhole units in an upright position.

## **PART 2 MATERIALS**

### **2.1 GENERAL**

- A. Products furnished under this Section which are damaged or found defective in any way prior to being set in place and final acceptance, may be rejected. Engineer may reject an entire lot of pipe should the sample pipe from such lot fail to meet requirements.

### **2.2 CONCRETE GRAVITY PIPE**

- A. Reinforced concrete pipe:
  1. Pipe less than 12 inches in diameter: ASTM C14, Class 3.
  2. Pipe greater than 12 inches in diameter: ASTM C76, Class 3.
  3. Class 4 pipe shall be required when cover is less than 12 inches.

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- B. Fittings and specials: conform to the applicable requirements specified for the pipe.
- C. Gaskets and pipe ends for rubber gasket joint: ASTM C443.

**2.3 CORRUGATED POLYETHYLENE PIPE**

- A. Pipe: High density polyethylene, corrugated, smooth interior, ASTM D3350, Cell Classification 424420C.
  - 1. Four (4) inch through 10 inch diameter pipe: AASHTO M252, Type S.
  - 2. 12 inch through 60 inch diameter pipe: AASHTO M294, Type S or ASTM F2306.
- B. Joints: Bell-and-spigot joint, AASHTO M252, AASHTO M294, or ASTM F2306. Bell shall be an integral part of the pipe and provide a minimum pull-apart strength of 400 pounds. Bell-and-spigot joint shall incorporate a gasket making it silt-tight. Gaskets shall be installed in the bell, or on the pipe by the pipe manufacturer.
  - 1. Four-inch (4") through 60-inch (60") diameter pipe joint, watertight, ASTM D3212. Gaskets: polyisoprene, ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
  - 2. 12-inch (12") through 60-inch (60") diameter pipe shall have a reinforced bell with a bell tolerance device. The bell tolerance device shall be installed by the manufacturer.
  - 3. Coupling bands shall conform to the manufacturer's specifications. Couplers shall cover not less than one corrugation on each section of pipe.
- C. Fittings: AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.
- D. Saddle Tee
  - 1. Saddle tees shall be manufactured saddle tees designed to connect to the corrugated polyethylene pipe.
  - 2. Fittings shall conform to AASHTO M 294. Fabricated fittings shall be welded on the interior and exterior of all junctions.
  - 3. A soil-tight seal shall be obtained with the coupling at the saddle tee stub to the storm service pipe.

**2.4 POLYVINYL CHLORIDE (PVC) GRAVITY PIPE**

- A. Polyvinyl Chloride Pipe formulated for drainage application:
  - 1. Pipe 4-inch to 15-inch diameter: ASTM D3034, SDR-35. Elastomeric gasket joints, retained gaskets, part of a complete pipe section and supplied as such.
  - 2. Pipe 18 inch to 36 inch diameter: ASTM F679. Elastomeric gasket joints, retained gaskets, part of a complete pipe section and supplied as such.
- B. PVC Cell classification: 12454 or 12364, ASTM D1784.

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- C. Pipe shall have a minimum pipe stiffness that equals or exceeds 46 psi (lbs/in.<sup>2</sup>).
- D. Pipe shall be marked along the outside of the barrel with the following:
  - 1. The manufacturer's name or trademark.
  - 2. The standard to which it conforms/ASTM Designation.
  - 3. Pipe size.
  - 4. Material designation code/PVC cell classification.
  - 5. SDR number or schedule number.
- E. Standard length of pipe: maximum of 20 feet with the following exceptions.
  - 1. Length of 6-inch pipe shall be a maximum of 13 feet unless otherwise approved by Engineer.
  - 2. Pipe used in house connections and/or laterals shall not exceed 6.5 feet in length unless otherwise approved by Engineer.
- F. PVC Plastic Gravity Joints and Jointing Material.
  - 1. Joints: ASTM D3213, gasketed, bell-and-spigot, push-on type.
  - 2. Gaskets: ASTM F477. Since each pipe manufacturer has a different design for push-on joints, gaskets shall be part of a complete pipe section and provided as such. Gaskets may be factory installed or field installed as recommended by the pipe manufacturer. Lubricant shall be as recommended by the pipe manufacturer.
- G. Fittings: SDR-35, ASTM D3034 and ASTM F1336, specifications as pipe.
- H. The manufacturer shall provide waterstops acceptable to Engineer, which shall be applied to the outside of the plastic pipe where the pipe is to be enclosed in any structure where concrete or mortar is used to prevent leakage along the outer wall of the barrel of the pipe.
- I. No single piece of pipe shall be laid on any project covered by these specifications unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed  $\frac{1}{16}$  inch per foot of length. If the deviation from straightness exceeds this requirement, then the particular piece of pipe shall be rejected.

## 2.5 UNDERDRAIN

- A. Pipe: Perforated Polyvinyl Chloride (PVC) Gravity Pipe or Corrugated Polyethylene Pipe as indicated on the Drawings.
  - 1. Perforated Polyvinyl Chloride (PVC) Gravity Pipe: ASTM F758.
    - a. Perforations shall be uniformly spaced along the length and circumference of the pipe.
    - b. Joints: Solvent weld with primer (ASTM F656) and solvent cement (ASTM F493) per ASTM D2855 or integrally-formed bell and spigot gasketed connections with elastomeric seals (gaskets) meeting the requirements of ASTM F477.

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2. Corrugated Polyethylene Pipe: AASHTO M252 Type SP (Double Wall).
  - a. Perforations: Class 2 slotted perforations per AASHTO M252. Perforations shall be uniformly spaced along the length and circumference of the pipe.
  - b. Joints: Joint: Silt-tight, ASTM D3212.

**2.6 JOINT LUBRICANT**

- A. As specified by pipe manufacturer, ANSI/AWWA C111/A21.11.

**2.7 CATCH BASINS**

- A. Reinforced precast concrete base, sump, transition, riser, corbel, and top: ASTM C913 for precast rectangular catch basins, ASTM C478 for precast circular catch basins. Type, construction, and dimensions as indicated on the Drawings.
  1. Concrete: 4,000 psi minimum, 4%–7% entrained air.
  2. Reinforcement: ASTM C890. Steel bars, ASTM A615. Welded-wire fabric, ASTM A185. Additional reinforcing at openings.
  3. Precast sections shall consist of smooth sections in standard nominal inside diameters. All precast concrete sections shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities. Lifting holes shall be filled with mortar, or other approved material.
  4. Openings or “knockouts” in precast units shall be located as shown on the Drawings and to accommodate the inflow and outflow pipe orientation required. Openings shall be sized sufficiently to permit passage of the largest outside dimension of pipe or fittings. Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.
- B. Gaskets for joints between sections: Butyl rubber, ASTM C443.
- C. Grade Rings: ASTM C478, precast reinforced concrete, 1-inch to 4-inch thickness, dimensions to match basin and top section.
- D. Frame and Grate.
  1. Cast iron: AASHTO M 105, Class 25 for frames and Class 30 for grates.
  2. Cast steel: ASTM A27, Grade optional, thoroughly annealed.
  3. Structural Steel: ASTM A36, or A283, Grade B or better, as to quality and details of fabrication, except that in the chemical composition of the steel, the 2/10 of 1% of copper may be omitted.
  4. Grate type: ConnDOT “Type A” unless otherwise specified.
  5. Covers and gratings shall bear uniformly on their supports.
  6. Frame and grate shall be galvanized, ConnDOT Form 818 M.06.03. Cast Iron frames and grates shall not be galvanized.

**2.8 YARD DRAIN/AREA DRAIN**



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- A. Configured as indicated on the Drawings. Precast concrete.
- B. Frame and Grate: Ductile iron as an integral part of the surface drainage inlet and furnished by the same manufacturer of the drain, frame and grate set manufactured for use on PVC pipe, or insert-type grate manufactured for use on PVC pipe.
  - 1. Grates for drain basins shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas.
  - 2. 12" and 15" square grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron.
  - 3. Grates shall be provided painted black.

## 2.9 CONCRETE MANHOLE

- A. Precast concrete manhole risers, base sections, and tops: ASTM C478. Precast manhole sections shall consist of smooth circular sections in standard nominal inside diameters. All precast concrete manhole sections shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities. Lifting holes, when provided, shall be filled with mortar, or other approved material.
  - 1. Concrete: 4,000 psi minimum, 4%–7% entrained air.
  - 2. Diameter: 48 inches unless otherwise indicated.
  - 3. Base and first riser: Monolithic and built to the dimensions and requirements indicated on the Drawings.
    - a. Bottoms shall be integrally cast unless specialty bases at points of connection to existing piping ("Dog-House") is indicated on the Drawings or otherwise proposed for use. Unless indicated on the Drawings, any special bases or riser used must be detailed in shop drawings and submitted for approval.
  - 4. Riser sections: As required to provide depths indicated.
  - 5. Top Section: Concentric-cone type, unless eccentric-cone or flat-slab-top type is indicated. Cones shall have the same wall thickness and reinforcement as riser sections. If required or called-for, flat slab shall be a minimum of 8 inches thick designed to carry AASHTO H-20 loading with one foot cover and conform to ASTM C478.
  - 6. External damp-proofing: Asphalt, ASTM D449, Type A.
  - 7. Openings or "knockouts" in precast units shall be located as shown on the Drawings and to accommodate the inflow and outflow pipe orientation required. Openings shall be sized sufficiently to permit passage of the largest outside dimension of pipe or fittings. Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.
- B. Gaskets for joints between manhole sections: Butyl rubber, ASTM C443.
- C. Grade Rings: ASTM C478, precast reinforced concrete, 1 inch to 4 inch thickness, diameter to match manhole and frame.
- D. Mortar: Packaged, ASTM C387 or as Specified in Section 033200—Site Cast-in-Place Concrete.

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- E. Frame and Cover: Ductile Cast Iron, ASTM A536, Grade 60-40-18.
- F. Frame and Cover: Grey Cast Iron, ASTM A48, Class 25B (Frame) and Class 30B (Covers), uncoated.
  - 1. Cover: 26 inch diameter, non-vented with non-penetrating pickholes. Unless otherwise detailed or indicated, covers shall be cast with 1½ inch wide, raised letters, indicating "STORM SEWER" unless other lettering is called-for.
  - 2. Frame and cover shall be supplied as a pair from the same manufacturer. Castings shall be of tough, even-grained iron, free from scale, lumps, blisters, sand-holes and other injurious defects, and of the size and type shown on the Drawings. Frames and covers shall have machined bearing surfaces to seat firmly and prevent rocking and rattling under traffic loads. Before leaving the foundry, castings shall be thoroughly cleaned, subjected to hammer tests for soundness and given two coats of coal tar pitch varnish.
- G. Resilient connectors for joints between manhole and pipes entering manhole: Continuous boot of ¾ inch minimum thickness neoprene, ASTM C923 or ASTM C990. Boots shall be either cast into the manhole wall or installed into a cored opening using internal compression rings. Installed boot shall result in a water-tight connection meeting the performance requirements of ASTM C443.
- H. Manhole Steps: ASTM C478 and OSHA 29 CFR 1910.27, drop front or equivalent. Steps shall be nine inches in depth and at least twelve inches in width with an abrasive step surface.
  - 1. [Cast Aluminum Alloy: Aluminum alloy, 6061-T6, tensile 38,000 psi, yield 35,000 psi. Drop front design with upturned embedded ends. All parts of aluminum steps to be embedded in concrete or masonry shall be coated with bituminous paint or zinc chromate primer.]
  - 2. [Composite Plastic-Steel: One-half (½) inch deformed steel reinforcing rod, ASTM A615, Grade 60, encapsulated in a co-polymer polypropylene plastic, ASTM D2146, Type II, Grade 16906.]
  - 3. Steps shall be placed in vertical alignment as indicated on the Drawings. Steps shall be uniformly spaced not more than sixteen inches (16") on center, including the spacing between the top step and the manhole cover. Steps shall be embedded in the wall a minimum distance of 4 inches in either cast or drilled holes. Steps shall not be driven or vibrated into fresh concrete and shall withstand a pullout resistance of 2000 lbs when tested in accordance with ASTM C497. Each step shall project a minimum of 5 inches from the wall measured from the point of embedment.

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**2.10 DROP MANHOLE**

- A. Drop inlet shall be constructed with ductile iron gravity pipe laid in undisturbed soil in conformance with ASTM A746-82. Adapt to PVC with Fernco coupling or approved equivalent.
- B. Vertical drop pipe shall be 8", 10", or 12" maximum SDR 35 PVC with 90 degree short bend radius shall conform to ASTM D3034.
- C. Vertical drop pipe shall be anchored a minimum of every 4 feet with 1/8" x 1 1/2" type 304 stainless steel pipe straps set as ordered with lag bolts and shields.

**2.11 MASONRY UNITS**

- A. Brick: ASTM C32 Grade MS or ASTM C62 Grade SW.
- B. Concrete block: Solid block, ASTM C139.

**2.12 MORTAR**

- A. Mortar: ASTM C387.
  - 1. Portland Cement: ASTM C150, Type I.
  - 2. Sand: ASTM C144.
  - 3. Hydrated Lime: ASTM C207.
  - 4. Water: Potable.
  - 5. Mix proportions for manhole rims and covers: 1 part portland cement, 2 parts sand, and 1/4 part hydrated lime by dry volume. Hydrated lime shall not exceed 10 percent by weight of the total dry mix. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5 1/2 gallons of water per sack of cement.
  - 6. Mix Proportions for invert construction: 1 part portland cement and 2 parts sand by volume. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5 1/2 gallons of water per sack of cement.

**2.13 STORMWATER TREATMENT UNIT**

- A. Stormwater Treatment Units shall be hydrodynamic separators made of precast concrete sections and shall have the capacity and dimensions indicated on the Drawings. Treatment units shall be Vortechs®, as manufactured by CONTECH Stormwater Solutions, Scarborough, Maine (877-907-8676); Stormceptor® by CSR—Farmington, CT (860-677-1374); or approved equivalent.
- B. Units shown on the Drawings have been sized to meet specific criteria as indicated. Contractor shall submit only those units that are sized and manufactured to meet such criteria as shown with the details and/or listed below:
  - 1. Unit 1
    - a. Conveyed flow = 21.6 c.f.s. (total flow to the treatment system)
    - b. Treated flow = 4.0 c.f.s. (total flow actually subjected to treatment)

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- c. Removal efficiency particle size = maximum of 100 microns
  - d. Evidence of Independent Third Party field testing
  - e. Evidence of full scale laboratory testing
  - f. Minimum removal of 80% Total Suspended Solids (TSS) for 1.3 inch of rainfall on the impervious surfaces within its drainage area.
- 2. Unit 2
  - a. Conveyed flow = 14.25 c.f.s. (total flow to the treatment system)
  - b. Treated flow = 0.9 c.f.s. (total flow actually subjected to treatment)
  - c. Removal efficiency particle size = maximum of 100 microns
  - d. Evidence of Independent Third Party field testing
  - e. Evidence of full scale laboratory testing
  - f. Minimum removal of 80% Total Suspended Solids (TSS) for 1.3 inch of rainfall on the impervious surfaces within its drainage area.
- 3. Unit 3
  - a. Conveyed flow = 9.5 c.f.s. (total flow to the treatment system)
  - b. Treated flow = 0.6 c.f.s. (total flow actually subjected to treatment)
  - c. Removal efficiency particle size = maximum of 100 microns
  - d. Evidence of Independent Third Party field testing
  - e. Evidence of full scale laboratory testing
  - f. Minimum removal of 80% Total Suspended Solids (TSS) for 1.3 inch of rainfall on the impervious surfaces within its drainage area.

C. Precast Sections: portland cement shall be Type II, ASTM C150, 4,000 psi minimum.

D. Loading requirements:

- 1. H-20 loading, manhole riser with frame and cones, plus the weight of soil above.
- 2. Weight of precast concrete structure.
- 3. Initial handling and erection loadings.

E. Construction joints shall be sealed with a butyl rubber based sealant.

F. Manhole riser sections, manhole steps, frames and covers shall be as detailed on the Drawings.

## 2.14 UNDERGROUND DETENTION SYSTEM

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- A. Underground detention system shall be made of precast concrete section and shall have the capacity and dimensions indicated on the Drawings. Detention System shall be Retain-It as manufactured by Retain-It Stormwater Management Systems; StormTrap manufactured by StormTrap or approved equal.
- B. Underground detention system to have a water proof liner surrounding the chambers and stone along with underdrain as designed.

**2.15 BEDDING**

- A. Bedding for concrete and PVC pipes: Bedding, Haunching and Initial Backfill shall consist of screened gravel, maximum size  $\frac{3}{4}$  inches and minimum size  $\frac{3}{8}$  inches.
- B. Bedding for HDPE pipes: Bedding, Haunching and Initial Backfill shall consist of ConnDOT No. 6, No. 67, or No. 8 aggregate, or other materials meeting the requirements of ASTM D2321 for Class IA, Class IB, Class II, or Class III unless otherwise specified by the pipe manufacturer.
- C. Bedding for Catch Basins: Screened Gravel or Crushed Stone, well graded in size from  $\frac{3}{4}$  inch to  $\frac{3}{8}$  inch consisting of clean, hard, and durable fragments. No limestone shall be permitted.

**PART 3 EXECUTION**

**3.1 PIPE INSTALLATION**

- A. As soon as the excavation is completed to the normal grade of the bottom of the trench, the Contractor shall immediately place the bedding material in the trench. Then the pipe shall be firmly bedded in the compacted bedding material to conform accurately to the lines and grade indicated on the Drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions.
  - 1. Concrete pipe shall be installed per ASTM C1479, as may be modified by the pipe manufacturer's instructions.
  - 2. HDPE pipe shall be installed per ASTM D2321, as may be modified by the pipe manufacturer's instructions.
- C. Notch under pipe bells and joints, where applicable to provide for uniform bearing under entire length of pipe.
- D. Excavation, backfilling and compaction shall be as specified in Section 312310—Earthwork of these Specifications.
- E. Maintain optimum moisture content of bedding material to attain required compaction density.

**3.2 MANHOLES AND CATCH BASINS**

- A. Manholes and Catch Basins shall be constructed at the locations and to the lines, grades and dimensions noted on the Drawings, or as required.
- B. Precast concrete construction shall be done in a manner to insure watertight construction and all leaks in precast concrete shall be sealed. If required, precast concrete shall be repaired or replaced to obtain watertight construction.
- C. Concrete barrels and cones shall be precast concrete sections.

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1. Bases shall be either precast with a barrel integrally cast with the base, or poured concrete suitably shaped by means of accurate bell-rung forms to receive the barrel sections. Manhole invert channels in manholes shall be formed in concrete.
2. Precast manholes shall have an adjustment ring at the top of the cone to permit the frame and cover to meet the finished surface. This shall consist of courses of brick or reinforced grading rings not to exceed 11 inches.
- D. Stubs shall be short pieces cut from the bell ends of the appropriate size and class of pipe. Concrete stubs shall be plugged with brick masonry unless otherwise directed.
- E. Manhole inverts shall conform accurately to the size of the adjoining pipes.
  1. Manhole inverts shall be constructed of concrete developing 3,500 psi with the concrete being placed to the spring line of the pipe form.
  2. Smooth plastic pipe, matching the dimension of the outlet pipe, shall be used to form the invert.
  3. Side inverts and main inverts, where the direction changes, shall be laid out in smooth curves of the longest possible radius, which is tangent, within the manhole, to the centerline of adjoining pipelines.
  4. Invert shelves shall be graded to provide a 1-inch per 1-foot wash from the manhole walls.
- F. Manhole sections shall contain manhole steps accurately positioned and embedded in the concrete when the section is cast. Precast-reinforced concrete manhole sections shall be set so as to be vertical and with sections and steps in true alignment.
- G. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs, made specifically for this purpose, or with mortar. The mortar shall be one part cement to 1½ parts sand, mixed slightly damp to the touch (just short of “balling”), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.
- H. The Contractor may, as an alternate to suitable nonshrink mortar joints, use premolded elastomeric-sealed joints for pipe into precast manhole bases.
  1. All materials, accessories and construction methods used in making the joints shall be supplied or approved by the manufacturer of the premolded elastomeric-sealed joint.
- I. Openings for pipe and materials to be embedded in the walls of the base for these joints shall be cast in the base at the required locations during the manufacture of the base. Incorrectly cast and patched pipe openings will be rejected.
- J. Manhole risers and tops shall be installed using approved “o-ring” type, neoprene gaskets for sealing joints. Units shall be installed level and plumb. Water shall not be permitted to rise over newly made joints nor until after inspection as to their acceptability. All jointing shall be done in a manner to insure water tightness.
- K. Openings shall be provided in the risers to receive entering pipes. These openings may be made at the place of manufacture. The openings shall be sized to provide a uniform 1 inch maximum annular space between the outside of the pipe wall and the opening in the riser. After the pipe is in position, the annular space shall be solidly filled with nonshrink mortar. Care shall

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be taken to assure that the openings are located to permit setting of the entering pipe at its correct elevation as indicated.

- L. Openings, which are cut in the risers in the field, shall be carefully made by coring so as not to damage the riser. Damaged risers will be rejected and shall be replaced at no additional expense to the Owner.
- M. Where required by the Drawings, a slot and opening shall be cast in the catch basin wall suitable for mounting the cast iron hood and discharge pipe. The hood hinge may be furnished to the precast supplier by the Contractor for incorporation into the casting during manufacture.

### 3.3 BRICK MASONRY

- A. Brick Masonry Construction shall be done in a manner to insure watertight construction and all leaks in brick masonry shall be sealed. All workmanship shall conform to the best standard practice and all brick masonry shall be laid by skilled workmen.
- B. All beds on which masonry is to be laid shall be cleaned and wetted properly. Brick shall be wetted as required and shall be damp but free of any surface water when placed in the Work. Bed joints shall be formed of a thick layer of mortar, which shall be smoothed or furrowed slightly. Head joints shall be formed by applying to the brick to be laid a full coat of mortar on the entire end, or on the entire side as the case requires, and then shoving the mortar covered end or side of the brick tightly against the bricks laid previously. The practice of buttering at the corners of the brick and then throwing the mortar or crappings in the empty joints will not be permitted. Dry or butt joints will not be permitted. Joints shall be uniform in thickness and shall be approximately 1¼ inch thick.
- C. Brickwork shall be constructed accurately to dimensions and brickwork at top of manholes shall be to the dimensions of the flanges of the cast-iron frames.
- D. Joints on the inside face of walls shall be tooled slightly concave with an approved jointer when the mortar is thumbprint hard. The mortar shall be compressed with complete contact along the edges to seal the surface of the joints.
- E. All castings to be embedded in the brickwork shall be accurately set and built-in as the Work progresses. Cast-iron frames and manhole covers shall be well bedded in mortar and accurately set to finished grade indicated or as directed.
- F. Water shall not be allowed to flow against brickwork or to rise on the masonry for 60 hours after it has been laid, and any brick masonry damaged in this manner shall be replaced as directed at no additional expense to the Owner. Adequate precautions shall be taken in freezing weather to protect the masonry from damage by frost.

### 3.4 CONCRETE MASONRY UNITS

- A. Concrete Masonry unit construction shall be soaked in water before laying. As circular concrete block walls are laid-up, the horizontal joints and keyways shall be flushed full with mortar. As rectangular blocks are laid-up, all horizontal and vertical joints shall be flushed full with mortar. Plastering of the outside of block structures will not be required. The joints in precast units shall be wetted and completely mortared immediately prior to setting a section. No structure shall be backfilled until all mortar has completely set.

### 3.5 MANHOLE STEPS

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- A. Placement of steps into the precast walls shall be by a proven method as recommended by the supplier of the precast manhole sections. Details of the steps and method of placement shall be submitted for approval.
- B. Plastic steps shall be placed into the wet concrete wall during manufacture or if designed for press fit installation shall be driven into a wall opening according to the manufacturer's specifications. Steps shall not be mortared into place after the concrete has set.
- C. All manholes, catch basins, lawn inlets, etc., which are in excess of five feet in depth, shall be constructed with standard aluminum steps, spaced at 12-inch on center.

**3.6 DROP INLETS**

- A. Drop inlets shall be constructed to the lines, grades, dimensions and design at the locations indicated on the Drawings or as required.
- B. Construction shall conform to requirements outlined in Section 033013—Site Cast-in-Place Concrete.
- C. Engineer may permit brick or concrete masonry construction. If this alternate is being employed, construction shall be done in accordance with paragraphs 3.04 or 3.05 in this Section.

**3.7 CASTINGS**

- A. Cast-iron frames for grates and covers shall be well bedded in cement mortar and accurately set to the grades indicated or as directed. The frames shall be encased with a thick cement-mortar collar around the entire perimeter of the frames.
- B. All voids between the bottom flange shall be completely filled to make a watertight fit. A ring of mortar, at least one inch thick and pitched to shed water away from the frame shall be placed over and around the outside of the bottom flange. The mortar shall extend to the outer edge of the masonry all around its circumference and shall be finished smooth. No visible leakage will be permitted.
- C. Structures within the limits of bituminous concrete pavement shall be temporarily set at the elevation of the bottom of the binder course or as ordered. After the binder course has been compacted, these structures shall be set at their final grade. Backfill necessary around such structures after the binder course has been completed shall be made with Class A concrete unless otherwise ordered.

**3.8 TRENCH DRAINS/SLOTTED DRAINS**

- A. Precast, pre-sloped trench drain metals, accessories, and installation methods shall be in accordance with the manufacturer's recommendations and the details shown on the Drawings.
- B. Slotted drains shall be installed in accordance with the manufacturer's recommendations and the details shown on the Drawings.
- C. Contractor shall furnish to Engineer the manufacturer's written instructions for installation prior to such installation.

**3.9 STORMWATER TREATMENT UNIT**

- A. Stormwater Treatment Units shall be installed in accordance with the manufacturer's instructions.



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- B. Vaults shall be placed on a minimum foundation of 12 inches of gravel material. If groundwater is encountered, the foundation base shall be a minimum of 12 inches of crushed stone.
- C. If precast sections are to be field assembled, adequate waterproofing shall be used at the joints.
- D. Stormwater Treatment Units installed on interior floor drain discharges from parking garages shall have gasoline trapping capabilities in accordance with local and state regulations.

**3.10 CLEANING**

- A. At the completion of the Work, clean all piping, structures and open drainage courses, through and to which water from this construction is directed, to the satisfaction of Engineer.

**3.11 AS-BUILT DRAWINGS**

- A. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relieve Contractor from satisfying the requirements of local permitting authorities.
- B. As work progresses, record the following on two (2) sets of Drawings:
  - 1. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.
  - 2. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
- C. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.
- D. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.
- E. As-Built drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

END OF SECTION 334000

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SECTION 335100 – NATURAL GAS DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SECTION INCLUDES:

- A. Furnish all labor, materials and equipment necessary to install pipe and fittings for site utility natural gas distribution as shown in the Drawings.
- B. Contractor is responsible for all health and safety.

PART 2 PRODUCTS

- A. As required by the local gas company.

PART 3 EXECUTION

- A. Gas line to be installed in accordance with the local gas company. The Contractor to coordinate with the local gas company to ensure that gas line is installed properly.

END OF SECTION 335100

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**SECTION 338126 COMMUNICATIONS UNDERGROUND DUCTS, MANHOLES, AND  
HANDHOLES**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

**1.2 SECTION INCLUDES**

- A. Installation of telecommunications/data underground ducts and raceways, including conduit, vaults, manholes, and associated appurtenances as shown on the Drawings and as Specified herein.
- B. All facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the Work specified in this section, and as shown on the Drawings.
- C. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- D. Contractor shall be responsible for the health and safety of all Contractor and Subcontractor workers during progress of the work.

**1.3 REFERENCE STANDARDS**

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. American National Standards Institute (ANSI)
  - 1. ANSI/NFPA-70 2005—National Electrical Code (NEC).
  - 2. ANSI/IEEE C2 2007—National Electrical Safety Code (NESC).
  - 3. ANSI/IEEE 1100 2005—Recommended Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book).
  - 4. ANSI/TIA/EIA-569-B—Commercial Building Standard for Telecommunications Pathways and Spaces.
  - 5. ANSI/TIA/EIA-606-A—The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
  - 6. ANSI-J-STD-607-A—Commercial Building Grounding and Bonding Requirements for Telecommunications.
  - 7. ANSI/TIA/EIA-758-A—Customer-Owned Outside Plant Telecommunications Cabling Standard.
- C. ASTM International (ASTM)

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1. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
  2. ASTM D2855—Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
  3. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- D. Code of Federal Regulations (CFR)
1. 29 CFR 1926, Safety and Health Regulations for Construction.
- E. State of Connecticut
1. State Building Code, including all Amendments, Supplements, and Errata.
- F. Underwriters Laboratories, Inc. (UL)
1. UL Standards as indicated.

**1.4 QUALITY ASSURANCE**

- A. Dimensions, locations, and details of equipment pads, anchors, supports, and similar features indicated on the Drawings are approximate.
- B. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- C. Do not deviate from the Drawings or Specifications without first gaining approval of Engineer.
- D. Coordination with Other Utilities
1. Unless otherwise noted, maintain the following minimum clearances:

<u>Utility</u>	<u>Crossing</u>	<u>Parallel</u>
Gas Main	12"	30"
Gas Service	12"	12"
Water	12"	18"
Steam	18"	48"
Electric	12"	12"
Storm Sewers	12"	12"
Sanitary Sewers	12"	12"

**1.5 SUBMITTALS**

- A. Product Data: Submit product data for all materials furnished under this Section.
1. Conduits, ducts, and their related accessories, including elbows, end bells, bends, fittings, adaptors, primers, and solvent cement.
  2. Duct-bank materials, including spacers, and miscellaneous components.

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3. Accessories for manholes, handholes, boxes and other utility structures.
4. Warning tape.
5. Marker Balls.
- B. Material Data: Submit material data demonstrating compliance with the requirements defined herein.
- C. Shop Drawings: Provide Shop Drawings showing dimensions, joints and other details of all materials, utility structures, and appurtenances to be furnished. Include plans, elevations, sections, details, attachments to other work, and accessories, including, but not necessarily limited to, the following:
  1. Duct entry provisions, including locations and duct sizes.
  2. Reinforcement details.
  3. Frame and cover design and manhole frame support rings.
  4. Ladder and step details.
  5. Grounding details.
  6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
  7. Joint details.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Transport all materials in a secure manner to avoid damage. Inspect all materials delivered to site for damage.
- B. Handling: Use appropriate methods for handling materials at the Project Site. Off-load and store materials with minimum of handling.
  1. In cold weather conditions, use caution to prevent impact damage. Handling methods considered acceptable for warm weather may be unacceptable during cold weather.
- C. Storage: Store materials on site in enclosures or under protective coverings so as to provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

**1.7 COORDINATION**

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, grades and/or grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated on the Drawings as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by UITS.

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**PART 2 PRODUCTS**

**2.1 PLASTIC CONDUIT**

- A. Non-Metallic Conduit: Rigid Polyvinyl Chloride Conduit (PVC), Schedule 40, UL category reference DZYR, complying to ANSI/UL standard 651. Fitting shall match requirements for conduit.

**2.2 METAL CONDUIT**

- A. Rigid Metal Conduit, Steel, ANSI C80.1, Hot Dip Galvanized interior and exterior, NPT threads, ANSI B1.20.1. Fitting shall match requirements for conduit.
- B. Unless otherwise indicated, provide Rigid Metal Conduit at the following locations:
  - 1. Entrance to manhole, 10' minimum.
  - 2. Entrance to Buildings, 10' minimum.
  - 3. All road and driveway crossings

**2.3 MANHOLE**

- A. Oldcastle Precast 322UTT38Y, 6 foot x 12 foot x 7 foot Telephone Vault or approved equal, based on UITS requirements. Manhole cover to have lettering "TELEPHONE".

**2.4 TRACING SYSTEMS**

- A. Plastic Marking Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored orange.
- B. Tracer Wire: Wire Minimum—#12AWG solid copper conductor insulation type THWN (Gas & Oil Resistant).
- C. Tracer Wire Access Box: Provide grade level access to each end of the tracer wire. ABS tubular valve box with Cast iron cover, color: Orange, accessible via standard pentagonal key. Tracer wire lug attached to underside of cover. Rated for road surface applications. Install in close proximity to manhole cover with maximum separation of 500' between boxes (e.i. Copperhead Industries, LLC "Snake Pit Magnetized Tracer Box" series or equal).
- D. Utility Marker Ball: 3M™ EMS 4" Extended Range 5' Ball Marker—Telephone 1401-XR

**2.5 CONDUIT SPACERS**

- A. Carlon "SNAP-N-STACK" SP4W20-2 or equal. Spacers shall maintain a minimum 2" wall-to-wall separation of conduits in all directions and elevate bottom conduits a minimum 3" above trench floor. Maximum spacing between spacers: 7'0".

**2.6 JOINING MATERIALS**

- A. Solvent Cement: ASTM D2564

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- B. Primer: ASTM F656

**2.7 GROUNDING WIRE**

- A. No. 6 copper grounding wire.

**2.8 WATERTIGHT BOOTED CONNECTOR**

- A. C-DRIVE 8QRS Multi-Size Pipe-to-manhole Connector or approved equal.

**2.9 PULL LINE**

- A.  $\frac{3}{8}$ -inch double-braided, low-stretch, polyester composite rope.

**2.10 CONCRETE**

- A. Ready Mix Concrete: Portland Cement Concrete, ASTM C94.
- B. Encase conduits in concrete having a nominal compression strength of 2500lbs/sq.in. with  $\frac{1}{2}$ " maximum aggregate crush stone or washed gravel. Concrete slump size: 6" minimum, 8" maximum.
- C. Work concrete to remove all trapped air and insure each conduit is completely surrounded by a minimum 2" of concrete. Allow concrete to cure for at least one hour before backfilling.

**PART 3 EXECUTION**

**3.1 GENERAL**

- A. Visit the project location prior to the start of the project; examine and evaluate all existing conditions. Included in this project's Scope of Work are the processes, equipment, services, materials, and labor necessary for the safe, timely, orderly, and proper completion of the project.
- B. All measurements are approximate. Verify all dimensions with field conditions.
- C. The locations of all underground structures shown on the Drawings are according to the best available information. They are not guaranteed to be correct or complete.
- D. Unless otherwise noted, maintain the following minimum buried depths. Measure from the top of the structure to the nearest portion of finished grade:
  - 1. Duct Bank: 30 inches.
  - 2. Manhole: 12 inches.

**3.2 EXCAVATION**

- A. Contractor shall make excavations in such manner, and to such widths, as will give suitable room for laying and joining conduit and installing related appurtenances. Comply with the trench limits shown on the Drawings.

**3.3 INSTALLATION**

- A. The number, size, and duct material shall be as indicated on the Drawings.

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- B. All bends must be long, sweeping bends. Where manufactured bends are required, minimum radius shall be 36 inches.
- C. All conduit shall be installed per the recommendations of the pipe manufacturer, unless otherwise specified.
- D. Cement all PVC conduit joints using a PVC primer and solvent cement according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- E. All conduits shall be capped with manufactured caps (Duct Plugs) when installation is temporarily discontinued.
- F. Feeder and Distribution ducts shall enter on the narrow walls of the manholes. Duct providing Service Laterals to buildings may enter on the long walls near the corners.
- G. Ducts shall not enter the manhole in the cover chimney.
- H. Conduits shall enter manholes perpendicular to the wall
- I. Utilize provided knock-outs for installing conduits into manholes whenever possible. Whenever possible, populate the lowest knock-outs first to provide room for future growth.
- J. Splay conduits entering telecommunication manholes. Equally separate duct banks so that half the conduits will enter near the left corner of the narrow wall and the other half will enter near the right corner of the same narrow wall. The splaying of the conduits should start at least 20' from the manhole.
- K. Where possible, organize conduits in such a manner as to provide "in-line" or "pull-through" cable installations.
- L. Provide #6 reinforcing bars 12" in length into inserts provided in manhole walls prior to concrete encasement of duct bank.
- M. Patch walls around conduit entrances with hydraulic cement or watertight grout to prevent water infiltration.

#### 3.4 ENCASEMENT

- A. Place concrete only after duct bank has been installed and configuration verified by UITS.
- B. Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

#### 3.5 BACKFILL

- A. Place tracer wire on top and along the centerline of duct bank.
- B. The first 12" of fill shall be sand or other granular material tamped using lightweight equipment such as pneumatic or vibrating tampers.



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- C. Install Utility Marker Balls above duct bank at intervals not exceed 50' when duct bank is in a straight line. Shorten intervals as appropriate to accurately identify changes in direction.
- D. Backfill shall be free from large stones, frozen materials, wood, and other extraneous materials.
- E. Place backfill in layers not exceed 6". Thoroughly compact each layer.
- F. Place a plastic marking tape above the duct bank and 12" below finished grade. The plastic tape shall clearly indicate that there is a buried Telecommunications Utility Structure below.

**3.6 GROUNDING**

- A. Ground underground ducts and utility structures according to Section 27 0526 "Grounding and Bonding for Communications Systems."

**3.7 RESTORATION AND EROSION PROTECTION**

- A. Cut back all concrete and bituminous concrete surfaces 1'6"
- B. Restore all disturbed footpaths, walkways, sidewalks, driveways and roadways to match existing materials and depths ("Like-for-Like"). Comply with the requirements shown on the Drawings.
- C. When laterally crossing under a concrete sidewalk with a duct bank, replace/restore no less than "Full Square" increments of walkway (i.e. Dummy Joint to Dummy Joint or Dummy Joint to Expansion Joint). Provide expansion joint at each abutting joint.
- D. Provide erosion and sediment controls along the entire length of the excavation.

**3.8 TESTING AND AS-BUILT DOCUMENTATION**

- A. Rod and mandrel each conduit and provide a 1250lbs test fabric "Muletape" with distance markings.
- B. Utilizing a 3M "Dynatel" locating tool, identify the duct bank's path by both tracer wire and marker balls. The UITs project manager must be present for this test.
- C. Refer to Section 01 7123, "Field Engineering" for additional requirements for the documentation of as-built conditions.

END OF SECTION 338126



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SECTION 34 7123 – MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

- A. Section includes:
  - 1. Coordination with state or local police/public safety.
  - 2. Development and submittal of a Traffic Management Plan.
  - 3. Development and submittal of a Detour Plan.
  - 4. Contractor shall identify safety hazards and then furnish all necessary labor, materials, testing, submittals, tools, and equipment including, but not limited, to signs, barricades, traffic drums, cones, flashers, construction fencing, flaggers, warning devices, temporary pavement markings, delineators, etc., to control vehicular and pedestrian traffic through and adjacent to the project area. These measures and actions shall safely maintain the accessibility of public and construction traffic by preventing potential construction hazards.
  - 5. The work shall also include all costs associated with the erecting, maintaining, moving, adjusting, cleaning, relocating, and storing the aforementioned materials as is necessary to ensure safe movement of vehicular and pedestrian traffic throughout the project area.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
  - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut.
  - 1. Standard Specifications for Roads, Bridges, Facilities, and Incidental Construction, Form 817, 2016 and any supplements.
- D. American Association of State High and Transportation Officials (AASHTO).

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1. Roadside Design Guide, latest edition.
  2. Manual for Signing and Pavement Marking of the National System of Interstate and Defense Highways, latest edition.
  3. AASHTO M 268 - Standard Specification for Retroreflective Sheeting for Traffic Control.
- E. United States Department of Transportation, Federal Highway Administration (FHWA).
1. Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), latest edition.
  2. Standard Highway Signs Including Pavement Markings and Standard Alphabets, latest edition.

#### 1.4 SUBMITTALS

A. Traffic Management Plan

1. Contractor shall identify safety hazards and then prepare and submit a Traffic Management Plan to describe all necessary labor, materials, testing, submittals, tools, and equipment including, but not limited, to signs, barricades, traffic drums, cones, flashers, construction fencing, flaggers, warning devices, temporary pavement markings, delineators, etc., proposed for use in controlling vehicular and pedestrian traffic through and adjacent to the project area.

B. Detour Plan

1. Prepare and submit a Detour Plan to describe the temporary re-routing of traffic around the work zone(s) showing all proposed routing, signs, barricades, traffic drums, cones, flashers, construction fencing, flaggers, warning devices, temporary pavement markings, delineators, etc., proposed for use in conjunction with such detour.

#### 1.5 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.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. All materials furnished under this Section including any warning devices, such as signs, barricades, flashers, cones, drums, vests, paddle signs, delineators, and other incidentals necessary to protect the work area and maintain vehicular and pedestrian traffic through and adjacent to the project area shall be in accordance with the Manual of Uniform Traffic Control Devices, as amended, or as approved by Engineer.

### PART 3 EXECUTION

#### 3.1 GENERAL

- A. Verify site conditions before proceeding with the work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.

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- B. Contractor shall keep the roadway under construction open to vehicular and pedestrian traffic for the full length of the project. Traffic is to be maintained on one section of existing pavement, proposed pavement, or a combination thereof.
- C. Alternating one way traffic may be utilized and limited to a maximum length of 500 feet during construction hours.
- D. Lane width for alternating one-way traffic shall be kept to a minimum width of 10 feet, or as directed by the Engineer. A sufficient number of travel ways and pedestrian passways shall be provided to move that traffic ordinarily using the roadway. The travel lanes and pedestrian passways shall be drained and kept reasonably smooth, and in a suitable condition at all times in order to provide minimum interference to traffic consistent with the prosecution of the work. Suitable ingress and egress shall be provided at all times where required for all intersections, driveways, and for all abutting properties having legal access.

### 3.2 TRAFFIC CONTROL

- A. Contractor shall furnish, light, and maintain such signs as may be directed, or may be necessary, for the safe regulation, and convenience of traffic. Said signs will be as specified on the Contract Drawings or elsewhere herein, or if not specified, they shall be adequate for the regulation, safety and convenience of traffic and in conformance with the applicable requirements of the Manual on Uniform Traffic Control Devices, latest edition. Engineer reserves the right to reject any sign deemed unsuitable.
- B. Contractor shall provide, erect, and maintain suitably lighted barricades, warning lights, etc. as needed, or as directed in order to keep people, animals, and vehicles from excavations, obstacles, etc. Contractor may be required to employ traffic control personnel and take other such reasonable means or precautions as Engineer or local traffic authority may direct, or as may be needed to prevent damage or injury to persons, vehicles, or other property, and to minimize the inconvenience and danger to the public by his construction operations.
- C. Contractor shall arrange his operations to provide access to properties along the street, including temporary bridges to driveways, and provide access to fire hydrants, manholes, gate boxes, or other utilities. Whenever any trench obstructs traffic in, or to, any public street, private driveway, or property entrance, Contractor shall take such steps as required to maintain necessary traffic and access, including temporary bridging if required.
- D. Contractor shall confine his occupancy of public or traveled ways to the smallest space compatible with the efficient and safe performance of the Work contemplated by the Contract.
- E. Contractor shall observe and obey all local and state laws, ordinances, regulations and permits in relation to the obstruction of streets and highways, keeping passageways open and protecting traffic where there may be danger from blasting or other construction activities.
- F. Suitable lighted barriers or barricades shall be furnished by Contractor, and erected and maintained at all times, including daylight and night time, around all open ditches, trenches, excavations, or other work potentially dangerous to traffic or pedestrians. Such barricades shall conform to the Manual on Uniform Traffic Control Devices, latest edition. Barricades shall be placed on all sides and throughout the entire length and breadth of all open ditches, trenches, excavations, or other work, which must be barred to the general public. Barricades shall be properly painted and lighted to retain a high degree of visibility to vehicular and pedestrian traffic.
- G. Suitable lighted barricades shall be defined as barricades lit by flashers in accordance with this paragraph or other lighting methods required by the Uniform Traffic Control Devices, latest edition, Engineer, or the local traffic authority. Flashers shall be placed along the entire length

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of the barricades at an interval no greater than 8 feet, center to center. Flashers shall be power operated, lens directed, enclosed light units which shall provide intermittent light from 70 to 120 flashes per minute, with the period of light emittance occurring not less than 25 percent of each on off cycle, regardless of temperature. The emitted light shall be yellow in color and the area of light on at least one face of the unit shall be not less than 12 square inches. The discernible light shall be bright enough to be conspicuously visible during the hours of darkness at a minimum distance of 800 feet from the unit under normal atmospheric conditions. For units, which beam light in one or more directions, the foregoing specifications shall apply 10 degrees or more to the side and 5 degrees or more above and below the photometric axis.

- H. Contractor shall furnish and securely fasten flashing units to signs, barricades, and other objects in such numbers and for such lengths of time as are required for the maintenance and protection of traffic, or as the Engineer and/or local traffic authority may order. The flasher shall be in operation during all hours between sunset and sunrise, and during periods of low visibility. Contractor shall maintain, relocate and operate barricades and flashers throughout the life of the Contract as required. No special payment will be made for barricades or flashers.
- I. Should Contractor or his employees neglect to set out and maintain barricades or lights, as required in these Specifications, Engineer immediately, and without notice, may furnish, install and maintain barricades or lights. The cost thereof shall be borne by Contractor and may be deducted from any amount due, or to become due, to Contractor under this Contract.
- J. Contractor will be held responsible for any damages that the Owner, Governmental units, or their heirs or assigns may have to pay as a consequence of Contractor's failure to protect the public from injury, and the same may be deducted from any payments that are due or may become due to Contractor under this Contract. Contractor shall allow for bridging for trenches at all street and driveway crossings in such manner as the Engineer and/or local traffic authority may direct in order that the traffic on intersecting streets may not be blocked, and in order that entrance may be made to properties along the line of work.

### 3.3 MAINTENANCE OF TRAVEL LANES

- A. During non-construction hours, weekends and holidays, a minimum of two 12-foot wide travel lanes shall be open to traffic. Trenches shall be either temporarily paved or covered with skid resistant steel plates, unless otherwise directed by Engineer or the local traffic authority. The steel plates to be designed to withstand the normal traffic loads. Also during the above mentioned times, all public and private driveways shall be accessible to vehicular traffic.
- B. During construction hours, Contractor will be allowed to close the streets to through traffic, provided alternate detour arrangements are made which are acceptable to the Police, Fire, Emergency Medical Services, Public Safety, and local traffic authority. Contractor shall notify the local Police, Fire, Emergency Medical Services, Public Safety, and local traffic authority ten (10) calendar days in advance of any/or all street closures, or partial closures.

### 3.4 SNOW REMOVAL

- A. If Contractor's operations or occupancy of any public street or highway, or the uneven surfaces over any trenches being maintained by Contractor shall interfere with the removal or sanding of snow or ice by the public authorities or adjoining land owners, in an ordinary manner with regular highway equipment, Contractor shall be required to perform such services for the public authorities or adjoining owners without charge.
- B. If the Contractor fails to perform snow removal services for the public authorities or adjoining owners, he shall reimburse the said authorities or adjoining owners for any additional cost to them for doing such work occasioned by conditions arising from Contractor's operations,

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occupancy, or trench surfaces, together with any damage to the equipment of said parties by those conditions, or claims of any parties for damage or injury or loss by reason of failure to remove snow or ice or to sand icy spots under these conditions.

**3.5 STREET DETOURS**

- A. Where detours will be required, Contractor shall prepare and submit a proposed Detour Plan for all portions of the Work. Such Detour Plan will be subject to review and approval by Engineer, the local traffic authority, and other applicable town or state entities having jurisdiction. This submittal shall be made at least seven days prior to commencing construction. It shall be the sole responsibility of Contractor to keep the Local Regulatory Agencies (including, but not limited to, the Police and Fire Departments) forewarned at least 72 hours in advance of changes in traffic patterns due to reduction of pavement widths or closing of streets. Contractor shall supply, install, maintain, replace as necessary, adjust, move, relocate, and store all signs, suitably lighted barricades, traffic cones, and traffic delineators, as necessary to carry out the traffic routing plan and maintain vehicular and pedestrian traffic. All of this work shall meet with the requirements of Engineer, local traffic authority, and other applicable town or state entities having jurisdiction.

**3.6 TRAFFIC CONTROL PROCEDURES**

- A. The proper and adequate signing of the construction zone, and any approved detours, is considered of utmost importance. Prior to the start of construction, Contractor shall submit a Traffic Management Plan for review by Engineer, the local traffic authority, Owner, Police, and Fire Department.
- B. Contractor shall provide one flagman for each work crew within signed areas for the control and direction of vehicular and pedestrian traffic on as needed, or as directed, basis and at no cost to Owner. This flagman shall be dedicated to traffic control only and shall not be utilized as part of the work crew.
- C. Uniformed policemen will be provided at major intersections and at other locations where the applicable local traffic authority or local regulatory agencies may determine their need for the control and direction of vehicular traffic and pedestrians.

**3.7 CLEAN UP**

- A. Contractor shall remove all debris, residuals, and materials at the conclusion of the work.

END OF SECTION 347123

