INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA

REHABILITATE SECOND BANK BLOCK LANDSCAPE FEATURES
INDE
PMIS NO. 308228

PROJECT SPECIFICATIONS

NATIONAL PARK SERVICE

Revised 3/31/2026
100% CONSTRUCTION DOCUMENTS

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7-5-2023

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- 8-11-2023

SECTION 01 11 00 - SUMMARY OF WORK –

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Work Covered by Contract Documents
2. Contractor Use of Site
3. Public Use of Site
4. Conduct of Operations
5. Work Restrictions
6. Special Construction Requirements
7. Additional Reports

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Location: Second Bank Block, Walnut Street between 4th Street and 5th Street, Independence National Historical Park, Philadelphia, PA.

B. The Work consists of:

1. Rehabilitation of the Second Bank Block Landscape Features
   a. Replacement of damaged walkways and paving, including the Morris Sculpture surrounds
   b. Construction of an exposed aggregate concrete walk to replace the desire pathway. (Alt. porous concrete)
   c. Address drainage deficiencies through regrading and reseeding and repair of drainage systems
   d. Restoration of trees and shrub plantings around Morris Plaza.
   e. Helical pile foundation repairs at Morris Statue base and pier at south Walnut Plaza.
   f. Option 1: Repair of deteriorating perimeter walls
   g. Option 2: Restoration of interpretive site walls representing historic structures on new foundations and associated soils and planting renewal
   h. Option 3: Conservation of Robert Morris statue off-site and restoration and cleaning of marble base and steps. Replacement of concrete foundation.

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

1.3 CONTRACTOR USE OF SITE

A. General: Contractor shall have limited use of site for construction operations. Limit use of premises to **areas within the Construction limits** indicated on drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Limits: Confine constructions operations to areas shown on drawings for staging

B. Storage of Materials: Confine storage of materials to Contractor's staging area. Storage of hazardous materials should follow NPS policies and NFPA 21 and are not allowed within 30' of historic resource.

C. Parking: No parking is permitted on NPS property, including Library Street.

D. Stockpiling: Confine stockpiling to staging area shown on drawings

E. Preservation of Natural Features:

   1. Prevent damage to natural surroundings. Restore damaged areas, repairing or replacing damaged trees and plants, at no additional expense to the Government.
   2. Provide temporary barriers to protect existing trees and plants and root zones.
   3. Do not remove, injure, or destroy trees or other plants without prior approval. Consult with Contracting Officer (CO) and remove agreed-on roots and branches that interfere with construction.
   4. Do not fasten ropes, cables, or guys to existing trees.
   5. Carefully supervise excavating, grading, filling, and other construction operations near trees to prevent damage.

F. Historic Protection: The Second Bank Block is a part of the Independence National Historical Park National Register Historic District. Existing Park elements and features are to be protected during construction operations. See section 013591 Historic Preservation Treatment Procedures for protection measures.

G. Driveways and Entrances: Keep driveways, roadways, accessways, and entrances serving premises clear and available to Government employees, and emergency vehicles at all times. Do not use for parking or storage of materials.

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

H. Construction Camp: Establishment of a camp within park will not be permitted.

I. Hauling Restrictions: Comply with legal load restrictions in hauling of materials. Load restrictions on park roads are identical to state load restrictions with such additional regulations as may be imposed by the Park Superintendent. Information regarding rules and regulations for vehicular traffic on park roads may be obtained from the Office of the Park Superintendent. A special permit will not relieve Contractor of liability for damage which may result from moving of equipment.
   1. Public Roadways: Comply with hauling and load restrictions in hauling of materials as required by the City of Philadelphia.

1.4 PUBLIC USE OF SITE

A. The park or area will be closed to the public during construction.

B. The Contractors shall restrict public access to the site during non-construction hours. The contractor shall arrange for site access by NPS Staff and approved persons during non-construction hours.

C. Contractor shall conduct his operations to ensure the least inconvenience to public. Road closures may be permitted, when required, upon specific approval of Contracting Officer and the City of Philadelphia Licenses & Inspections.

D. Library Street and through walk connection to Fourth Street may not be closed to the public nor emergency access at any time throughout Construction operations.

E. The Contractor shall maintain public sidewalks accessible to the public during construction. Sidewalk may be closed for short periods of time to ensure public safety during hauling, loading, unloading and material deliveries.
   1. Required permits for sidewalk closure shall be the responsibility of the Contractor.
   2. Pedestrian safety measures, barricades and signage, etc. are the responsibility of the Contractor.
      a. Provide a public safety plan for review by the COR for review and comment.

1.5 CONDUCT OF OPERATIONS

A. Contractor shall conduct his operations in conformance with rules and regulations promulgated by the Secretary of the Interior for the National Park Service, and applicable park rules and regulations prescribed by Park Superintendent.

B. Work on Saturdays, Sundays, Federal holidays or at night may not be performed unless stated in the Work Restrictions below or without prior consent from the Contracting Officer. Submit requests 48 hours in advance of the work to the Contracting Officer for approval.

C. No signs or advertisements (except those specified herein) shall be displayed on the construction site or within the park unless approved by the Contracting Officer.

1.6 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, except when otherwise indicated. Requests for work outside of these hours must be submitted to the Contracting Officer in writing at least 48 hours in advance of the proposed work time, and will be considered on a case by case basis.
   1. When construction noise affects residences, it should be no more than five decibels above the background sound level from: 8 p.m. to 7 a.m. on weekdays. 8 p.m. to 8 a.m. on weekends.

B. Existing Utilities

1. Existing Utilities: Notify Contracting Officer and utility companies of proposed locations and times for excavation.
2. Contractor shall be responsible for locating and preventing damage to known utilities. If damage occurs, repair utility at no additional expense to the Government.
3. If damage occurs to an unknown utility, repair utility. An equitable adjustment will be made in accordance with the Changes clause of the contract.

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

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

1.7 SPECIAL CONSTRUCTION REQUIREMENTS

A. Project Website: A project website administered by NPS will be used for purposes of managing communication and documents during construction stage.

1. See Section 01 31 00 "Project Management and Coordination" for requirements on using Project Website.

1.8 ADDITIONAL REPORTS

A. Appendix B - Robert Morris Statue Nondestructive Testing Report - 7-5-2023 and Appendix C - Robert Morris Statue Assessment & Cleaning Test Report - 8-11-2023, both by EverGreene Architectural Arts. Submitted to Mills + Schnoering Architects, LLC.

B. In case of conflict between report and drawings or specifications, drawings and specifications govern.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 00

SECTION 01 26 01 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section consists of administrative and procedural requirements for contract modifications.

1.2 DEFINITIONS AND ALLOWANCES

A. Home Office Overhead: Costs incurred in support of all of a contractor's projects and not attributable to a specific job. The cost for home office overhead is only allowed as a percentage of all direct work excluding profit. The following items represent allowable home office overhead costs identified in Part 31 of the Federal Acquisition Regulation (FAR):

1. Rent
2. Utilities
3. Furnishings
4. Office equipment
5. Executive and management staff not exclusively assigned to the project
6. Support, accounting, and administrative staff
7. Preparation of cost proposals, estimating, and schedule analyses connected with Modifications
8. Estimating and preconstruction services
9. Mortgage costs
10. Real estate and corporate taxes
11. Automobile maintenance and travel costs for home office personnel
12. Home office insurances i.e. structure, automotive, umbrella, flood, etc.
13. Depreciation of equipment and other assets
14. Home office supplies (paper, staples, etc.)
15. Legal services
16. Accounting and data processing
17. Professional fees/registration

B. General Conditions (Field Office Overhead): Management and administrative costs incurred on site for the designated project. Costs associated with preparation of modifications will not be allowed. Costs for these items are to be included only in the general conditions of the modification estimate. Only in the case of a contract time extension are additional general conditions included in modifications. The following items, if applicable, are considered allowable costs for calculating General Conditions:

1. Project Manager (PM), Assistant Project Manager
2. Superintendent, Assistant Superintendent
3. Quality Control, Safety Officer, Environmental Manager, etc.
4. Engineers
5. Travel, lodging, and per diem (as established by Federal Travel Regulations)

6. Scheduling
7. Field Office Trailers and associated temporary utilities
8. Field office supplies

    a. Mailing and couriers
    b. Reproduction costs
    c. Storage
    d. Phones
    e. Computers
    f. Copiers

9. Personal vehicles i.e. Superintendent Pickup trucks

C. General Requirements: Costs directly associated with the project and are necessary to perform the actual work of the modification. These costs shall be shown as direct costs in the estimate. The following items, if applicable, are considered allowable costs for calculating General Requirements:

1. Hoisting
2. Material handling
3. Temporary fencing
4. Port-a-lets
5. Trash removal, dumpsters
6. Barricades
7. Small tools
8. Safety supplies
9. Scaffolding
10. Daily cleaning
11. Traffic control
12. Temporary signage
13. Temporary heating and power

D. Personnel Costs: Costs included in the modification must only be for General Conditions staff and workers actually present and working on project site. Modification costs for salaried workers are only allowed within the structure of a 40-hour week and no overtime or holiday pay will be allowed.

1. Worker Hourly Rates are costs directly associated with the individual worker and consist of the following:

    a. Base Rate: The hourly rate paid directly to the worker
    b. Labor Burden: Employer payments of all applicable burdens; includes insurance and taxes the business must pay on behalf of the worker to government entities and educational forums, such as:

        1) Social Security
        2) Medicare
        3) Workers Compensation – Policy and company calculation to be made available.
        4) Federal Unemployment Tax Act (FUTA) - Cap Rate and percentage to be proportionally allocated over one year.

5) State Unemployment Tax Act (SUTA) - Cap Rate and percentage to be proportionally allocated over one year.
6) Union agreement costs - Other costs required under an enforceable collective bargaining agreement.

c. Fringe Benefits: Various non-wage compensations provided to employees such as:

1) Health Care Insurance Premiums
2) Cell Phone
3) Clothing
4) 401K and Pensions
5) Vehicle allowances
6) Gas allowance
7) Life insurance premiums
8) Disability insurance
9) Other Fringe Benefits required under an enforceable collective bargaining agreement

E. Bonuses or Deferred Compensation: No Bonus or Deferred Compensation will be allowed within any components of pricing including Home Office Overhead, General Conditions, General Requirements, Hourly Worker Rates, or the direct costs of work.

F. General Liability Insurance: An insurance policy that protects Contractor from claims resulting from bodily injury or property damage to a third party. Include as a separate line item within all modification proposals and provide a current insurance quote upon request.

G. Performance and Payment Bonds: A performance bond is a surety bond issued by an insurance company or bank to guarantee satisfactory completion of a project. The Payment Bond guarantees the Contractor will pay the labor and material costs incurred. Banks and Insurance companies charge a premium for individual project based on a sliding scale related to the size of the project. Include as a separate line item in modification proposals and provide current company bonding rates upon request.

H. Builder's Risk Insurance: Covers the contractor's loss due to fire, high winds, or other natural forces. Not reimbursed by the National Park Service (NPS) and shall not be included in modification proposals.

1.3 MODIFICATION PROPOSAL PRICING REQUIREMENTS

A. General:

1. Proposal be received in the format and within the time frame specified in the Request for Proposal (RFP) letter. Costs or delays resulting from failure of contractor to submit within the time frame specified will not be compensable.
2. Proposal shall be detailed with itemized lists of equipment, materials, labor, production rates, overhead, profit, and bond markup for each item. Labor costs must be itemized by craft and hourly rate, including Fringe Benefits and Labor Burden. If the costs of Fringe Benefits and Labor Burden are not itemized, it is assumed they are included in the hourly rate shown, or contractor is not requesting reimbursement. Contractor may

utilize the government provided Contractor Estimate Form, or their own form, provided that it contains the same information and level of detail as the Government's form.

3. Requests for extensions of contract time as a result of change must be justified with a Time Impact Analysis (TIA). Refer to Section 01 32 16 "Construction Schedule", for time impact analysis requirements. TIA and associated costs shall be received with the proposal by the date shown within the Request for Proposal letter. Contractor's failure to submit within the specified time frame will be construed as the Contractor waiving right for additional time and no time extension will be allowed.
4. All supporting documentation used to justify the proposed modification will be made available to the Contracting Officer (CO) upon request.
5. Contractor shall review and approve all subcontractor/supplier pricing in detail for proper format, scope, production rates, and pricing prior to submission to NPS. All delay costs associated with not reviewing and approving subcontractor/supplier pricing will be borne by the Contractor.
6. All pricing and production rates within the estimate must be based on fair and reasonable pricing and cannot include built-in contingency.

B. Labor:

1. Contractor shall estimate cost of labor by itemizing each craft involved, indicating worker hourly rate (base rate + labor burden + fringe benefits) for each and itemizing hours required for each craft directly engaged in modification work. Any work proposed requiring overtime work or premium pay shall be itemized separately. Rates shall be in accordance with the Davis-Bacon Act as incorporated herein. Labor Burden may include payroll taxes, Social Security, unemployment insurances, workers compensation insurance, Federal Insurance Contributions Act (FICA), FUTA, and other direct costs resulting from Federal, State or local laws.
2. Itemize labor costs for equipment operators separate from equipment costs.
3. Labor cost for foremen shall only be costs for related work required for the modification.

C. Materials:

1. Estimated cost for materials shall include quotes from multiple sources. Material prices shall include applicable fees and credits, including but not limited to, sales tax, freight and delivery charges, and tax rebates.
2. No markup shall be applied to any material provided by NPS.

D. Equipment:

1. Equipment used for the project must be appropriately sized for work being performed.
2. Do not include costs for "miscellaneous tools and equipment", in your proposal for a replacement value of $500 or less. Costs shown in excess of $500 shall be broken out separately.
3. Regardless of ownership, rates to be used in determining equipment rental costs shall be the lowest cost from one of the following sources:

   a. United States (U.S.) Army Corps of Engineers, Ownership and Operating Expense Schedule (use latest edition and applicable region)
   b. Construction Blue Book

c. Local equipment rental rates, documented by actual invoice charges, or itemized vendor quotes.

4. Estimated equipment rates shall include operating costs of all fuel, oil, lubrication, supplies, small tools, necessary attachments, ground engaging components, tires and tracks, routine repairs and maintenance (cost of major repair and overhaul is not allowed per Federal Acquisition Regulation (FAR) 31.105(d)(2)), depreciation, storage, insurance, and all incidentals. Mobilization, if applicable, may be included for equipment solely used on the modification work but must be listed separately.
5. Estimate full rate for equipment only for duration that equipment will be utilized to accomplish work of the modification.
6. Standby unit rates used in accordance with paragraph 1.3, D, 2, above. If the U.S. Army Corp of Engineers is utilized then their standby rates prevail. If Bluebook or local equipment pricing is accepted, then 1/2 of equipment costs minus any operating costs, major repair and overhaul will be accepted.
7. If equipment is in standby mode due solely to a documented NPS delay, established standby rate shall apply from the first day of the delay.
8. Equipment not used and on job site for up to five consecutive days may be classified at standby rates, provided the equipment is or has been used solely to perform work on the modification and will be necessary to complete additional modification work. Equipment still on the jobsite but not in use after five consecutive days will not be considered in the modification pricing.
9. Requests for compensation for equipment stand by time must be justified, documented and itemized separately.
10. The estimated timeframe (daily, weekly, monthly) for use of the equipment must reflect the lowest cost to the Government.

E. Establishment and Application of Overhead and Profit Percentages:

1. Home Office Overhead and Profit (OH&P) shall be applied to direct costs only. Profit shall not be applied to overhead amounts; and overhead shall not be applied to profit. Home office overhead shall contain only allowable, allocable, and reasonable costs per the contract documents and FAR Part 31. Profit percentages are based on risk factors found in FAR Part 31which have been applied to the specific type of work included in this project. Negotiated rates shall not exceed the following percentages for OH&P for contractor self-performed work:

   Overhead……10%
   Profit……**8**%

2. Total aggregate limit of markup (OH&P) for Contractor and Subcontractors on modification work shall not exceed 25%. The NPS will not be responsible for allocation of percentages between contractor and subcontractors at any tier.
3. If Contractors form a partnership, partnership may only receive home office overhead and profit in same amount as an individual Contractor (refer to paragraph 1.3,E,1 above). It is the responsibility of the partners to decide on division of revenue.
4. Combined Increases and Decreases: On proposals involving both increases and decreases in the Contract Price, overhead and profit mark-ups are required on net increases and deducted on net decreases.
5. At no time can profit be calculated on Overhead or itself, it must be calculated on direct costs of work only.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 012601

SECTION 01 27 00 – DEFINITION OF CONTRACT LINE ITEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section explains in general, what is and is not included in a contract line item, and limits or cut-off points where one item ends and another begins.

B. If no contract line item exists for a portion of work, include costs in a related item.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF CONTRACT LINE ITEMS

A. Contract Line Item Number **0001** Rehabilitation of Second Bank Block Landscape Features

1. This item consists of new exposed aggregate concrete path (SW-NE), restoration of paving, grading and drainage improvements, soil improvements, repair to site walls, new plantings, and sculpture foundation stabilization.
2. Measurement for payment will be lump sum.
3. Payment will be made at the contract **lump sum price**.

B. **Option 1 Repairs to perimeter walls**

1. Contract Line Item Number **002**:

a. This item consists of repointing, crack repairs, stone and brick replacement to perimeter and planter walls, including prep and repainting of iron fencing.
b. Measurement for payment: Lump sum
c. Payment will be made at the contract **lump sum price**.

C. **Option 2 Rebuild interpretive foundation walls**

1. Contract Line Item Number **003**:

a. This item consists of rebuilding two interpretive foundation markers along Walnut Street and 5th Street on new foundations with salvage brick and new plantings. Work at the 5th Street marker will include the restoration of adjacent brick paving.
b. Measurement for payment: Lump sum
c. Payment will be made at the contract **lump sum price**.

D. **Option 3 Sculpture Conservation**

1. Contract Line Item Number **004**:

   a. This item consists of dismantling sculpture and stone plinth for conservation off-site. Foundation replacement and stone cleaning and repairing to marble base. Reinstallation of sculpture.
   b. Measurement for payment: Lump sum
   c. Payment will be made at the contract **lump sum price**.

E. **Option 4 Pervious Concrete Paving**

1. Contract Line Item Number **005**:

   a. This item consists of an alternate for pervious concrete paving in lieu of exposed aggregate concrete at the new social path.
   b. Measurement for payment: Lump sum
   c. Payment will be made at the contract **lump sum price**.

END OF SECTION 01 27 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Definitions
2. Construction Coordination
3. Submittals
4. Coordination Drawings
5. Requests for Information (RFIs)
6. NPS/DSC Project Website
7. Project Meetings
8. Environmental Coordination
9. Permits

B. Related Requirements:

1. Section 01 32 16 "Construction Schedule" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 40 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

A. Agency with Jurisdiction
B. Construction Permits – Contractor Provided
C. Government Furnished Permits

1.3 CONSTRUCTION COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain 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 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 components, including mechanical and electrical.
5. Properly plan construction operations to include permit requirements. Allow enough time to execute permit provisions to maintain work schedule, site visits, inspections, and reporting deadlines.

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.

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:

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. Progress meetings
6. Permit requirements
7. Pre-installation conferences
8. Project closeout activities
9. Commissioning activities

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

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

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate dimensions shown on 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 Contracting Officer (CO) for resolution of such conflicts.
c. Indicate space requirements for routine maintenance and 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 controls.
e. Indicate required installation sequences.

2. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
3. Follow **NPS DSC Electronic Drawing Standards.** See CAD/BIM (Computer Aided Design/Building Information Modeling) & Drafting Standards page > **DSC Requirements** section.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
2. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
3. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
4. Plumbing Work:

    a. Sizes and bottom elevations of 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.

5. Electrical Work:

    a. Runs of vertical and horizontal conduit 1-1/4 inches (32 millimeters) in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm 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.

6. Review: Contracting Officer will review coordination drawings to confirm Work is being coordinated; details of coordination are Contractor's responsibility. If Contracting Officer determines coordination drawings are not prepared in scope or detail, or are otherwise deficient, Contracting Officer will inform Contractor, who shall make changes and resubmit.
7. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 23 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using Portable Document Format (PDF) file format.
3. Contracting Officer will furnish Contractor one set of digital data files (AutoCad.dwg) of Drawings for use in preparing coordination digital data files.

    a. Contracting Officer makes no representations as to accuracy or completeness of digital data files as they relate to Drawings.

b. Digital Data Software Program: Drawings are available in AutoCad.dwg.

D. Division 1 documents:

1. Letter designating Project Superintendent
2. Construction Schedule
3. A Comprehensive Schedule of Values
4. Accident Prevention Plan
5. A List of Subcontractors for this project
6. Written statements from Subcontractors certifying compliance with applicable labor standard clauses.
7. Certificates of Insurance and Standard Form SF1413 for Contactor and all Subcontractors
8. Waste Management Plan
9. Quality Control Plan
10. Temporary Storm Water Pollution Prevention Plan (SWPP or UPPP)
11. Indoor Air Quality (IAQ) Management Plan
12. Contractors Commissioning Plan
13. Historic Preservation Treatment Plan (HPTP)
14. List of Required Construction Permits. Include the following information for each permit:
    a. Name of Permit
    b. Agency(ies) with Jurisdiction issuing the permit
    c. Information required from Government to complete permit application

E. Provide items listed to Contracting Officer at least one week prior to Pre-Construction Conference, or as directed by Contracting Officer.
1. Failure to submit items may result in:
    a. Construction conference may be cancelled, Notice to Proceed may not be issued, and Contracting Officer will consider other contractual remedies.
    b. Work shall not commence until written Notice to Proceed has been issued and Certificates of Insurance and SF1413 documents are received for Contractor and all Subcontractors.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of Contract Documents, Contractor shall prepare and submit an RFI utilizing form created on NPS/DSC management software-website.

1. Contracting Officer will not respond to RFIs submitted by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in the work.

B. Content of RFI: Include detailed, legible description of item needing information or interpretation and the following:

1. RFI number, numbered sequentially
2. Date
3. RFI subject
4. Specification Section number and title and related paragraphs, as appropriate.
5. Drawing number and detail references, as appropriate.

6. Field dimensions and conditions, as appropriate.
7. Contractor's suggested resolution: If Contractor's suggested resolution impacts Contract Time or Contract Sum, Contractor shall state impact in RFI.
8. Contractor's signature
9. Requested date for response
10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Form: Complete RFI Form on NPS/DSC Project Website as follows:

1. Enter general information at the top of the form.
2. Under the "Action" section at the bottom of the form, select "Question" then select "CMR" in drop-down of "Send to" box.
3. Enter details of question and attach related documents.
4. Select "Submit Form" at bottom of page.

D. Contracting Officer’s Action: Contracting Officer will review each RFI, determine action required, and respond. Contracting Officer will determine critical nature of each RFI and issue response accordingly.

1. The following are not considered to be RFIs and will receive no 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 Contract Documents.
    e. Requests for adjustments in Contract Time or Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Contracting Officer's action may include a request for additional information; time for response will date from time of receipt of additional information.
3. Contracting Officer's action on RFIs may result in need for a change to Contract Time or Contract Sum. All contract changes will be processed following terms and conditions of contract.

1.6 PROJECT WEB SITE

A. Use NPS/DSC management software website for communication throughout contract period on:

1. Project directory
2. Project correspondence
3. Meeting agendas and minutes
4. Contract modifications forms and logs
5. RFI form and processing
6. Task and issue management

7. Photo documentation
8. Baseline schedule, schedule updates and calendar management
9. Submittal form and processing
10. Payment coordination documentation
11. Drawing and specification document hosting, viewing, and updating
12. Online document collaboration
13. Reminder and tracking functions
14. Archiving functions
15. Notification of submittal and RFI statuses and current responsible party
16. Permits and addendums

B. Some documents are not suitable to be shared using the NPS/DSC management software website. Documents containing Personal Identifying Information (PII) (i.e. certified payrolls) shall not be shared using NPS/DSC management software website and shall be coordinated with Project team as appropriate.

C. Submit to Contracting Officer a list of employees who will need access to the website. Users will receive an invitation to register from Department of Interior (DOI). Once registered on DOI website, user will be given access to NPS/DSC management software website.

D. All users will be required to have the following software packages:

1. Internet Explorer version 7 or later.
2. Adobe Acrobat Professional (Pro) version 9 or later.

1.7 PROJECT MEETINGS

A. Preconstruction Conference: Before start of construction, Contracting Officer will arrange an on-site meeting with Contractor. Meeting agenda will include the following as a minimum:

1. Roles & Responsibilities / Lines of Authority
2. Park rules and regulations
3. Jobsite Safety
4. Resolution of comments on required Division 1 documents
5. Coordination of Subcontractors
6. Labor law application
7. Modifications
8. Payments to Contractor
9. Payroll reports
10. Contract time
11. Contractor Performance Evaluation
12. Display of Hotline posters
13. Notice to proceed
14. Correspondence procedures
15. NPS/DSC Project website
16. Acceptance/rejection of work
17. Progress meetings
18. Submittal procedures
19. NPS Final Accessibility Inspection
20. Environmental requirements

21. Permit requirements
22. As-constructed drawings/operation and maintenance (O&M) manuals.
23. Saturday, Sunday, holiday and night work.
24. Reference materials
25. Value engineering
26. Schedule of Values

B. Progress Meetings: Contracting Officer will schedule weekly meetings with Contractor.

1. Attendees: In addition to Government Representatives, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented. Participants at meeting 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. Meeting agenda will include:

    a. Approval of minutes of previous meetings
    b. Submittal status
    c. Review of off-site fabrication and delivery schedules.
    d. Requests for information (RFI) and other issues.
    e. Modifications
    f. Work in progress and projected.
        1) Status of required inspections (Special Inspections, Accessibility, etc.)
    g. Inspections of work in progress and projected (Special inspections, Accessibility, etc.)
    h. Construction Schedule update (provide updated Critical Path Method (CPM)).
    i. Status of Project Record Drawings and O&M manuals.
    j. Other business relating to work.
    k. Permit requirements

C. Preinstallation Conferences: Conduct 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 installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend meeting. Advise Contracting Officer of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for particular activity under consideration, including requirements for:

    a. 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 requirements

k. Time schedules
l. Weather limitations
m. Manufacturer's written instructions
n. Warranty requirements
o. Compatibility of materials
p. Acceptability of substrates
q. Temporary facilities and controls
r. Space and access limitations
s. Regulations of agency(ies) with 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: Distribute minutes of meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.

1.8 ENVIRONMENTAL COORDINATION

A. Contractor’s Environmental Manager: Designate on-site party responsible for overseeing Contractor’s conformance to environmental goals for project and implementing procedures for environmental protection.

1. Qualifications: Minimum 3 years Construction experience on projects of similar size and scope; with environmental procedures similar to this project;; familiar with environmental regulations applicable to construction operations.
2. Responsibilities: Responsibilities shall include:

a. Compliance with applicable Federal, State, and local environmental regulations, including maintaining required documentation.
b. Implementation of Waste Management Plan (WMP).
c. Implementation of Storm Water Pollution Prevention Plan (SWPPP).
d. Present overview of environmental issues and summarize site specific procedures relating to management plans at Preconstruction conference.
e. Training for Contractor personnel in accordance with position requirements.
f. Monitoring and documentation of environmental procedures.

B. Perform project quality control in accordance with requirements specified in Related Sections, including:

1. Quality Requirements
2. Regulatory Requirements
3. Noise and Acoustics Management

4. Temporary Storm Water Pollution Prevention Environmental Management
5. Construction Waste Management

C. Contractor's Environmental Training Program: Contractor shall provide environmental training for workers performing work on project site. Training shall include:

1. Overview of environmental issues related to building industry.
2. Overview of environmental issues related to Project.
3. Review of site-specific procedures and management plans:

   a. Construction Waste Management
   b. Noise and Acoustics Management
   c. Temporary Storm Water Pollution Prevention

4. Pollution Prevention (P2) practices: Submit evidence of P2 training
5. Compliance with environmental regulations: As specified in Regulatory Requirements. Submit Contractor 40 CFR (Code of Federal Regulations) employee training records upon request of Contracting Officer.

D. Provide documentation for environmental procedures as specified herein and in accordance with approved Waste Management Plan, IAQ Management Plan, and Storm Water Pollution Prevention Plan.

1.9 PERMITS

A. General:

1. Permits and Responsibilities: Contractor shall, without additional expense to the Government, be responsible for obtaining necessary licenses and permits, and for complying with Federal, State and municipal laws, codes, and regulations applicable to the performance of the work. Contractor shall also be responsible for damages to persons or property that occur as a result of Contractor's fault or negligence; and for materials delivered and work performed until completion and acceptance of the work.
2. For the purpose of this contract, Contractor will not be considered an agent of the Government. Contractor shall comply with appropriate Federal, State and local laws.

B. Government Furnished Permits: During development of the project's design, permits listed below were negotiated and agreed to by the Government. Terms and provisions of these permits shall be adhered to for the duration specified in each permit.

1. A permit was acquired for **Existing Resources and Site Analysis (ERSA)** with identification number **FY24-NPSI-7800-01.** The Agency(ies) with Jurisdiction for this permit is **Philadelphia Water Department.**

C. Potential Permits: Permits listed below were identified during the design process as likely to be required based on typical means and methods of construction. The list is provided to assist Contractor in determining which permits will be required for contract's chosen means and methods. The list shall not be considered complete; it is the Contractors' responsibility to determine means and methods and obtain required permits. Contractor shall obtain all permits required to legally conduct work.

1. Construction trailer, Utilities hookup permit – **Philadelphia Department of Licenses and Inspections**
2. Street Closure - **Philadelphia Streets Department**
3. Stormwater Pollution Prevention Permit – **Philadelphia Water Department**
4. MS4 Stormwater Permit – **Philadelphia Water Department**
5. Dewatering Permit – **Philadelphia Water Department**

D. Coordination with Agency(ies) with Jurisdiction Issuing Permits

1. Coordination: Contact the Agency(ies) with Jurisdiction as needed and sufficiently in advance to avoid delaying work: Coordinate meetings, reporting requirements, inspections, and other requirements.

E. Administrative Procedures:

1. Coordinate scheduling and timing of required administrative provisions of project permits with Agency(ies) with Jurisdiction, Construction Manager, and Park to avoid conflicts.
2. Supply needed information to Agency(ies) with Jurisdiction issuing permits, pay fees required and provide material needed to comply with permit's conditions and provisions.
3. Upload permits to NPS/DSC management software website when permits are obtained.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 18 – CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Section consists of Construction Schedule requirements including:

1. Schedule of Values
2. Construction Schedule Requirements.
3. Construction Schedule Updates.
4. Time Impact Analysis.

B. Purpose: The Construction Schedule ensures adequate planning, coordination, scheduling, and reporting during execution of the work by the Contractor. It shall assist the Contractor and Contracting Officer (CO) in monitoring the progress of the work, evaluating proposed changes, and processing Contractor's monthly progress payments. It shall include the dates in the contract, phases, milestones, occupancies, holidays, weather consideration, a critical path, and the requirements of this section.

1.2 DEFINITIONS

A. Activity: A discrete part of a project 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 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. Cost Loading: Allocation of the Schedule of Values for completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by the Contracting Officer.

C. Critical Path Method (CPM): 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.

D. Critical Path: Longest connected chain of interdependent activities through the network schedule that establishes minimum overall Project duration and contains no float.

E. Float: Measure of leeway in starting and completing an activity.

1. Float: Not for the exclusive use or benefit of the Government or Contractor but is jointly owned.
2. Free Float: Amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total Float: Measure of leeway in starting or completing an activity without adversely affecting planned Project completion date.

F. Resource Loading: Allocation of manpower and equipment necessary for completion of an activity as scheduled.

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

1.3 SUBMITTALS

A. Electronic Copies: Schedules and reports submitted shall be posted on the NPS/DSC management software website in native electronic file formats. The intent of the Government is to limit the number of printed reports to those determined by the project team as essential.

B. Schedule of Values: After contract award and before Pre-Construction conference, submit schedule of dollar values based on Contract Price Schedule.

C. Construction Baseline Schedule: After contract award and before Pre-Construction conference, submit [**two**] paper copies of baseline schedule, large enough to show entire schedule for entire construction period. Utilize Schedule of Values in preparation of Construction Baseline Schedule.

D. Critical Path Method (CPM) Reports: Concurrent with CPM schedule, submit [**three**] paper copies of the following computer-generated reports. For each activity, include activity number, 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 activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of predecessor and successor tasks for 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 activities sorted in ascending order of total float.

E. Construction Schedule Updates: On or before 7th day preceding progress payment request date, submit estimates of percent completion of each schedule activity and necessary supporting data. Provide two paper copies.

F. Construction Schedule Revisions and Time Impact Analysis: For each Construction Schedule revision, submit two paper copies of a Time Impact Analysis. Incorporate a Fragmentary Network (Fragnet) into currently accepted Construction Schedule that demonstrating how Contractor proposes to incorporate a modification, change, delay, or Contractor request.

1.4 QUALITY ASSURANCE

A. Contractor shall meet with Contracting Officer on day of the preconstruction conference to go over:

1. Review software limitations, content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, interim milestones and partial Government occupancy/substantial completions**.**
4. Review delivery dates for Government-furnished products.
5. Review schedule for work of separate Government contracts.
6. Review time required for review of submittals and re-submittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review time required for obtaining and activating permits.
10. Review and finalize list of construction activities to be included in schedule.
11. Review baseline schedule comments, resolve issues and progress on incorporating them
12. Review procedures for updating schedule.
13. Discuss reporting requirements and establish protocol for naming and transmitting electronic schedules.

B. Contractor's Schedule Representative: Before the preconstruction conference, designate an authorized representative to be responsible for preparing and maintaining the Construction Schedule. Submit resume outlining qualifications of Scheduler to Contracting Officer for acceptance. Scheduler shall have prepared and maintained at least 5 previous schedules of similar size and complexity similar to this Contract, demonstrating proficiency of using scheduling software. Authorized representative will be responsible for preparing the Baseline Schedule, required updates, revisions, Time Impact Analyses, and reports.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate Contractors.

B. Coordinate Construction Baseline Schedule with Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. In developing Construction Baseline Schedule, ensure Subcontractor’s work at all tiers, and prime Contractor’s work, is included and coordinated.
2. Secure time commitments for performing critical elements of work from parties involved.
3. Coordinate each construction activity in network with other activities and schedule in proper sequence.

PART 2 - PRODUCTS

2.1 SCHEDULE OF VALUES

A. Breakdown each lump-sum item into component work activities used in the schedule for which progress payments may be requested. Work activities broken out within schedule of values shall be integrated into and made a logical part of the construction baseline schedule. Total costs for the component work activities shall equal contract price for that lump-sum item. Contracting Officer may request data to verify accuracy of dollar values. Include mobilization, general condition costs, overhead and profit in the total dollar value of unit price items and in the component work activities for each lump-sum item. Do not include mobilization, general condition costs, overhead or profit as a separate item.

B. Do not break down unit price items. Use only the contract price for unit price items.

C. Total cost of all items shall equal the contract price. The Schedule of Values will form the basis for progress payments and the Construction Schedule.

2.2 CONSTRUCTION SCHEDULE REQUIREMENTS

A. Construction Baseline Schedule: Prepare Construction Baseline Schedule using a computerized, cost and resource-based**,** time-scaled Critical Path Method network analysis diagram for the Work.

1. Develop and finalize Construction Baseline Schedule so it can be accepted for use no later than **30**days after date established for the Notice of Award.

   a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing work within applicable completion dates, regardless of Governments acceptance of schedule.

2. Establish procedures for monitoring and updating Construction Baseline Schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

B. Construction Baseline Schedule Preparation: Prepare a list of all activities required to complete the Work. Using preliminary Critical Path Method network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate estimated duration, sequence requirements, and relationship of each activity in relation to other activities.
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 Critical Path Method schedule within the limitations of the Contract Time.

4. Show sequence and interdependence of activities required for completion of work. Ensure work sequences are logical and Construction Baseline Schedule shows a coordinated plan of the work.
5. Resource loading of each activity shall include personnel by labor category and equipment type and capacity proposed to complete the activity in duration shown.
6. Consider seasonal weather conditions in planning and scheduling work influenced by high and low ambient temperatures, wind, or precipitation to ensure completion of work within contract time.
7. Time Frame: Proposed duration assigned to each activity shall be Contractor's best estimate of time required to complete activity considering the scope and resources planned for activity.

    a. An early finish date may be shown but the late finish date shall be same date as last day of contract period. An early completion schedule shall contain:

        1) Insert an activity titled "Project Float" as a successor to last activity in early project completion schedule network.
        2) Add a milestone titled "Contract End Date" as a successor to the activity "Project Float".
        3) Add duration to the activity "Project Float" as required so the milestone "Contract End Date" equals the last day of Contract Period.

    b. Contract completion date shall not be changed by submission of a schedule that shows an early completion date.
    c. Contractor shall limit use of lead or lag duration’s between schedule activities.
    d. Project Calendars: Develop and incorporate the following calendars:

        1) Administrative Calendar: Include calendar based on a 7-day week to be used on activities based on calendar days. Apply this calendar to administrative tasks or other tasks not affected by non-working days (Federal Holidays, weather, etc.).
        2) Project Calendar: Include calendar based on planned work week for the project. Include Federal Holidays, weekends, and non-workdays indicated in contract documents. Apply this calendar to activities not anticipated to be affected by weather. Be clear when identifying number of work days in work week.
        3) Weather Calendar: Utilize Project Calendar and show anticipated normal downtime related to weather as non-working time. Weather days shall be based on data for local area from a reliable source like the National Oceanic and Atmospheric Administration (NOAA), National Park Service records, or source acceptable to Contracting Officer. Apply this calendar to activities anticipated to be affected by weather.

    e. Activity Duration: Define so no activity is longer than **14** days, except for non-construction activities including mobilization, shop drawings and submittals, fabrication and delivery of materials and equipment.
    f. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in the schedule. Procurement cycle activities can include submittals, approvals, purchasing, fabrication, and delivery.

g. Submittal Review Time: Include review and re-submittal times indicated. Coordinate submittal review times in Construction Baseline Schedule.
h. Substantial Completion: Allow time for Government administrative procedures necessary for certification of Substantial Completion. (For more information, refer to Specification 01 77 00 "Closeout Procedures.")

8. Constraints: Include constraints and work restrictions indicated in Contract Documents and as follows in schedule and show how the sequence of Work is affected.

a. Phasing: Arrange list of activities on schedule by phase.
b. Work under More Than One Contract: Include a separate activity for each contract.
c. Work Restrictions: Show effect of the following on the schedule:

1) Coordination with existing construction
2) Limitations of continued occupancies
3) Uninterruptible services
4) Partial occupancy before Substantial Completion
5) Use of premises restrictions
6) Provisions for future construction
7) Seasonal variations
8) Environmental control
9) Permit provisions

d. Other Constraints: N/A
e. Work Stages: Indicate important stages of construction for each major portion of the Work.

1) Subcontract awards
2) Submittals
3) Purchases
4) Mockups
5) Fabrication
6) Sample testing
7) Deliveries
8) Installation
9) Tests and inspections
10) Adjusting
11) Curing

9. Milestones: Include milestones indicated in Contract Documents in schedule, including, but not limited to, Notice to Proceed, Substantial Completion.

C. Joint Review, Revision, and Acceptance:

1. Within seven calendar days of receiving Contractor's proposed Construction Baseline Schedule, Contracting Officer shall review initial Construction Baseline Schedule.
2. Within seven calendar days after review, Contractor shall revise and resubmit Construction Baseline Schedule in accordance with comments presented from review.
3. In the event the Contractor fails to define any element of work, activity, or logic, and the Contracting Officer review does not detect this omission or error, such omission or error,

when discovered by Contractor or Contracting Officer, shall be corrected by Contractor within seven calendar days and shall not affect contract period.

4. Upon acceptance of the Construction Baseline Schedule, Contracting Officer saves schedule as a baseline and updates on a monthly basis. Construction schedule update will be used to evaluate Contractor's monthly applications for payment based upon information developed at monthly Construction Schedule update meeting.

D. Cost Correlation: In the heading of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of dates used to prepare payment requests.

1. Contractor shall assign cost to construction activities on Construction Baseline Schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Contracting Officer's approval, be assigned to fabrication and delivery activities. Costs shall be included for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable).
2. Each activity cost shall reflect an accurate value based on the Contract Price Schedule.
3. Total cost assigned to activities shall equal total Contract Price.

E. Recovery Schedule: When periodic schedule update indicates Work is 14 or more calendar days behind current accepted schedule, a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule shall also be submitted. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery shall be accomplished.

F. Computer Software: Prepare schedules using a program developed specifically to manage construction schedules.

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE UPDATES

A. Progress Meeting Updates: Provide a 2 week look-ahead schedule, derived from the currently accepted schedule, before each weekly progress meeting. Utilize look-ahead schedule to facilitate and take notes on discussions held during progress meeting.

B. Monthly Schedule Updates:

1. General: Update Construction Schedule on monthly basis to reflect construction progress and activities throughout entire contract period and until project substantial completion. The status date of each schedule update shall be the 7th day preceding the progress payment request date.
2. Procedure: Contractor shall meet with Contracting Officer each month at Construction Schedule update meeting to review progress made through the status date of the Construction Schedule update, including dates activities were started or completed and percentage of work completed on each activity started or completed.
3. Reports: Concurrent schedule revisions, prepare tabulated reports showing:

a. Identification of activities that have changed
b. Changes in early and late start dates
c. Changes in early and late finish dates
d. Changes in activity durations in workdays
e. Changes in the critical path
f. Changes in total float or slack time
g. Changes in the Contract Time

4. Narrative: Report shall include a brief description of actual progress made during update period; actual and potential delaying activities; impediments to progress; issues related to inclement weather; progress toward established milestones and project float. Report shall include a brief description of work anticipated to be performed in the next month. Minor revisions to the schedule should be identified for evaluation and acceptance or rejection.
5. As Work progresses, indicate Actual Completion percentage for each activity.
6. If schedule update shows a late finish date after contract completion date, include:

   a. Known delays
   b. Actions to get back on schedule
   c. Pending modifications
   d. Impediments or constraints affecting progress

7. Progress Payments: Monthly updating of the currently accepted Construction Schedule shall be an integral part of the process upon which progress payments will be made. If Contractor fails to provide schedule updates or revisions, a portion of the monthly payment may be retained until corrections have been made.

C. Distribution: Distribute copies of accepted schedule to Contracting Officer, Contracting Officers Representative, Construction Management Representative, Subcontractors, 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 same parties and post in same locations. Delete parties from distribution when they have completed their assigned portion of the Work.

D. Construction Schedule Revisions:

1. Required Revisions: If, as a result of the monthly schedule update, it appears the currently accepted Construction Schedule no longer represents actual prosecution and progress of the work, Contracting Officer will request, and Contractor shall submit, a revision to the Construction Schedule. Contractor may also request reasonable revisions to currently accepted Construction Schedule in event the Contractor's planning for the work is revised. If Contractor desires to make changes, Contractor shall notify Contracting Officer in writing, stating reason for proposed revision. Accepted revisions shall be incorporated into currently accepted Construction Schedule for next monthly schedule update.
2. Procedure: If revision to currently accepted Construction Schedule is contemplated, Contractor or Contracting Officer shall advise the other in writing at least seven calendar days prior to next monthly schedule update meeting, describing revision and reasons for the revision. Government-requested revisions will be presented in writing to the Contractor, who shall respond in writing within seven calendar days.
3. Reports: Concurrent with making revisions to schedule, prepare tabulated reports showing:

a. Identification of activities changed
b. Changes in early and late start dates
c. Changes in early and late finish dates
d. Changes in activity durations in workdays
e. Changes in critical path
f. Changes in total float or slack time

3.2 TIME IMPACT ANALYSIS FOR CONTRACT MODIFICATIONS CHANGES DELAYS AND CONTRACTOR REQUESTS:

1. Requirements: When contract modifications or changes are initiated, delays experienced, or Contractor desires to revise currently accepted Construction Schedule, Contractor shall submit to Contracting Officer a written time impact analysis illustrating the influence of modification, change, delay, or Contractor request on contract time.
2. Time Extensions: Activity delays, resulting in a late completion date projection, shall not automatically mean an extension of contract time is warranted or due to Contractor. It is possible a modification, change, or delay will not affect existing critical path activities or cause non-critical activities to become critical. A modification, change, or delay may result in absorbing a part of available total float that may exist within an activity chain of the Schedule, not causing any effect on contract time. Time extensions will be granted in accordance with terms of contract.
3. Extension of contract time will be granted only to the extent the equitable time adjustments to activity or activities affected by modification, change, or delay exceeds total (positive or zero) float available on a particular activity.
4. Procedure: Each time impact analysis shall be submitted within time period stated in a request for proposal, or time period designated under the clauses entitled Changes or Default. In cases where Contractor does not submit a written request for extension of time and a time impact analysis within the designated time, it is mutually agreed that the particular modification, change, delay, or Contractor request does not require an extension of the contract time. Upon acceptance, time impact analysis shall be incorporated into currently accepted Construction Schedule at next monthly schedule update.
5. Contract Modifications: Prepare time-impact analysis using fragnets to demonstrate effect of proposed change on overall Construction Schedule for each proposed contract modification concurrent with submission.

END OF SECTION 01 32 16

SECTION 01 32 33 – PHOTO DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for:

1. Existing condition images
2. Periodic construction images

B. See Section 01 77 00 "Closeout Procedures" for a complete listing of closeout documents.

C. See Section 01 79 00 "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of National Park Service (NPS) personnel.

1.2 SUBMITTALS

A. Construction Images: Submit images electronically within seven days of taking the image. Include:

1. Date, time and number (sequentially number all images) in filename.
2. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
3. Submit digital images exactly as originally recorded in digital camera, without alteration, or modifications using image-editing software.

B. Closeout: Submit complete set of digital image electronic files as a Project Record Document.

1. Provide index. List each image as a file name with number, date, and time. Include description and or vantage point image was taken.
2. Submit images that have the same aspect ratio as the sensor, un-cropped.

PART 2 - PRODUCTS

2.1 FORMAT REQUIREMENTS

A. Images: Provide sRGB (standard Red Green Blue) color images in JPEG (Joint Photographic Experts Group) format. Minimum sensor size of 8 megapixels, and at image resolution of not less than 3200 by 2400, and 300 dpi (dots per inch).

PART 3 - EXECUTION

3.1 CONSTRUCTION IMAGES

A. General: Take digital images using the maximum range of depth of field, in-focus, to clearly show the Work. No blurry or out-of-focus areas accepted.

1. Maintain index with each set of Construction images and identify the number, date, time, and description for each.
2. Maintain one set of images accessible in field office at Project site available for reference.

B. Existing Condition Images: Before starting construction, take color digital images of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

1. Flag excavation areas and construction limits before recording construction images.
2. Take eight separate images to show existing conditions adjacent to property before starting Work.
3. Take eight separate images of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

C. Periodic Construction Images: Take 12 color, digital images weekly, with timing each month adjusted to coincide with cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last images were taken.

D. Additional Images: Contracting Officer may issue requests for additional images.

1. Three days advance, where feasible.
2. In emergency situations, take additional images within 24 hours of request.
3. Additional images include, but are not limited to:

a. Immediate follow-up when on-site events result in construction damage or losses.
b. Fabrication locations away from Project site.
c. Substantial Completion of a major phase or component of Work.
d. Extra record images at time of final acceptance.

END OF SECTION 01 32 33

SECTION 01 33 23 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

A. Action Submittals: Written, graphic information, and physical samples that require Government's responsive action.

B. Informational Submittals: Written information that does not require Government'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.

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.

1.3 GENERAL SUBMITTAL PROCEDURES

A. General: Prepare and submit submittals required by individual Specification Sections and in some cases as requested in drawings. Types of submittals are indicated in individual specific sections.

1. Contracting Officer (CO) reserves right to require submittals in addition to those called for in individual sections.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Review for legibility, accuracy, completeness, and compliance with Contract Documents.

1. Coordinate submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of Work so processing will not be delayed because of need for concurrent review coordination.

a. Contracting Officer reserves right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittal List: Submittal list is attached to the end of this Specification Section. The intent is to provide an overall summary of submittal requirements. The requirements of individual Specification Sections and terms and conditions of the Contract still apply regardless of what is shown on submittal list.

D. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence when e-mail notification is received by Contracting Officer (or designee) indicating submittal has been posted on NPS management software website and is ready for review. When Contracting Officer has completed review, e-mail notification will be sent to Contractor indicating submittal has been processed. No extension of Contract Time will be authorized because of failure to transmit submittals in advance of Work to permit processing, including re-submittals.

1. Action Submittals

a. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
b. Re-submittal Review: Allow 10 days for review of each re-submittal.

2. Informational submittals

a. Review: Allow **10** days for review of each submittal.

E. Equivalents:

1. For each item proposed as an "equivalent," submit supporting data, including:

a. Drawings and samples as appropriate.
b. Comparison of the characteristics of the proposed item with that specified.
c. Changes required in other elements of the work because of the substitution.
d. Name, address, and telephone number of vendor.
e. Manufacturer’s literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.

2. A request for approval constitutes a representation that Contractor:

a. Has investigated the proposed item and determined that it is equal or superior in all respects to that specified.
b. Will provide the same warranties for the proposed item as for the item specified.
c. Has determined that the proposed item is compatible with interfacing items.
d. Will coordinate installation of an approved item and make changes required in other elements of the work because of the substitution.
e. Waives claims for additional expenses that may be incurred as a result of the substitution.

F. **Electronic Submittals:** Identify and incorporate information in each electronic submittal file as follows:

1. Transmittal Form (CM-16): All submittals shall be transmitted using National Park Service Transmittal Form (CM-16). The form can be downloaded from the DSC Workflows website's Submittal Review page and completed on the NPS/DSC management software website. No action will be taken on a submittal item unless accompanied by this Transmittal Form.

    a. Complete the general information at the top of form.
    b. Provide all required information based on submittal type
    c. Attach all related documents.
    d. Sign the Contractor section at bottom of the Transmittal Form (CM-16).

2. Physical samples: Complete Transmittal Form (CM-16) on the NPS/DSC management software website as described above. Deliver physical sample to the Contracting Officer (or designee) on site for processing. All comments and actions will be documented on the Transmittal Form (CM-16) on the NPS/DSC management software website.

G. Identification: Submittal number or other unique identifier, including revision identifier.

1. Submittal number shall use a sequential number (e.g. .001). Re-submittals shall include alphabetic suffix after another decimal point (e.g. .001.A).

H. Re-submittals: Make re-submittals using same process used with initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in the title block on the Transmittal Form (CM-16) and clearly indicate extent of revision.
3. Re-submit submittals until they are marked "Approved" or "Approved with notations".

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and others as necessary for performance of construction activities.

J. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved with notations". Ensure notations have been incorporated and, at a minimum, keep one copy of final approved submittal on site for use during construction.

1.4 CONTRACTOR'S USE OF CAD/BIM FILES

A. General: At Contractor's written request, copies of CAD (Computer Aided Design)/BIM (Building Information Modeling) files will be provided to Contractor for Contractor's use in connection with Project, subject to:

1. Files provided as is; no format or other changes to files or changes to objects in the drawing will be done by the Government

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

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 submittal to show which products and options are applicable.
3. As applicable, include:

a. Manufacturer's product specifications.
b. Manufacturer's installation instructions: When Contract Documents require compliance with manufacturer's printed instructions, provide one complete set of instructions to Contracting Officer and keep another complete set of instructions at the project site until substantial completion.
c. Manufacturer's catalog cuts: Submit only pertinent pages; mark each page of standard printed data to identify specific products proposed for use.
d. Wiring diagrams showing factory-installed wiring.
e. Printed performance curves.
f. Operational range diagrams.
g. Compliance with specified referenced standards.
h. Testing by recognized testing agency.

4. Submit product data in PDF (portable document format) file format 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

1. Preparation: Fully illustrate requirements in Contract Documents. As applicable, include:

a. Dimensions
b. Identification of products
c. Fabrication and installation drawings
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. Notation of coordination requirements
j. Notation of dimensions established by field measurement
k. Relationship to adjoining construction clearly indicated
l. Seal and signature of professional engineer if specified
m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring

2. Submit shop drawings as PDF electronic file

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. Complete and post the Transmittal Form (CM-16) on the NPS/DSC management software website for processing and documentation of action on submitted samples.
3. Identification: Attach label on unexposed side of Samples that includes:

    a. Generic description of Sample
    b. Product name and name of manufacturer
    c. Sample source
    d. Submittal Number and title of appropriate Specification Section

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing 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. Contracting Officer will return with options selected.

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: 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 four sets of Samples. Contracting Officer will retain three Sample sets; remainder will be returned. **Retain Sample set as a Project Record Sample.**

D. Construction Materials: Contractor is encouraged to submit products made out of recycled or environmentally responsible material. Every effort will be made by National Park Service to approve these materials.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by individual Specification Sections.

1. Post informational submittals as PDF electronic files directly to the NPS management software website.

2. Certificates and Certifications: Provide a notarized statement with signature of entity responsible for preparing certification. Certificates and certifications shall be signed by officer or other individual authorized to sign documents on behalf of that entity.
3. Informational submittals that do not comply with requirements specified in Contract Documents will be rejected and one copy will be returned.

B. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

C. Contractors Construction Schedule: Comply with requirements specified in Section 01 32 16 "Construction Schedule."

D. Accident Prevention Plan: Comply with requirements specified in Section 01 35 23 "Safety Requirements."

E. Schedule of Values: Comply with requirements specified in Section 01 32 16 "Construction Schedule."

F. Waste Recycling Plan: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

G. Quality Control Plan: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

H. Storm Water Pollution Prevention Plan: Comply with requirements specified in Section 01 57 23 "Temporary Storm Water Pollution Prevention" and storm water permit requirements identified in Section 01 31 00 "Project Management and Coordination."

I. Indoor Air Quality Management Plan: Comply with requirements specified in Section 01 57 19.11 "Indoor Air Quality Management."

J. Leadership in Energy and Environmental Design (LEED™) Submittals: Comply with requirements specified in Section 01 81 13.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations," Section 01 81 13.16 "Sustainable Design Requirements - LEED for Commercial Interiors," Section 01 81 13.19 "Sustainable Design Requirements - LEED for Core and Shell Development," and Section 01 81 13.23 "Sustainable Design Requirements - LEED for Schools."

K. Qualification Data: Prepare written information demonstrating 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.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on American Welding Society (AWS) forms. Include names of firms and personnel certified.

M. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying Installer complies with Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying manufacturer complies with Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Prepare written statements on manufacturer's letterhead certifying product complies with Contract Documents.

P. Material Certificates: Prepare written statements on manufacturer's letterhead certifying material complies with Contract Documents.

Q. 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 Contract Documents.

R. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in 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.

S. 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.

T. 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 Contract Documents.

U. 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.

V. 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 Contract Documents.

W. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

X. Design Data: Prepare written and graphic information, including: 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.

Y. Manufacturer's Instructions: Prepare written or published information documenting 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.

Z. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. As applicable, include:

1. Statement on condition of substrates and their acceptability for installation of product.
2. Summary of installation procedures being followed, compliance with requirements and, if not, what corrective action was taken.
3. Results of operational and other tests and a statement of whether observed performance complies with the requirements.

AA. Permit Compliance Products: Prepare required information for compliance with permit provisions. Products include written notification of project startup, suspension, and completion of work; photo documentation of site conditions; reports; and drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of Contract and for compliance with Contract Documents. Note corrections and field dimensions.

3.2 CONTRACTING OFFICER'S ACTION

A. General: Submittals will be disapproved without technical review if identification information is missing, not filled in, or if placed on back of submittal; an incorrect format of submittals is provided; transmittal form is incorrectly filled out; submittals are not coordinated; or submittals do not show evidence of Contractor's approval.

1. Any work done or orders for materials or services placed before approval shall be at Contractor's own risk.

B. Action Submittals: Contracting Officer will review each submittal, generate comments on corrections or modifications required, and indicate appropriate action on the Transmittal Form (CM-16). Submittal will be marked as defined below:

1. APPROVED: Acceptable with no corrections.
2. APPROVED WITH NOTATIONS: Minor corrections or clarifications required. Comments are clear and no further review is required. Contractor shall address review comments when proceeding with the work.
3. DISAPPROVED - RESUBMIT: Rejected as not in accordance with the contract or as requiring major corrections or clarifications. Contracting Officer will identify reasons for disapproval. Contractor shall revise and resubmit with changes clearly identified.

C. Informational Submittals: Contracting Officer will review each submittal and will either accept or reject it.

D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

END OF SECTION 01 33 23

SECTION 01 35 13.22 – ARCHEOLOGICAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section consists of protecting archeological resources contained in soil deposits.

1.2 DEFINITIONS

A. Archeological Resources: Archeological resources are physical evidences of past human activity, including evidences of effects of that activity on the environment. Archeological resources represent both prehistoric and historic time periods, found above and below ground and under water.

B. Archeologically Sensitive Areas: Areas having potential to contain significant (National Register eligible) archeological resources. If National Register eligible or listed archeological resources could not be avoided, an appropriate mitigation strategy would be developed in consultation with state historic preservation officer and, if necessary, associated American Indian tribes.

C. Non-sensitive Areas: Areas with little potential of containing significant (National Register eligible) archeological resources.

D. Archeological Monitor: Representative of Government designated to oversee construction activities that could disturb archeological resources.

E. Archeological Resources Protection Act (ARPA) of 1979 (Public Law (P.L.) 96-95; 93 United States Statues at Large (Stat.) 712): defines archeological resources as any material remains of past human life or activities that are of archeological interest and at least 100 years old; Section 4 of the statute describes the requirements that must be met before Federal authorities can issue a permit to excavate or remove any archeological resource on Federal or Indian lands; the curatorial requirements of artifacts, and other materials excavated or removed.

1.3 SUBMITTALS

A. Daily Work Schedule: Detail construction work in archeologically sensitive areas. Submit to Contracting Officer (CO) 30 days before start of ground disturbing site work.

1.4 QUALITY ASSURANCE

A. At least one week before on-site work begins, Contractor shall meet with Contracting Officer and Archeological Monitor to discuss Daily Work Schedule, equipment, and special methods used in

archeologically sensitive areas. Contractor shall ensure approved Daily Work Schedule is followed throughout construction.

PART 2 - PRODUCTS

2.1 DAILY WORK SCHEDULE

A. Daily Work Schedule is required for work occurring within archeologically sensitive areas. Include all work that is to occur within the area and key the schedule to the drawings to include:

1. Starting and ending dates of ground-disturbing construction.
2. Locations of temporary facilities, such as barriers, field offices, staging areas, sanitary facilities, borrow pits, and haul and access roads.
3. Types of construction, such as clearing, topsoil stripping, structure or trench excavation, landscaping, and post construction clean-up.
4. Methods and equipment used for each type of construction.
5. Plan for relocating work in the event of temporary work stoppages at each archeologically sensitive area

PART 3 - EXECUTION

3.1 BARRICADES

A. Comply with requirements specified in Section 01 50 00 "Temporary Facilities and Controls."

3.2 ARCHEOLOGICAL INVESTIGATION BY NON-NPS PERSONNEL

A. A permit is required for archeological investigations (e.g. excavation, shovel testing, coring, pedestrian survey, underwater archeology, rock art documentation, or other types of reconnaissance including archaeological monitoring of construction) carried out on parklands by non-National Park Service (NPS) personnel, unless carried out under a contract or a cooperative agreement specifically written for archeological investigations. Permits are issued under the Archaeological Resources Protection Act of 1979 (ARPA). The NPS does not issue a permit for archeological investigations carried out by NPS archeologists, or to archeologists working on NPS archeological projects under a contract or cooperative agreement.

B. Applicants should submit a Permit Application (DI Form 1926 (Revision September 2004) Office of Management and Budget (OMB) Number (No.) 1024-0037, approved through 1/31/2008. Permit Application form is available, in PDF (portable document file) format, to the manager of the park in which they propose to work; or to the regional director, with a copy to the park manager.

C.

3.3 OBSERVATION

A. Archeological Monitor will observe ground-disturbing site work, including construction of temporary facilities, at archeologically sensitive areas, from a safe location mutually agreed on by Contractor and Monitor. As new ground is broken, Monitor will examine excavated materials, using construction layout centerline and perimeter staking as a reference point to record locations of findings.

3.4 DISCOVERY OF RESOURCES

A. If Archeological Monitor discovers resources, immediate relocation of work to a non-sensitive area may be required for Monitor to identify and document resources and, if necessary, develop appropriate mitigation plan. While Archeological Monitor is documenting resources in sensitive areas, Contractor shall relocate work to non-sensitive areas where monitoring is not normally required.

B. If resources are discovered while Archeological Monitor is absent, stop work immediately and report the discovery to the Contracting Officer.

3.5 WORK STOPPAGE

A. Contractor shall plan, schedule, and execute work to prevent stoppages at one area from stopping all work at construction site.

END OF SECTION 01 35 13.22

SECTION 01 35 23 - SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes establishing an effective accident prevention program and providing a safe working environment for personnel and visitors.

1.2 SUBMITTALS

A. Accident Prevention Plan (APP): Submit APP after contract award and before Pre-Construction conference. Contracting Officer (CO) will review proposed APP. If APP requires any revisions or corrections, Contractor shall resubmit Plan within 10 days. No progress payments will be made until the APP is accepted.

1.3 QUALITY ASSURANCE

A. Comply with contract clauses "Accident Prevention" and "Permits and Responsibilities." In case of conflicts between Federal, State, and local safety and health requirements, the most stringent shall apply. Onsite equipment shall meet 29 CFR 1926 (Code of Federal Regulations) (Occupational Safety and Health Administration (OSHA)) requirements. Failure to comply with requirements of this section and related sections may result in suspension of work.

B. Site Safety Supervisor:

1. Designate authorized onsite representative for preparation and maintenance of the APP.
2. Shall be responsible for:

    a. Implementation and enforcement of the APP
    b. Daily safety inspections
    c. Conducting and documenting weekly and monthly safety meetings
    d. Review of safety requirements at progress meetings
    e. Compilation and maintenance of Safety Data Sheets (SDS) and safety reference materials
    f. Tracking and resolution of safety violations
    g. Site personnel and visitor compliance with site safety and health requirements and APP
    h. Investigation and reporting of accidents and injuries

C. Qualifications of Employees:

1. Physically and able to perform their assigned duties in a safe manner.

2. Do not allow employees whose ability or alertness is impaired because of prescription or illegal drug use, fatigue, illness, intoxication, or other conditions that may expose themselves or others to injury to perform work.
3. Provide operating instructions for equipment. Operators of vehicles, hoisting equipment, and hazardous plant equipment shall be able to understand signs, signals, operating instructions, and be fully capable of operating such equipment. Retain copies of operator licenses and certifications onsite.

1.4 ACCIDENT REPORTING

A. Reportable Accidents: Defined as: death, occupational disease, and/or traumatic injury to employees or the public; fires; and/or property damage by accident in excess of $100.

1. Notify Contracting Officer immediately in the event of a reportable accident.
2. Fill out and forward an Accident/Property Damage Report Form (CM-22) to Contracting Officer within 7 days of a reportable accident. Obtain form from Contracting Officer.

PART 2 - PRODUCTS

2.1 ACCIDENT PREVENTION PLAN (APP)

A. APP shall be written to comply with OSHA and project requirements (generic plan is not acceptable) including but not limited to:

1. Name and qualifications of supervisor responsible to carry out program.
2. Weekly and monthly safety meetings shall be documented with topics and attendees.
3. First aid and rescue procedures.
4. Job Hazard Analysis (JHA) for each major phase. List of hazards associated and methods proposed to provide for property protection and safety of the public, National Park Service personnel, and Contractor's employees. Include initial and continuing training.
5. Planning for possible emergency situations, as detailed in Article 1.2. Such planning shall take nature of construction, site conditions, and degree of exposure of persons and property into consideration.
6. Infectious Disease Preparedness:

   a. Contractors are responsible for their employees' safety and the safety of job site visitors during the performance of this contract. We encourage Contractors to follow guidance from the Department of Labor (DOL), Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention (CDC), and all other applicable local, city, and state mandates. We encourage Contractors to develop policies for infection prevention and an Infectious Disease Preparedness and Response Plan.
   b. To the extent appropriate, Contractors should include the protective health and safety measures they intend to implement in any accident prevention or safety submittals required under this contract. These plans should contain preventive measures the Contractor intends to follow while performing work on government property as well as responsive and corrective actions to be taken if an employee exhibits symptoms or tests positive for contagion.

c. Upon contract award, Contractors should communicate with Contracting Officer regarding Contractor decisions and actions to protect the health and safety of workers for the duration of contract performance under which pandemic conditions exist.

2.2 FIRST AID FACILITIES

A. Provide adequate facilities for number of employees and appropriate to construction hazards.

2.3 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

A. Selection shall conform to OSHA Subpart E.

PART 3 - EXECUTION

3.1 DAILY SAFETY INSPECTIONS

A. Conduct daily safety inspections and maintain daily safety reports which include:
   1. Area/operation inspected
   2. Date of inspection
   3. Identified hazards
   4. Corrective actions taken

3.2 EMERGENCY INSTRUCTIONS

A. Post telephone numbers and reporting instructions for ambulance, physician, hospital, fire department, and police in conspicuous locations at work site.

3.3 FIRE AND LIFE SAFETY

A. Comply with requirements of National Fire Protection Association (NFPA) 241 (Standard for Safeguarding Construction, Alteration, and Demolition Operations).

3.4 HAZARDOUS MATERIALS

A. Hazardous materials: Explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful substances that could cause death or injury.

B. Store hazardous materials in accordance with manufacturer's and OSHA Subpart D requirements. Maintain Safety Data Sheets (SDS) for each chemical readily available on site.

   1. Immediately report spills of hazardous materials to the Park.
   2. Maintain a spill emergency response kit.
   3. Train employees how to respond to a spill and use emergency response kit.

3.5 PROTECTIVE EQUIPMENT

A. Inspect personal protective equipment daily and maintain in a serviceable condition. Clean, sanitize, and repair personal items as appropriate before issuing to another individual.

3.6 SAFETY MEETINGS

A. As a minimum, conduct one weekly 15-minute "toolbox" safety meeting conducted by a foreman or supervisor and attended by construction personnel at worksite. Topics shall coincide with work scheduled for following week. Document and submit meeting minutes to Contracting Officer within one day after meeting.

B. Conduct monthly safety meetings for personnel, contractors, and subcontractors performing work on the site. Notify Contracting Officer of meeting dates and times. Meetings shall be used to: review effectiveness of Contractor's safety effort; resolve current health and safety problems; provide a forum for planning safe construction activities, and for updating Accident Prevention Plan. Contracting Officers Representative will attend meetings and enter results of meetings into the daily log.

3.7 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

A. A hard hat use area shall be designated by Contractor. Hard hat area shall be posted by Contractor in a manner satisfactory to Contracting Officer.

B. It is Contractor's responsibility to require persons working on or visiting site to wear hard hats and PPE in good repair at all times. As a minimum, maintain six hard hats and other APP required equipment.

3.8 TRAINING

A. First Aid: Provide training to personnel to ensure prompt and efficient first aid.

B. Hazardous Material: Train and instruct each employee exposed to hazardous material in safe and approved methods of handling and storage.

END OF SECTION 01 35 23

SECTION 01 35 91.1 – SCULPTURE REMOVAL AND REINSTALLATION

1.1 SUMMARY

A. This section includes the removal method for the historic bronze sculpture from site and eventual reinstallation.

B. Related sections include the following:
   1. Division 1 – "01 11 00 Summary of Work" for description of work
   2. Division 1 – "01 35 91 Historical Preservation Treatment Procedures"
   3. Division 1 – "01 40 00 Quality Requirements"
   4. Division 1 – "01 73 40 Execution"
   5. Division 4 – "04 01 10 Marble Plinth Conservation"
   6. Division 4 – "04 01 40.61 Stone Repair and Replacement"
   7. Division 5 – "05 70 00 Bronze Sculpture Conservation"

C. The Contractor shall provide all labor, materials, equipment, and services required to safely remove, crate/palatize, transport, and eventual reinstallation of the sculptural pieces including the bronze and plinth.

1.2 REFERENCES

A. Technical Reports:
   1. Appendix C "Robert Morris Statue Assessment & Cleaning Tests Report" by EverGreene Architectural Arts. Submitted to Mills + Schnoering Architects, LLC August 11, 2023.
   2. Appendix B "Robert Morris Statue Nondestructive Testing Report" by Atkinson-Noland & Associates. Submitted to EverGreene Architectural Arts, July 5, 2023.

1.3 DEFINITIONS

A. Removal refers to material handling undertaken by qualified moving and rigging practitioners to physically disassemble and remove material without harming historic fabric, using methods and procedures in compliance with the Code of Ethics and Guidelines for Practice of the American Institute for Conservation (AIC).

B. Reinstallation refers to material handling undertaken by qualified moving and rigging practitioners to physically reassemble material without harming historic fabric, using methods and procedures in compliance with the Code of Ethics and Guidelines for Practice of the American Institute for Conservation (AIC).

C. Treatments executed as part of this contract shall be designed and executed in a manner respectful of the historic nature and character of the sculpture.

1.4 QUALITY CONTROL

A. Work shall be performed by a firm specializing in the deinstallation, removal, and reinstallation of historic and contemporary outdoor sculpture.
   1. The firm shall be required to have at least ten (10) years of experience in these specifications.
   2. The Contractor shall submit a minimum of three (3) similar projects in scope and or objects as references.

B. The Contractor shall be required to submit certifications for each of the Contractor personal working on the project.
   1. Each personnel shall have a minimum of three (3) similar projects in scope and or objects as reference prior to being selected for this project.

C. Standards:
   1. U.S. Department of Interior, National Parks Service, "Secretary of the Interior's Standards for the Treatment of Historic Properties" (latest edition).
   2. "Code of Ethics and Guidelines for Practice" of the American Institute for conservation (AIC).
   3. American Society for Testing of Materials (ASTM).
   4. Manufacturer's printed instructions.

D. The Contractor shall replace all broken, lost, and damaged material resulting from conservation activities at no expense to the Owner.

1.5 SUBMITTALS

A. Work Plan: Work plans will be submitted to the Contracting Officer's Representative detailing all work to be performed on the bronze sculptural. All materials, methods, and equipment to be used will be described in detail.

B. A Removal Work Plan shall be submitted to and approved by the Contracting Officer's Representative prior to any work being performed onsite. The Removal Work Plan shall cover:
   1. Access and logistics to and from the work site
   2. Best rigging and lifting practices
   3. Lifting and removal procedures
   4. Transportation and handling procedures and routes
   5. Rigging materials and equipment specifications
   6. Crate and or palletization requirements and specifications

C. A Reinstallation Work Plan shall be submitted to and approved by the Contracting Officer's Representative prior to any work being performed onsite. The Removal Work Plan shall cover:
   1. Access and logistics to and from the work site
   2. Transportation and handling procedures and routes
   3. Best rigging and lifting practices
   4. Lifting and reinstallation procedures
   5. Rigging materials and equipment specifications
   6. Crate and or palletization requirements and specifications

1.6 DOCUMENTATION

A. Photographs
   1. Provide photographic documentation of the sculpture before, during, and after removal and reinstallation. Photographs shall be in a color/digital, Jpeg 300 dpi minimum.
   2. All handling and moving activities will be thoroughly documented in the Conservation Treatment Report. Refer to Section “05 70 00 Bronze Sculpture Conservation” for specifics.

2.1 MATERIALS AND PRODUCTS

A. This section outlines the products used in the removal and reinstallation of the sculpture.

B. This section assures quality of the work by setting standards of quality for materials.

C. Final material selection to be used in the work of this section shall be based on approved work plan reviewed and approved by the Contracting Officer's Representative.

2.2 MATERIALS

A. Specific equipment and materials will be provided by the Contractor in the detailed workplan. General categories of materials will be listed here.

B. All packing materials shall be supplied in a new and clean condition to not cause harm or damage to the sculpture. Rigging straps should be nylon, rated for the appropriate weights. Straps should be non-marring.

C. Best practices for packing shall be followed to prevent shifting during transit.

D. Deinstallation:
   1. Articulating Lift
   2. Mobile Crane
   3. Lull or forklift
   4. Reciprocating Saw
   5. Angle Grinder
   6. Lifting Straps

E. Loading/Unloading
   1. Mobile Crane
   2. Lull or forklift
   3. Pallet jacks
   4. Lifting Straps

F. Transportation
   1. Tractor-trailer
   2. Ratchet straps
   3. Clean padded blankets
   4. Ethafoam Polyethylene foam
   5. Wood pallets

6. Plywood
7. Non-pressure treated wood planks

G. Handling
1. Cut-resistant gloves and or nitrile gloves
2. Clean padded blankets
3. Ethafoam Polyethylene foam
4. Plastic Sheeting
5. Inter padding/blocks

H. Reinstallation
1. Articulating Lift
2. Mobile Crane
3. Lull or forklift
4. ¼” Stainless steel threaded rod or other specified anchoring system
5. High modulus, high strength moisture-insensitive epoxy adhesive or equal.
6. Angle Grinder
7. Lifting Straps
8. Grout
9. Type N Mortar or equal.

3.1 REMOVAL

A. This section outlines the procedure for the removal process of the bronze sculpture and plinth. It will include a general outline of the:
1. Removal
2. Packing
3. Transportation

3.2 DOCUMENTATION

A. Complete a conditions survey of historic elements prior to treatment, noting locations and extent of deterioration on measured drawings provided by the Contracting Officer's Representative.

B. Provide photographic documentation of sculpture, plinth, and step elements before, during, and after conservation treatment. Photographs shall be in color/digital, Jpeg 300 dpi minimum.

C. Upon completion of work, provide a written conservation treatment report describing conditions prior to treatment and materials and procedures used in treatments, illustrated with photographs depicting conditions before, during, and after treatment.

3.3 GENERAL

A. Work in this section shall be coordinated with other work at the site and project schedule.

B. Follow all protection, usage, and precautionary measures noted by the manufactures in the product literature.

C. All personnel involved with the removal process shall have a detailed understanding of the process prior to the commencement of work.

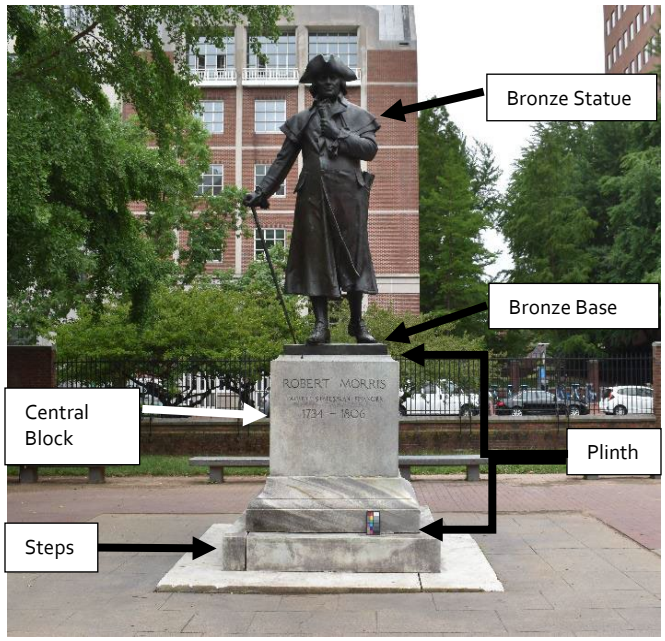
D. All sculptural elements should be palletized or crated for transport and storage.

E. Only one part of the sculpture shall be hoisted and moved at a time. The sculpture shall not be moved more then is necessary for its safe removal.

F. Personnel operating the equipment shall be in constant communication to ensure safety of both the object and ground crew.

G. All work shall be based off of a previously submitted and approved detailed workplan.

H. The sculpture is composed of three sections:
   1. Bronze Statue including the bronze base
   2. Plinth including the central block and die block
   3. Steps



I. The sculpture has two sets of connecting pins:
   1. Three pins connecting the bronze base to the plinth
   2. One pin connecting the central block, through the die block, and into the concrete foundation.
   3. Refer to the References Section 1.3 for reports on pins position.

3.4 PROCEDURES

A. Assess the sculpture for preexisting conditions, photo documenting any and all pretreatment conditions/existing damage.

B. Position the rigging equipment, packing materials and equipment, and transportation equipment and vehicles for removal of the sculpture prior to work commencing.

C. Inspect all lifting straps and other lifting equipment before use.

D. Strap the bronze figure to support the statue as it is lifted.
   1. Ensure that the center of gravity is low and the sculpture will not twist or turn out of the lifting straps.
   2. Ensure the lifting straps are positioned correctly and will not cause damage to sensitive sections of the sculpture.
   3. Straps should not be wrapped around thin elements like the arms, ankles, or cane.

E. Slowly lift the sculpture applying tension to the straps, lifting it enough that the connecting pins can be accessed.
   1. At least ¼" of space is needed between the statue and plinth to access the pins.
   2. Cut the attachment pins using a Reciprocating Saw
   3. Add protection to the adjacent plinth to prevent abrasion from cutting.

F. Lift the sculpture off of the plinth as a single unit once the connecting pins have been cut.
   1. While raised, remove and document the cut pin locations and connection point details
   2. Ensure all extant connections are not damaged
   3. Place sculpture on a pallet with vertical crate supports.

G. Place crated bronze sculpture on the transport vehicle, ensuring the sculpture is securely packed and padded, only coming into direct contact with padding/packing.

H. Remove the Central Block of the plinth.
   1. Cut the joint between the Central Block and die block of the plinth.
   2. Use wooden wedges to lift the Central Block, allowing for access to the central pin and to attach lifting straps.
   3. Cut the central pin using a reciprocating saw. Add protection to the adjacent marble plinth to prevent abrasion from cutting.
   4. Lift the Central Block off the rest of the plinth.

I. Place the Central Block on a pallet or built crate with pallet access.
   1. Place pallet/crate on the transport vehicle
   2. Ensure the block is securely packed and padded, only coming into direct contact with padding/packing/pallet.

J. Lift the remaining die block using lifting straps and place on a pallet or built crate with pallet access.
   1. Place pallet/crate on the transport vehicle.
   2. Ensure the marble is securely packed and padded, only coming into direct contact with padding/packing.

K. Remove the steps using lifting straps.
   1. Secure the steps to pallets which can be loaded onto the transportation vehicle.

L. Transport the disassembled sculpture off site to the designated storage location following all road laws and safety standards.
   1. Confirm permitting requirements prior to transport

M. Unload pallets/crates from truck to approved location and reassess/photo document the existing conditions.

4.1 REINSTALLATION

A. This section outlines the procedure for the reinstallation process of the bronze sculpture and plinth. It will include a general outline of the:
   1. Transportation
   2. Unpacking
   3. Reinstallation

4.2 DOCUMENTATION

A. All work will be thoroughly documented throughout the transportation and reinstallation process.

B. The sculptural elements shall be documented in their pre-transport condition and in their post installation condition.

C. Photographs
   1. Provide photographic documentation of the sculpture before, during, and after removal and reinstallation. Photographs shall be in a color/digital, Jpeg 300 dpi minimum.
   2. All handling and moving activities will be thoroughly documented in the Conservation Treatment Report. Refer to Section "05 70 00 Bronze Sculpture Conservation" for specifics.

4.3 GENERAL

A. Work in this section shall be coordinated with other work at the site and project schedule.

B. Follow all protection, use, and precautionary measures noted by the manufactures in the product literature.

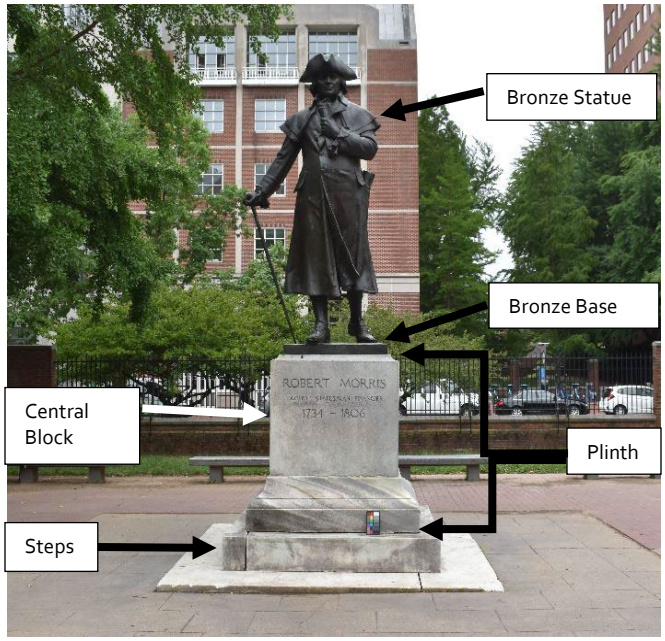
C. All personnel involved with the reinstallation process shall have a detailed understanding of the process prior to the commencement of work.

D. Only one part of the sculpture shall be hoisted and moved at a time. The sculpture shall not be moved more than is necessary for its safe removal.

E. Personnel operating the equipment shall be in constant communication to ensure safety of both the object and ground crew.

F. All work shall be based off of a previously submitted and approved detailed workplan.

G. The sculpture is composed of three sections:
   1. Bronze Statue including the bronze base
   2. Plinth including the central block and die block
   3. Steps



4.4 PROCEDURES

A. Assess the sculpture for preexisting conditions, photo documenting any and all pretreatment conditions/existing damage.

B. Transport the disassembled sculpture to site from the designated storage location following all road laws and safety standard.
   1. Confirm permit requirements prior to transport.

C. Position the rigging equipment, packing materials and equipment, and transportation equipment and vehicles for removal of the sculpture prior to work commencing.

D. Inspect all lifting straps and other lifting equipment before use.

E. Remove all palletized/crated elements from the transport vehicle and using forklift or lifting straps to set them within the work space.
   1. If materials are left onsite uninstalled, ensure all elements are secured from tipping or vandalism.

F. Lift all steps from pallets and set into designated location. Set stones on Type N mortar bed or other mortar, in a level configuration.
   1. Press stones evenly into the mortar bed ensuring mortar is equally distributed across the entire face of the stone.
   2. Use leveling equipment to ensure a level plane across the steps.
   3. Wipe away excess mortar from work area after installation.

G. Lift the die block using lifting straps from the pallet onto the concrete foundation of the sculpture.
   1. Install ¼” stainless steel threaded pin or other anchors as designed by engineers into the center of the die block, down into the concrete foundation. Use high modulus, high

strength moisture-insensitive epoxy adhesive or another anchor setting material to secure the pin. Ensure the pin is exposed to allow it to slot into the central block.

H. Unload the central block from the transport vehicle, placing it securely on the die block.
   1. Prior to installation, drill a 5/8" blind hole into the base of the central block that aligns with the threaded pin installed into the die block.
   2. Ensure threaded pin and attachments points are aligned
   3. Apply the specified epoxy, or specified product into the blind hole prior to placing the central block onto the die block.
   4. Ensure the threaded pin and epoxy, or specified product connecting the central block, die block, and concrete foundation are secure prior to removing straps.
   5. At previous pin locations for sculpture – core drill openings
   6. Ensure the anchor locations are free and clear of all debris.

I. Lift the bronze sculpture from the transport vehicle and carefully place onto the top of the central block aligning the pins with the blind pinholes.
   1. Ensure that the center of gravity is low and the sculpture will not twist or turn out of the lifting straps.
   2. Ensure the lifting straps are positioned correctly and will not cause damage to sensitive sections of the sculpture.
   3. Straps should not be wrapped around thin elements like the arms, ankles, or cane.
   4. Ensure threaded pins or other attachments points between the bronze and plinth are set in and secured with specified epoxy prior to removing straps.

J. Demobilize equipment and transportation vehicles from the jobsite.

K. Repoint sculpture using appropriate mortar/grout as defined in *Specifications Section 04 01 10.10 – Marble Plinth Conservation*

L. Reassess/photo document the existing conditions once installation is complete.

END OF SECTION 01 35 91.1

SECTION 01 35 91 - HISTORIC PRESERVATION TREATMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special procedures for historic treatment on Project including, but not limited to:

1. Definitions
2. Submittals
3. Quality Assurance
4. Storage and protection of existing historic materials
5. Project site conditions
6. Historic Preservation Treatment Plan
7. Protection, General
8. Protection during application of chemicals
9. Protection during use of heat-generating equipment
10. Historic preservation treatment procedures

1.2 DEFINITIONS

A. "Preservation" - To apply measures necessary to sustain existing form, integrity, and materials of historic property. Work may include preliminary measures to protect and stabilize the property.

B. "Rehabilitation" - To make possible a compatible use for property through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, or architectural values.

C. "Restoration" - To accurately return form, features, and character of a property to its appearance at a particular period of time by means of removal of features from other periods in its history and repair and reconstruction of missing and deteriorated features from the restoration period.

D. "Reconstruction" - To reproduce in exact form and detail, a building, structure, or artifact as it appeared at a specific period in time. Reconstructed elements do not possess historic integrity in their own right since they are-not original fabric.

E. "Stabilize" - To apply measures designed to reestablish a weather-resistant enclosure and structural reinforcement of an item or portion of the building while maintaining essential form as it exists at present. This level of intervention is aimed at retarding or arresting adverse impacts to structures.

F. "Protect and Maintain" - To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.

G. "Repair" - To stabilize, consolidate, or conserve; to retain existing materials and features while employing as little new material as possible. Repair includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials. Within restoration, repair also includes limited replacement in kind, rehabilitation, and reconstruction, with compatible substitute materials for deteriorated or missing parts of features when there are surviving prototypes.

H. "Replace" - To duplicate in its entirety, a historic element or feature by matching its historic pattern, detail and appearance. Replacement is justified when original or historic elements are damaged beyond repair or are missing. Replacement conditions and methods include:

1. Replacement with Original or Historic Fabric: Includes fabric salvaged from other locations or projects having identical architectural qualities. Duplication of appearance using identical material possessing historical significance.
2. Replacement with New Materials: Includes replacement with new material of like kind (custom fabricated of manufactured). Duplication of appearance using like material.
3. Replacement with Substitute Materials: Includes replacement with a compatible substitute that is frequently contemporary and unlike the historic fabric. Duplication of appearance using modern (non-traditional) material Use of substitute materials is not approved unless matching materials are not available.

I. "Remove" - To demolish or detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

J. "Remove and Salvage" - To detach items from existing construction and deliver them ready for reuse to Contracting Officer (CO) or designee.

K. "Remove and Reinstall" - To detach items from existing construction, repair and prepare for reuse, and reinstall where indicated.

L. "Existing to Remain" or "Retain" - Existing items of construction not to be removed and not otherwise indicated to be removed and salvaged or removed and reinstalled.

M. "Material in Kind" - Material that closely matches existing materials through comparison of architectural qualities and salient characteristic such as species, cut, color, grain, dimension, profile, thickness, and finish.

1.3 SUBMITTALS

A. Historic Preservation Treatment Plan:

1. After contract award and before Pre-Construction conference, submit for approval a written Historic Preservation Treatment Plan (HPTP).
2. If the plan requires revisions or corrections, Contractor shall resubmit plan within 10 days.
3. No change in approved plan may be made without written concurrence by Contracting Officer.

B. Alternative Methods and Materials: If alternative methods and materials to those indicated are proposed for any phase of work, provide a written description including evidence of successful

use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this Project.

C. Photographs or Videotape: In accordance with Section 01 32 33 "Photographic Documentation," show existing conditions of adjoining construction and site improvements including finish surfaces that might be misconstrued as damage caused by historic treatment operations. Submit before work begins.

1.4 QUALITY ASSURANCE

A. Historic Preservation Treatment Specialist Qualifications: Experienced firm with required certifications and training able to demonstrate through past performance they are qualified to perform this work.

1.5 STORAGE AND PROTECTION OF HISTORIC MATERIALS

A. Removed and Salvaged Historic Materials:

1. Clean salvaged historic items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in secure area until delivery to Contracting Officer.
4. Transport items to storage area
5. Protect items from damage during transport and storage.
6. Do not dispose of items removed from existing construction without prior written consent of Contracting Officer.

B. Removed and Reinstalled Historic Materials:

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

C. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling during historic treatment. When permitted by Contracting Officer, items may be removed to suitable, protected storage location during historic treatment and cleaned and reinstalled in their original locations after historic treatment operations are complete.

D. Storage and Protection: When removed from existing location, store historic materials within weather-tight enclosure protected from wetting by rain, snow, or ground water, and temperature variations. Secure stored materials to protect from theft.

1. Identify removed items with an inconspicuous mark indicating original location.
2. Develop key plan when many similar items are scheduled for removal and reinstallation.

1.6 PROJECT-SITE CONDITIONS

A. Exterior Cleaning and Repairing:

1. Proceed with work only when forecasted weather conditions are favorable.

a. Wet Weather: Do not attempt repairs during rainy or foggy weather. Do not apply primer, paint, putty, or epoxy when relative humidity is above 80 percent. Do not remove exterior elements of structures when rain is forecast or in progress.
b. Do not perform exterior wet work when air temperature is below 40 degrees Fahrenheit (5 degrees Celsius).
c. Do not begin cleaning, patching, or repairing given likelihood of frost or freezing.
d. Do not begin cleaning when either air or surface temperature is below 45 degrees Fahrenheit (7 degrees Celsius) unless approved means are provided for maintaining 45 degrees Fahrenheit (7 degrees Celsius) temperature of air and materials during, and for 48 hours subsequent to, cleaning.

2. Perform cleaning and rinsing of the exterior only during daylight hours.

B. National Park Service will occupy portions of building immediately adjacent to historic treatment area. Conduct historic treatment so National Park Service operations will not be disrupted. Provide **72**hours' notice to Contracting Officer of activities that will affect National Park Service operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 HISTORIC PRESERVATION TREATMENT PLAN

A. Prepare written plan for preservation work covering preservation components of project. Plan shall verify construction strategy and intent is compatible with Department of the Interior's (DOI) standards for Treatment of Historic Properties, guidelines for Treatment of Cultural Landscapes, and National Park Service management policies for cultural resources. Plan shall satisfy both project scope and resource protection requirements. Plan shall include:

1. Organized list of preservation components of project, systems, and tasks
2. Staging and sequence of work
3. Disassembly and reassembly techniques and steps
4. Equipment and tools required
5. Supplies and materials with manufacturer or supplier identified including specific clean up/storage procedure including frequency and documentation of such.
6. Skilled trades and crafts required
7. Anticipated testing and analysis of fabric
8. Additional investigations for extents or magnitude of treatments needed
9. Protective measures
10. Seasonal limitations on work
11. Alternative means if primary treatment method is unfeasible

12. Work conducted off-site (Approval from Contracting Officer required prior to taking resources off-site).

3.2 PROTECTION, GENERAL

A. Comply with manufacturer's written instructions for precautions and effects of products and procedures on adjacent building materials, components, and vegetation.

B. Ensure supervisory personnel are present when work begins and during progress.

C. Temporary Protection of Historic Materials during Construction:

1. Protect existing materials during installation of temporary protections and construction. Do not deface or remove existing materials.
2. Attachments of temporary protection to existing construction shall be approved by Contracting Officer prior to installation.

D. Protect landscape work adjacent to or within work areas as follows:

1. Provide barriers to protect tree trunks.
2. Bind spreading shrubs.
3. Coverings shall allow plants to breathe. Remove coverings at end of day. Do not cover plant material with waterproof membrane more than 8 hours at a time.
4. Set scaffolding and ladder legs away from plants.

E. Existing Drains: Prior to start of work or cleaning operations, test drains and other water removal systems to ensure drains and systems function properly. Notify Contracting Officer immediately of stopped or blocked drains or systems. Do not begin Work of this Section until drains are in working order.

1. Provide method to prevent solids including stone or mortar residue from entering drains or drain lines. Clean out drains and drain lines blocked or filled because of work performed under this Contract.
2. Protect storm drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm or damage resulting from applications of chemical cleaners and paint removers.

B. Comply with requirements in Section 01 50 00 "Temporary Facilities and Controls."

C. Cover adjacent surfaces with materials proven to resist chemical cleaners selected for Project unless chemicals being used will not damage adjacent surfaces. Use covering materials containing only waterproof, UV (ultraviolet)-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. Promptly remove masking to prevent adhesive staining on completion.

D. Do not clean surfaces during winds of sufficient force to spread cleaning solutions to unprotected surfaces.

E. Neutralize and collect alkaline and acid wastes and dispose of outside park boundaries.

F. Dispose of runoff from chemical operations by legal means and in a manner preventing soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

G. Document daily clean-up, proper storage, and disposition of any flammable/combustible materials with daily reports.

3.4 PROTECTION DURING USE OF HEAT-GENERATING EQUIPMENT

A. Comply with following procedures while performing work with heat-generating equipment, including welding, cutting, soldering, brazing, paint removal with heat, and other operations where open flames or implements utilizing heat are used:

1. Obtain Contracting Officer's approval for operations involving use of open-flame or welding equipment.

    a. Notification shall be given for each occurrence and location of work with heat-generating equipment.
    b. Obtain appropriate permit from the park as required.

2. As far as practical, use heat-generating equipment in shop areas or outside building.
3. Before work with heat-generating equipment commences, furnish fire watch (or watches) for location(s) where work is to be performed.
4. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use combustible gas indicator test to ensure area is safe.
5. Remove and keep area free of combustibles, including, rubbish, paper, waste, etc., within area of operations.

    a. If combustible material cannot be removed, provide fireproof blankets to cover such materials.

6. Where possible, furnish and use baffles of metal or gypsum board to prevent spraying of sparks or hot slag into surrounding combustible material.
7. Prevent extension of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
8. Inspect each location of day's work not sooner than 30 minutes after completion of operations to detect hidden or smoldering fires; ensure proper housekeeping is maintained.

B. Where sprinkler protection exists and is functional, maintain without interruption while operations are performed. If operations are performed near automatic sprinkler heads, shield individual heads temporarily with guards.

3.5 HISTORIC PRESERVATION TREATMENT PROCEDURES

The principal aim of preservation work is to halt the process of deterioration and stabilize the item's condition to sustain the integrity of the historic element, feature or structure being preserved. Cyclic maintenance is often required as well as repair work. Repair is required where specifically indicated. The following procedures shall be followed:

1. Retain as much existing material as possible; repair and consolidate rather than replace.
2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
3. Use reversible processes wherever possible.
4. Use traditional replacement materials and techniques if possible. New work shall be distinguishable from old work and original materials and techniques.
5. Record repair work during construction with periodic construction photos and daily inspection reporting. Photo documentation is specified in Section 013233 "Photographic Documentation."

B. Prohibit smoking by personnel performing work on or near historic structures.

C. Notify Contracting Officer of visible changes in integrity of material or components due to environmental causes including biological attack, UV degradation, freezing, or thawing, or due to structural defects including cracks, movement, or distortion.

1. Do not proceed with work in question until directed by Contracting Officer.

D. Where Work requires existing features to be removed, cleaned, and reinstalled, perform operations without damage to material itself, to adjacent materials, or to substrate.

E. Identify new or replacement materials and features with inconspicuous, permanent marks to distinguish from original materials. Record legend of identification marks and locations of these marks on Record Drawings.

F. When cleaning, match samples of existing materials that have been cleaned and identified for acceptable cleaning levels. Avoid over-cleaning to prevent damage. Use gentlest methods available. Initiate cleaning using hand cleaning methods before introducing power cleaning methods and equipment.

END OF SECTION 01 35 91

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. 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 Contract Document requirements. Quality of work shall be responsibility of the Contractor.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with Contract Document requirements.

C. See Divisions 2 through 49 Sections for specific test and inspection requirements.

1.2 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 actual products incorporated into the work and completed construction comply with requirements.

C. Mockups: Full-size physical assemblies constructed on-site. Mockups are constructed from selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Approved mockups establish the standard by which the Work will be judged, unless otherwise indicated.

1. Integrated Exterior Mockups: Mockups of exterior envelope erected separately from building but on Project site, consisting of multiple products, assemblies, and subassemblies.

D. Preconstruction Testing: Tests and inspections performed specifically for project before products and materials are incorporated into work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections performed by a Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or a testing agency

qualified to conduct product testing, to establish product performance and compliance with industry standards.

F. Source Quality Control Testing: Tests and inspections performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality Control Testing: Tests and inspections performed on-site for installation of work and for completed work.

H. Testing Agency or Laboratory: 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 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 trades people of corresponding generic name.

1.3 CONFLICTING REQUIREMENTS

A. Reference Standards: If compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Contracting Officer before proceeding.

B. Minimum Quality Levels: Quality level shown or specified shall be minimum provided or performed. Actual installation may comply exactly with minimum quality specified, or it may exceed minimum within reasonable limits. To comply with requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Contracting Officer before proceeding.

1.4 SUBMITTALS

A. Quality Control Plan:

1. After contract award and before Pre-Construction conference, submit a written Contractor Quality Control (CQC) plan.
2. If plan requires revisions or corrections, Contractor shall resubmit plan within 10 days.
3. Government reserves the right to require changes in plan during contract period as necessary to obtain the quality specified.
4. No change in the approved plan may be made without written concurrence by Contracting Officer.

B. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in form of a recent report on inspection of testing agency by a recognized authority.

C. Contractor Quality Control (CQC) Daily Reports: Submit showing inspections and tests on first workday following date covered by report. Quality Control Supervisor shall utilize DSC Forms.

1. Review Construction Management Representative (CMR) Daily report if applicable and reconcile any differences prior to posting.

D. Test Reports

1. Test reports shall be completed by person performing test.
2. Submit Daily Test Information Sheets with Quality Control Daily Reports.
3. Submit failing test results and proposed remedial actions within four hours of noted deficiency.
4. Submit three copies of complete test results no later than one calendar day after test was performed.

E. Accessibility Inspection Report:

1. Fill out applicable sections of the Accessibility Inspection Report and attach to Contractor Quality Control Daily Report.
2. Utilize attached Accessibility Inspection form to document compliance with Architectural Barriers Act Accessibility Standards (ABAAS).
3. Inspect at various stages of construction as needed to ensure finished product meets standards.
4. Submit report no later than one calendar day after inspection was performed.

F. Off-Site Inspection Reports: Submit prior to shipment.

G. If Contractor Quality Control plan and Quality Control Daily Reports are not submitted as specified, Contracting Officer may retain payments until such time plan(s) is/are accepted and implemented, or may retain payments for work completed on days with no Quality Control Daily Reports.

H. Permits, Licenses, and Certificates: For National Park Service (NPS) records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of work.

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Contractors Quality Control Staff:

1. Contractor's Quality Control Supervisor may also perform other duties.
2. Contractor's Quality Control Supervisor shall be assigned no other duties.
3. Contractor's designated Quality Control Supervisor shall be on the project site whenever contract work is in progress.
4. Contractor's job supervisory staff may be used to assist Quality Control Supervisor supplemented, as necessary, by additional certified testing technicians.

C. Installer Qualifications: Firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent indicated for Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: Firm experienced in manufacturing products or systems similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Fabricator Qualifications: Firm experienced in producing products similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

F. Professional Engineer Qualifications: Professional engineer legally qualified to practice in jurisdiction where Project is located and is experienced in providing engineering services of kind indicated (including Structural Tests and Special Inspections (STSI)). Engineering services are defined as those performed for installations of system, assembly, or products similar to those indicated for Project in material, design, and extent.

G. 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 activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing Work.

H. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or an independent agency with experience and capability to conduct testing and inspecting indicated, according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by Contract, is acceptable to Contracting Officer.

1. Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7 (Code of Federal Regulations).
2. National Voluntary Laboratory Accreditation Program (NVLAP): Testing agency accredited according to National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program.
3. Measuring devices, laboratory equipment, and instruments shall be calibrated at established intervals against certified standards in accordance with NIST requirements. Measuring and testing devices shall be made available for use by Government for verification tests.

I. Factory-Authorized Service Representative Qualifications: Authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products similar in material, design, and extent to those indicated for Project.

J. Mockups: Before installing portions of work requiring mockups, build mockups for each form of construction and finish required to comply with following requirements, using materials indicated for completed work:

1. Build mockups in location and of size indicated; if not indicated, as directed by Contracting Officer.

2. Notify Contracting Officer **seven**days in advance of dates and times when mockups will be constructed.
3. Demonstrate proposed range of aesthetic effects and workmanship.
4. Obtain Contracting Officer's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups in an undisturbed condition as a standard for judging the completed work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop DrawingsCoordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.6 QUALITY CONTROL

A. Contractor is responsible for testing and inspections, including Structural Tests and Special Inspections (STSI), as identified in attached STSI. Inspect and test work as needed to ensure quality of materials, workmanship, construction, finish, and functional performance are in compliance with applicable specifications, drawings, and those required by the Building Code.

1. Engage qualified testing agency to perform quality-control services.
2. Submit appropriate report for each quality-control service.
3. Testing and inspecting requested by Contractor and not required by Contract Documents are Contractor's responsibility.
4. Contracting Officer may designate test locations.

B. Manufacturer's Field Services: Where indicated, engage factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

C. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction of replaced work that failed to comply with Contract Documents.

D. Testing Agency Responsibilities: Cooperate with NPS and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Contracting Officer and Contractor promptly of irregularities or deficiencies observed in work during performance of services.
2. Determine location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, State in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit 3 copies of certified written report of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase Contract Document requirements or approve or accept any portion of Work.

E. 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:

1. Access to 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 material mixes that require control by testing agency.
7. Security and protection for samples and testing and inspecting equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with minimum delay and to avoid removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 QUALITY CONTROL PLAN

A. Quality Control Plan shall include:

1. List of personnel responsible for quality control and assigned duties. Include each person's qualifications. Include alternate(s) and qualifications.
2. Copy of letter of direction to Contractor's Quality Control Supervisor(s) outlining assigned duties and authorities designated by principal or owner.
3. Names, qualifications / accreditations, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms from laboratories.
4. Methods of performing, documenting, and enforcing quality control of work including Contractor report forms and acknowledgment of NPS forms.
5. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.
6. Specific discussion regarding mockups, off-site visits, receiving inspections, manufacturers representation, startup requirements, and other aspects of performance specific to Project.
7. Provisions for substantial completion(s) and final inspection(s) per Contract.

PART 3 - EXECUTION

3.1 OFF-SITE CONTROL

A. Items fabricated or assembled off-site shall be inspected for quality control at place of fabrication.

3.2 ON-SITE CONTROL

A. Notification:

1. Notify Contracting Officer at least 48 hours in advance of preparatory phase meeting.

2. Notify Contracting Officer at least 24 hours in advance of initial and follow-up phases.

B. Preparatory Phase: Perform before beginning each feature of work.

1. Review control submittal requirements with personnel directly responsible for quality assurance and quantity control of the work. As a minimum, Contractor's Quality Control Supervisor and foreman responsible for feature of work shall be in attendance.
2. Review applicable specifications sections and drawings related to feature of work.
3. Ensure copies of referenced standards related to sampling, testing, and execution for feature of work are available on site.
4. Ensure provisions have been made for field control testing.
5. Examine work area to ensure preliminary work has been completed.
6. Verify field dimensions and advise Contracting Officer of discrepancies with contract documents.
7. Ensure necessary equipment and materials are at project site and they comply with approved shop drawings and submittals.
8. Document preparatory phase activities and discussions on Contractor's Quality Control Daily Report.

C. Initial Phase:

1. As soon as work begins, inspect and test representative portion of particular feature of work for quality of workmanship.
2. Review control testing procedures to ensure compliance with contract requirements.
3. Document initial phase activities and discussions on Contractor's Quality Control Daily Report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

D. Follow-Up Phase: Inspect and test as work progresses to ensure compliance with contract requirements until completion of work.

E. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be required on same feature of work for following reasons:

1. Quality of on-going work is unacceptable.
2. Changes in quality control staff, on-site production supervision, or work crew.
3. Work on particular feature of work is resumed after substantial period of inactivity.

3.3 DOCUMENTATION

A. Maintain Quality Control Daily Reports, Daily Test Report Information Sheets, and Accessibility Inspection Reports of quality control activities and tests. (Download from DSC Workflows website > Forms/Templates/Samples/Guidelines page > Construction Forms section.)

B. Quality Control Daily Reports shall not be substituted for other written reports required under clauses of contract, such as Disputes, Differing Site Conditions, or Changes.

C. Quality Control Daily Reports shall accurately portray all work and materials. The materials shall match the materials as approved from the Construction Documents (CD) requirements. Combustible/flammable materials shall be documented as well.

3.4 ENFORCEMENT

A. Contractor shall stop work on any item or feature pending satisfactory correction of deficiency noted by quality control staff or Contracting Officer.

3.5 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 as invisible as possible.
2. Comply with Contract Document requirements for Section 01 73 29 "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 01 40 00

SECTION 01 42 00 – REFERENCE STANDARDS

PART 1 - GENERAL

1.1 ENVIRONMENTAL DEFINITIONS

A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified herein.

B. Biobased Materials: As defined in the Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, "biobased" means a "commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials." Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000.

1. Biobased content: Amount of biobased carbon in the material or product as a percentage of weight (mass) of total organic carbon in the material or product.

C. Chain-of-Custody: Process whereby a product or material is maintained under physical possession or control during its entire life cycle.

D. Deconstruction: Disassembly of buildings for purpose of recovering materials.

E. DFE (Design for the Environment): A technique that includes elements of resource conservation and pollution prevention as applied in various product sectors. A technique that incorporates approaches which are part of product (or assembly) concept, need and design. Considerations involve material selection, material and energy efficiency, reuse, maintainability and design for disassembly and recyclability. Refer to International Organization for Standardization (ISO) Guide 64 for additional clarification.

F. Environmentally preferable products: Products and services that have a lesser or reduced effect on the environment in comparison to conventional products and services. Refer to EPA's Final Guidance on Environmentally Preferable Purchasing Program.

G. Non-Renewable Resource: A resource that exists in a fixed amount that cannot be replenished on a human time scale. Non-renewable resources have potential for renewal only by geological, physical, and chemical processes taking place over of millions of years. Examples include iron ore, coal, and oil.

H. Perpetual Resource: A resource that is virtually inexhaustible on a human time scale. Examples include solar energy, tidal energy, and wind energy.

I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent Federal Trade Commission (FTC) Guide for Use of Environmental Marketing Claims.

J. Renewable Resource: A resource that is grown, naturally replenished, or cleansed, at a rate which exceeds depletion of the usable supply of that resource. A renewable resource can be exhausted if improperly managed. However, a renewable resource can last indefinitely with proper stewardship. Examples include trees in forests, grasses in grasslands, and fertile soil.

1.2 QUALITY ASSURANCE

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

B. Publication Dates: Comply with standards in effect as of date of Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and standards may establish different or conflicting requirements for minimum quantities or quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Contracting Officer (CO) for decision before proceeding.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents to the extent referenced. Such standards are made a part of Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of 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 Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

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 found in Section 01 42 00 Sources for Reference Publications, Unified Facilities Guide Specifications (UFGS) (accessible via Masters website > Downloads section > click on UFGS Master (WBDG Website).

Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

XX	EXAMPLE Association (The) www.EXAMPLE.org	

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in following list. Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

DIN	Deutsches Institut fur Normung e.V. www.din.de	49 30 2601-3003
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. icc-es.org	(800) 423-6587 (562) 699-0543

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in following list. Names, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

ABA & ABAAS United States Access Board	Architectural Barriers Act (ABA) Architectural Barriers Act Accessibility Standards (ABAAS) www.access-board.gov
CoE	Army Corps of Engineers www.usace.army.mil
CPSC	Consumer Product Safety Commission www.cpsc.gov
DOC	Department of Commerce www.commerce.gov
DOD	Department of Defense www.defense.gov
DOJ	Department of Justice www.justice.gov

DOE	Department of Energy www.energy.gov
EPA	Environmental Protection Agency www.epa.gov
FAA	Federal Aviation Administration www.faa.gov
FCC	Federal Communications Commission www.fcc.gov
FDA	Food and Drug Administration www.fda.gov
GSA	General Services Administration www.gsa.gov
HUD	Department of Housing and Urban Development www.hud.gov
LBL	Lawrence Berkeley National Laboratory www.lbl.gov
NCHRP	National Cooperative Highway Research Program (See TRB (Transportation Resource Board))
NIST	National Institute of Standards and Technology www.nist.gov
OSHA	Occupational Safety & Health Administration www.osha.gov
PHS	U.S. Department of Health and Human Services www.hhs.gov
RUS	Rural Utilities Service (See USDA (Department of Agriculture))
SD	State Department www.state.gov
TRB	Transportation Research Board www.nationalacademies.org/trb/transportation-research-board
USDA	Department of Agriculture www.usda.gov
USP	U.S. Pharmacopeia www.usp.org

USPS	Postal Service www.usps.com

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in following list. Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

ABAAS	Architectural Barriers Act Accessibility Standards www.access-board.gov
CFR	Code of Federal Regulations Available from Government Printing Office www.govinfo.gov/app/collection/cfr
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/
DSCC	Defense Supply Center Columbus (See FS (Federal Specification))
FED-STD	Federal Standard (See FS (Federal Specification))
FS	Federal Specification Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/ Available from General Services Administration www.gsa.gov Available from National Institute of Building Sciences www.nibs.org
FTMS	Federal Test Method Standard (See FS (Federal Specification))
MIL	(See MILSPEC (Military Specification and Standards))
MIL-STD	(See MILSPEC (Military Specification and Standards))
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-aba-standards/ufas *(UFAS is **only** for housing projects per Fair Housing Act. See also the Fair Housing Act Design Manual, www.huduser.gov/portal/publications/destech/fairhousing)*

1.5 ENVIRONMENTAL REFERENCE STANDARDS

A. American Forest and Paper Association:

1. Sustainable Forestry Initiative

B. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):
- **ASHRAE 52.2,** *Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size*
- **ASHRAE 55,** *Thermal Environmental Conditions for Human Occupancy*
- **ASHRAE 62.1,** *Ventilation for Acceptable Indoor Air Quality*
- **ASHRAE 62.2,** *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*
- **ASHRAE/IESNA 90.1,** *Energy Standard for Buildings, Except Low-Rise Residential Buildings*
- **ASHRAE 90.2,** *Energy Efficient Design of Low-Rise Residential Buildings*

C. American Association of State Highway and Transportation Officials (AASHTO):
- M288 Geotextile Specification for Highway Applications
- **MP009-06 Standard Specification for Compost for Erosion/Sediment Control (Filter Berms and Filter Socks)**
- **MP010-03 Standard Specification for Compost for Erosion/Sediment Control (Compost Blankets)**

D. American Society for Testing and Materials International (ASTM):
- A478 Standard Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire
- A580/A580M Standard Specification for Stainless Steel Wire
- A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- B813 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
- C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
- C128 Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
- C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C1319 Standard Specification for Concrete Grid Paving Units
- C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
- C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C1371 Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
- C1386 Standard Specification for Precast Autoclaved AERATED Concrete (PAAC) Wall Construction Units
- C1483 Standard Specification for Exterior Solar Radiation Control Coatings on Buildings
- C1549 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer

- C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces
- C289 Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
- C311 Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete
- C33 Standard Specification for Concrete Aggregates
- C593 Standard Specification for Fly Ash and Other Pozzolans for Use With Lime
- C595 Standard Specification for Blended Hydraulic Cements
- C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- C67 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
- C739 Standard Specification for Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation
- C936 Standard Specification for Interlocking Concrete Paver Units
- C989 Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
- D1435 Standard Practice for Outdoor Weathering of Plastics
- D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 foot pound force per cubic foot (ft-lbf/ft3) (2,700 kilonewton meter per cubic meter (kN-m/m3))
- D1972 Standard Practice for Generic Marking of Plastic Products
- D198 Standard Test Methods of Static Tests of Lumber in Structural Sizes
- D2103 Standard Specification for Polyethylene Film and Sheeting
- D217 Standard Test Methods for Cone Penetration of Lubricating Grease
- D2369 Standard Test Method for Volatile Content of Coatings
- D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
- D3792 Standard Test Method for Water Content of Coatings by Direct Injection Into a Gas Chromatograph
- D3864 Standard Guide for Continual On-Line Monitoring Systems for Water Analysis
- D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- D4017 Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method
- D4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
- D4444 Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters
- D4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- D4552 Standard Practice for Classifying Hot-Mix Recycling Agents
- D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- D4716 Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Product
- D4840 Standard Guide for Sampling Chain-of-Custody Procedures

- D4887 Standard Test Method for Preparation of Viscosity Blends for Hot Recycled Bituminous Materials
- D5106 Standard Specification for Steel Slag Aggregates for Bituminous Paving Mixtures
- D5116 Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products
- D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
- D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- D5268 Standard Specification for Topsoil Used for Landscaping Purposes
- D5359 Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
- D5505 Standard Practice for Classifying Emulsified Recycling Agents
- D5509 Standard Practice for Exposing Plastics to a Simulated Compost Environment
- D5512 Standard Practice for Exposing Plastics to a Simulated Compost Environment Using an Externally Heated Reactor
- D5539 Standard Specification for Seed Starter Mix
- D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations
- D5603 Standard Classification for Rubber Compounding Materials—Recycled Vulcanizate Particulate Rubber
- D5663 Standard Guide for Validating Recycled Content in Packaging Paper and Paperboard
- D5759 Standard Guide for Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
- D5792 Standard Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives
- D5834 Standard Guide for Source Reduction Reuse, Recycling, and Disposal of Solid and Corrugated Fiberboard (Cardboard)
- D5851 Standard Guide for Planning and Implementing a Water Monitoring Program
- D5852 Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
- D6002 Standard Guide for Assessing the Compostability of Environmentally Degradable Plastics
- D6006 Standard Guide for Assessing Biodegradability of Hydraulic Fluid
- D6007 Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber
- D6046 Standard Classification of Hydraulic Fluids for Environmental Impact
- D6081 Standard Practice for Aquatic Toxicity Testing of Lubricants: Sample Preparation and Results Interpretation
- D6108 Standard Test Method for Compressive Properties of Plastic Lumber and Shapes
- D6109 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber
- D6112 Standard Test Methods for Compressive and Flexural creep and Creep-Rupture of Plastic Lumber and Shapes
- D6117 Standard Test Methods for Mechanical Fasteners In Plastic Lumber and Shapes
- D6155 Standard Specification for Nontraditional Coarse Aggregates for Bituminous Paving Mixtures
- D6245 Standard Guide for Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation
- D6261 Standard Specification for Extruded and Compression Molded Basic Shapes Made from Thermoplastic Polyester (TPES)

- D6262 Standard Specification for Extruded, Compression Molded, and Injection Molded Basic Shapes of Poly(aryl ether ketone) (PAEK)
- D6270 Standard Practice for Use of Scrap Tires in Civil Engineering Applications
- D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers
- D6330 Standard Practice for Determination of Volatile Organic Compounds (Excluding Formaldehyde) Emissions from Wood-Based Panels Using Small Environmental Chambers Under Defined Test Conditions
- D6345 Standard Guide for Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air
- D6400 Standard Specification for Compostable Plastics
- D6435 Standard Test Method for Shear Properties of Plastic Lumber and Plastic Lumber Shapes
- D6629 Standard Guide for Selection of Methods for Estimating Soil Loss by Erosion
- D6662 Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards
- D6712 Standard Specification for Ultra-High-Molecular-Weight Polyethylene (UHMW-PE) Solid Plastic Shapes
- D6886 Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography
- D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
- D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
- D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
- D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair
- E1021 Standard Test Methods for Measuring Spectral Response of Photovoltaic Cells
- E1038 Standard Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact with Propelled Ice Balls
- E1039 Standard Test Method for Calibration of Silicon Non-Concentrator Photovoltaic Primary Reference Cells Under Global Irradiation
- E1040 Standard Specification for Physical Characteristics of Nonconcentrator Terrestrial Photovoltaic Reference Cells
- E1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
- E1171 Standard Test Method for Photovoltaic Modules in Cyclic Temperature and Humidity Environments
- E1333 Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Under Defined Test Conditions Using a Large Chamber
- E1362 Standard Test Method for Calibration of Non-Concentrator Photovoltaic Secondary Reference Cells
- E1433 Standard Guide for Selection of Standards on Environmental Acoustics
- E1462 Standard Test Methods for Insulation Integrity and Ground Path Continuity of Photovoltaic Modules
- E1596 Standard Test Methods for Solar Radiation Weathering of Photovoltaic Modules
- E1597 Standard Test Method for Saltwater Pressure Immersion and Temperature Testing of Photovoltaic Modules for Marine Environments

- E1609 Standard Guide for Development and Implementation of a Pollution Prevention Program
- E1686 Standard Guide for Selection of Environmental Noise Measurements and Criteria
- E1690 Standard Test Method for Determination of Ethanol Extractives in Biomass
- E1721 Standard Test Method for Determination of Acid-Insoluble Residue in Biomass
- E1755 Standard Test Method for Ash in Biomass
- E1758 Standard Test Method for Determination of Carbohydrates in Biomass by High Performance Liquid Chromatography
- E1780 Standard Guide for Measuring Outdoor Sound Received from a Nearby Fixed Source
- E1799 Standard Practice for Visual Inspections of Photovoltaic Modules
- E1802 Standard Test Methods for Wet Insulation Integrity Testing of Photovoltaic Modules
- E1821 Standard Test Method for Determination of Carbohydrates in Biomass by Gas Chromatography
- E1827 Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
- E1830 Standard Test Methods for Determining Mechanical Integrity of Photovoltaic Modules
- E1861 Standard Guide for Use of Coal Combustion By-Products in Structural Fills
- E1918 Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- E1971 Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings
- E1980 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- E1991 Standard Guide for Environmental Life Cycle Assessment of Building Materials/Products
- E2047 Standard Test Method for Wet Insulation Integrity Testing of Photovoltaic Arrays
- E2114 Standard Terminology for Sustainability Relative to the Performance of Buildings
- E2128 Standard Guide for Evaluating Water Leakage of Building Walls
- E2129 Standard Practice for Data Collection for Sustainability Assessment of Building Products
- E2397 Standard Practice for Determination of Dead Loads and Live Loads associated with Green Roof Systems
- E2398 Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Green Roof Systems
- E2399 Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems
- E2400 Standard Guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems
- E241 Standard Guide for Limiting Water-Induced Damage to Buildings
- E2432 Standard Guide for General Principles of Sustainability Relative to Buildings
- E408 Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- E413 Standard Classification for Rating Sound Insulation
- E477 Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers

- E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- E683 Standard Practice for Installation and Service of Solar Space Heating Systems for One- and Two-Family Dwellings
- E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
- E781 Standard Practice for Evaluating Absorptive Solar Receiver Materials When Exposed to Conditions Simulating Stagnation in Solar Collectors With Cover Plates
- E782 Standard Practice for Exposure of Cover Materials for Solar Collectors to Natural Weathering Under Conditions Simulating Operational Mode
- E823 Standard Practice for Nonoperational Exposure and Inspection of a Solar Collector
- E881 Standard Practice for Exposure of Solar Collector Cover Materials to Natural Weathering Under Conditions Simulating Stagnation Mode
- E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- E903 Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
- E948 Standard Test Method for Electrical Performance of Photovoltaic Cells Using Reference Cells Under Simulated Sunlight
- F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
- F2034 Standard Specification for Sheet Linoleum Floor Covering
- F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

E. Bat Conservation International:
- Bat Approved Bat Houses

F. Carpet and Rug Institute
- Green Label & Green Label Plus Testing Programs, carpet-rug.org/testing/green-label-plus

G. Center for Resource Solutions
- Green-e program

H. Environmental Protection Agency (EPA):
- **Comprehensive Procurement Guidelines**
- **ENERGY STAR**
- **Environmentally Preferable Purchasing Program Final Guidance**
- **GreenScapes program**
- **Heat Island Initiative**
- **Indoor Air Quality Building Education and Assessment Model (I-BEAM)**
- **National Environmental Performance Track**
- **Pollution Prevention (P2)**
- **Product Stewardship Program**
- **Significant New Alternatives Policy (SNAP) Program**

I. Federal Trade Commission:
- **Guide for the Use of Environmental Marketing Claims**

J. Forest Stewardship Council:
- **Chain-Of-Custody**
- **Forest Management**

K. Green Building Initiative (GBI):
- **Green Globes - US**

L. Green Seal:
- **GC-03 Anti-Corrosive Paints**
- **GC-12 Occupancy Sensors**
- **GC-13 Split-Ductless Air-Source Heat Pumps**
- **GS-05 Compact Fluorescent Lamps**
- **GS-11 Paints**
- **GS-13 Windows**
- **GS-14 Window Films**
- **GS-31 Electric Chillers**
- **GS-32 Photovoltaic Modules**
- **GS-36 Commercial Adhesives**
- **GS-37 Industrial & Institutional Cleaners**

M. International Iron and Steel Institute:
- **CO2 Breakthrough Program**

N. International Organization of Standardization:
- **Guide 64; Guide for Inclusion of Environmental Aspects in Product Standards**
- **9660 Information processing -- Volume and file structure of CD-ROM for information interchange**
- **14001 Environmental management systems – Specification with guidance for use**
- **14004 Environmental Management Systems – General Guidelines on Principles, Systems and Supporting Techniques**
- **14020 Environmental labels and declarations – General principles**
- **14024 Environmental labels and declarations – Type I environmental labelling - Principles and procedures**
- **14040 Environmental management – Life cycle assessment – Principles and framework**

O. National Association of Home Builders:
- **Advanced Framing Techniques: Optimum Value Engineering**

P. National Institute of Building Sciences:
- **MOIST program for transfer of heat and moisture**
- **Whole Building Design Guide**

Q. National Institute of Standards and Technology:
- **BEES (Building for Environmental and Economic Sustainability) Lifecycle Decision Support Tool**

R. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
- **IAQ Guidelines for Occupied Buildings Under Construction**

S. Southcoast Air Quality Management District:
- **1168 Adhesive And Sealant Applications**

T. US Composting Council:
- Seal of Testing Assurance Program

U. US Department of Agriculture:
- **Biobased Products – Definitions and Descriptions**

V. US Green Building Council:
- **LEED™ 2009 Green Building Rating System**
- **LEED™ v4 (version 4) Green Building Rating System**

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

A. Permanent Enclosure: As determined by Contracting Officer (CO), permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in Contract Sum as required.

B. Water Service: Water from 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 without any additional permit costs.

C. Electric Power Service: Electric power from 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 without any additional permit costs.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with National Electrical Contractors Association (NECA), National Electrical Manufacturers Association (NEMA), and Underwriter Laboratories (UL) standards and regulations for temporary electric service. Install service to comply with National Fire Protection Association (NFPA) 70.

B. Environmental Protection: Provide environmental protection as required by agency(ies) with jurisdiction and as indicated in Contract Documents. Coordinate with requirements of the following:

1. Regulatory Requirements
2. Indoor Air Quality (IAQ) Management
3. Noise and Acoustics Management
4. Environmental Management

5. Construction Waste Management

C. Accessible Temporary Egress: Comply with applicable provisions in the United States (U.S.) Architectural & Transportation Barriers Compliance Board's Architectural Barriers Act Accessibility Standard (ABAAS) Accessibility Guidelines.

1.5 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 NPS acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary materials may be new or used, but must be adequate in capacity for required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

B. Portable Chain-Link Fencing: Minimum 2 inch (50 millimeters), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 millimeters) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 millimeters) OD line posts and 2-7/8 inch (73 millimeters) OD corner and pull posts, with 1-5/8 inch (42 millimeters) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

C. Safety Barrier Fence: Orange plastic fence, minimum height, 4 feet.

D. Barrier Tape: Yellow tape Imprinted with "CAUTION: CONSTRUCTION AREA"

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Contracting Officers Field Office: Field office shall be a separate structure from Contractor's office.

1. Prefabricated, job built, or a mobile unit; excellent condition, structurally sound, non-flammable exterior construction, weather tight, minimum 300 square feet.
2. Operable windows and security screens, adjustable ventilation.
3. Restroom (minimum of lavatory and toilet, with exhaust fan if room is windowless).
4. Air conditioner and heater.
5. Interior partition with lockable door to divide office
6. Paneling or freshly painted walls, acoustical tile or painted ceilings, and resilient flooring.
7. Two exterior doors with dead bolts keyed from outside,
8. Minimum 20-square-foot landing and steps at each exterior door.

C. Storage and Fabrication Sheds: Temporary weather tight sheds or other covered facilities for storage of materials subject to weather damage. Number and size of structures shall be subject to Contracting Officer's approval.

D. Toilets: Sufficiently lighted and ventilated toilet facilities in weatherproof, sight proof, handicap accessible, sturdy enclosures with privacy locks.

1. Provide separate toilet facilities for men and women.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Heating, Ventilation, and Air Conditioning (HVAC) Equipment: Unless Contracting Officer authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

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

C. Contracting Officers Field Office

1. Outlets: Minimum of two, quad outlets with surge protection.
2. Refrigerator: Under counter, 3.2-cubic-foot volume with 0.8-cubic-foot freezer with dedicated power receptacle.
3. Fire Extinguisher: UL listed and FM (Fire Pump Motors) approved, minimum rating of 2-A:10-B:C, dry chemical.
4. First-Aid Kit: General office/light industrial kit which includes antiseptic wipes, bandages, disposable gloves, tape, instant cold pack, dressing pads, eye pads, scissors, and Tylenol tablets. Provide small size, such as manufactured by Johnson & Johnson, New Brunswick, New Jersey, or approved equal.
5. Two desks with five drawers each and two chairs with casters; two drafting tables (minimum 40 inches wide by 5 feet long) and two stools; drawing rack; two 2-drawer and one 4-drawer legal size locking filing cabinets with keys; 8 feet of 12 inch deep shelving; coat rack; two additional guest chairs; two desk lamps; two drafting table lamps; and a maximum/minimum thermometer.
6. Manufactured computer work station, capable of containing CPU (central processing unit), monitor, keyboard, printer; work station chair.
7. Additional tables necessary for FAX machine and copier.
8. Two 5-gallon trash cans and one 30-gallon trash can with lid.
9. Ceiling mounted general lighting fixtures.

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 and as directed by the Contracting Officer.

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, NPS, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Acquire necessary permits.

B. Storm Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by the agency(ies) with jurisdiction.

C. Potable water is not available on site. Furnish cool, potable water for construction personnel in locations convenient to work stations.

D. Sanitary Facilities: Provide temporary toilets, and wash facilities for use by construction personnel.

1. Place in approved locations secluded from public observation and convenient to work stations. Relocate as work progress requires.
2. Maintain and clean toilet facilities at least weekly.
3. Completely remove sanitary facilities on completion of work.

E. Heating: Provide temporary heating 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.

1. Provide and maintain adequate approved facilities, as required for safety and construction requirements, during the work. Provide ample clearance around stoves, heaters, chimney and vent connections to prevent ignition of combustible material

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

G. Electric Power Service: Use of existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to NPS.

1. When temporary connections are removed, restore existing utility services to original condition.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Telephone Service: No telephone service is available on site for Contractor's use.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 50 feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove structures, equipment, and furnishings, and terminate services after punch list is 100 percent completed or when directed by Contracting Officer. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Contracting Officer.

B. Contracting Officers Field Office:

1. Provide Heat, lights, power, air conditioning, temporary water pressure and sewage holding tanks.
2. Provide office, furnishings, and utility connections no later than 7 days after date of Notice to Proceed. Exact location will be determined by Contracting Officer.
3. Maintain equipment, furnishings, and structures. Provide equipment replacement elements as needed. Provide weekly cleaning services and trash disposal. Maintain and service water and sewer holding tanks as required.

C. Traffic Controls: Erect and maintain barricades, lights, danger signals, and warning signs in accordance with Manual on Uniform Traffic Control Devices (MUTCD), Part IV, latest edition.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
3. Illuminate barricades and obstructions at night; keep safety lights burning from sunset to sunrise.
4. Adequately barricade and post open cuts in or adjacent to thoroughfares.
5. Protect pedestrian traffic by guardrails or fences.
6. When pedestrian traffic is detoured onto a roadway, provide temporary walkways with protection as required at ends and overhead. For walkways, use lumber running parallel to direction of traffic movement and provide ramps at changes of elevation.
7. Cover pipes, hoses, and power lines crossing sidewalks and walkways with troughs using beveled edge boards.

8. Install Barrier Tape where directed by Contracting Officer. Keep a minimum of two rolls on site.

D. Parking: No parking areas are available for construction personnel. Library Street will not be available for parking.

E. Dewatering Facilities and Drains: Comply with requirements of the agency(ies) with jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in 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.

F. Project Identification and Temporary Signs: Provide Project identification and other signs. Fence, barricade, or otherwise block off the immediate work area to prevent unauthorized entry.

1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.
3. Erect and maintain sufficient detour signs at road closures and along detour routes.

G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of agency(ies) with jurisdiction.

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

B. Cleaning of Equipment: Contractor shall ensure prior to moving on to Project Area, equipment, is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Ensure equipment has been pressure washed and is free of exotic species. Equipment shall be considered free of soil, seeds, and other debris when visual inspection does not disclose such material. Disassembly of equipment components or specialized inspection tools are not required.

C. Temporary Erosion and Sedimentation Control: Refer to Section 01 57 23 "Temporary Storm Water Pollution Prevention".

D. Tree and Plant Protection: Refer to Section 01 11 00 "Summary of Work" and Section 015639 “Temporary Tree and Plant Protection”

E. Pest Control: Follow NPS requirements to minimize attraction and harboring of rodents, roaches, and other pests and perform extermination and control procedures at regular intervals so Project will be free of pests and residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

F. Site Enclosure Fence: Before construction operations begin, furnish and install chain link fencingto 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. Locate vehicular gates to avoid interference with traffic on public thoroughfares.
3. Locate pedestrian entrance gates as required to provide controlled personnel entry.
4. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

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 andagency(ies) with jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

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

J. 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. Responsible Person: Capable and qualified person shall be placed in charge of fire protection. Responsibilities shall include locating and maintaining fire protective equipment and establishing and maintaining safe torch cutting and welding procedures.
2. Tobacco Use, Smoking, and Vaping: Smoking within buildings or temporary storage sheds is prohibited.
3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of NPSCheck with Park; many require "burn permits" for welding.
4. Develop and supervise 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.
5. Provide temporary standpipes and hoses for fire protection. Hang hoses with warning sign stating hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
6. Hazard Control: Take necessary precautions to prevent fire during construction. Do not store flammable or combustible liquids in historic structures orexisting buildings. Provide adequate ventilation during use of volatile or noxious substances. Ensure cleanup procedures and storage requirements are followed at close of every work session.
7. Spark Arresters: Equip gasoline or diesel powered equipment used during periods of potential fire hazards or in potential forest and grass fire locations with spark arresters approved by United States Department of Agriculture (USDA) Forest Service.

    a. Written determinations of periods and areas of potential fire hazard will be issued by Contracting Officer.

8. Buildings: Furnish a minimum of one extinguisher for each 1,500 square feet of area or major fraction thereof.

a. Travel distance from any work station to nearest extinguisher shall not exceed 75 feet.

9. Vehicles and Equipment: Provide one extinguisher on each vehicle or piece of equipment.
10. Service and Refueling Areas: Locate areas a minimum of **100** feet from buildings. Shut down equipment before refueling.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. 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 24-hour basis where required to achieve indicated results and 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 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. NPS reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period.

END OF SECTION 01 50 00

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction. Work addressed in this section as follows:

1. Tree, lawn, plant and soil protection in and adjacent to construction work areas
2. Tree lawn, plant and soil protection in designated construction staging and stockpile areas
3. Landscape protection in areas of staging and stockpile areas.
4. Tree pruning for areas affected by fence installation

1.2 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches (150 mm) above the ground for trees up to, and including, 4-inch (100-mm) size; and 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 indicated on Drawings.

D. Protection-Zone Fencing: Area surrounding trees, vegetation, landscape or areas outside of the construction zone to be protected from construction operations, staging and material storage. Including area to be secured from public access.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 SUBMITTALS

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

B. Samples for Verification: For each type of the following:

1. Organic Mulch: 1-quart 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.

C. Tree Pruning: At no time shall tree branches be cut or trimmed without consultation with the NPS horticulturist and written approval.

1. Written schedule: Provide a written schedule and plan detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction in advance to review and obtain approval from the NPS horticulturalist. The schedule shall provide the following information:
2. Species and size of tree.
3. Location on site plan. Include unique identifier for each.
4. Reason for pruning.
5. Description of pruning to be performed.
6. Description of maintenance following pruning.

D. Root Pruning:

1. Written Schedule: Provide a written schedule and plan detailing the scope and extend of root pruning of trees that are affected by construction operations and as indicated on the landscape removals and protection plans.
2. Identify roots that are over two (2) inches in diameter and extend beyond the construction impact/excavation limits.

a. Provide a schedule of roots and their locations to the Contracting Officer.

E. Qualification Data: For qualified arborist and tree service firm

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 videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.4 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA and Licensed in the State of Pennsylvania. Approved Arborists include, and are limited to one of the following:

1. Provide credentials of not less than 3 certified arborist for review and acceptance by the COR..

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. Preinstallation Conference: Conduct conference at Project site or other site within the region as directed by the Contracting Officer's Representative.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
b. Enforcing requirements for protection zones.
c. Arborist's responsibilities.
d. Field quality control.

1.5 PROJECT CONDITIONS

A. The following practices are explicitly prohibited within protection zones:

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

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. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.

B. Topsoil: Stockpiled topsoil from project site at offsite location. or Imported or manufactured topsoil complying with ASTM D 5268 and Soils Specifications Section 32 1000 as part of these project documents .

C. Ground Protection for paving, hardscape elements and as otherwise indicated on the contract drawings.

1. Protection Mat: ½ inch thick vinyl loop coils extruded from 100% PVC and thermally bonded.

a. Skudo All-Terrain Mat -SKUDO USA
b. 3M 1500 Vinyl-loop Mat -Amarco
c. Vinyl Loop Mat – Uline

D. Ground Protection Board: Protection board for paving, hardscape elements and as otherwise indicated on the contract drawings.

1. 4 inch thick high-density polyethylene 6000 psi board deck 7'-6" x 14'-0"
   a. MegaDeck HD - Signature Systems
   b. System 7 Composite Mat System - Spartan Mat
   c. Dura Base - NewPark Mats and integrated services

E. Ground Protection for Trees and Vegetation: Ground protection system constructed using:

1. 1 inch thick plywood or particle board
2. Polyethylene ground protection sheathing 6 mil thick.

F. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood or Wood and bark chips.
2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum
3. Color: Natural. No artificial color or added materials are permissible

G. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch (50-mm) opening, 0.148-inch- (3.76-mm-) diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- (60-mm-) OD line posts, and 2-7/8-inch- (73-mm-) OD corner and pull posts; with 1-5/8-inch- (42-mm-) OD top rails and 0.177-inch- (4.5-mm-) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

   a. Height: 6 feet (1.8 m).

2. Gates: Double swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches (914 mm).

H. Tree / Plant 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, T-shape galvanized-steel posts or non treated lumber, spaced not more than 96 inches (2400 mm) apart.

1. Polyvinyl expanded mesh protection fencing

a. Color Orange
b. Height 48 Inch min,

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. For the record, 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 be removed and or to be relocated. Tie a 1-inch (25-mm) blue-vinyl tape around 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: Maintain existing vegetation within landscape protection areas indicated.

1. Maintain by mowing lawns to the desired height as determined by NPS

2. Maintain by watering:

a. Provide and set up temporary irrigation to offset existing irrigation disrupted by construction activities
b. Provide temporary irrigation for entirety of the zone affected by construction activities within and outside of the vegetation protection zones

3.3 TREE- AND PLANT-PROTECTION:

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 from easily entering protected area except by entrance gates. Coordinate Tree and Plant Protection-zone fencing with Project construction protection zone fencing and other site protection measures. 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. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.

2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings.
3. Where a post is located on existing paving or concrete to remain, set chain link fencing in movable concrete blocks.

    a. The contractor shall ensure that no damage is caused by the blocks and that the fence is securely anchored in case of wind. Anchoring shall be by means of sandbags or weights.
    b. Guying to existing structures, trees or ground stakes is not permissible, In the event that weather forecasts predict heavy winds, the area and the fence shall be secured to ensure worker safety and that no damage occurs to existing site features or adjacent trees. Post penetration into finish material surfaces is not permissible.

4. Access Gates: Install and adjust 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. Maintain protection zones free of weeds and trash.

C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Contracting Officer's Representative.

D. Maintain protection-zone fencing in good condition as acceptable to Contracting Officer's Representative 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 NPS Horticulturist 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 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving."

B. Trenching and excavation near Trees: Where utility trenches are required within protection zones, and/or where excavation is required for site improvements, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune roots on trees that are less than 8 caliper inches that are affected by temporary and permanent construction and as shown on the landscape removals and protection plans. Prune roots as shown on Drawings and 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. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Cover exposed roots with burlap and water regularly.
4. Backfill as soon as possible according to requirements in Division 31 Section "Earth Moving."

B. Root Pruning trees 8 inch caliper and larger within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use air rake (air excavating tool/ air knife) narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Air Rake to expose roots in advance of hand excavation
2. Review exposed root system with NPS Horticulturist at onset of root pruning operations to determine optimum measures to insure tree health.

3.6 CROWN PRUNING

A. Do not crown prune unless approved in writing by the NPS Horticulturalist:

1. Pruning Standards: Prune trees according to ANSI A300 (Part 1)and the following:
2. Cut branches with sharp pruning instruments; do not break or chop.
3. Do not apply pruning paint to wounds.

3.7 GROUND PROTECTION

A. Apply ground protection board for:

1. Areas atop tree root systems that cannot otherwise be avoided or outside of the tree protection zone as indicated on the contract drawings and on site conditions.
2. Lawn and turff areas that are temporarily affected by construction operations or equipment movements.
3. Sub soil in areas of Lawn and turf areas where turf and topsoil have been removed and sub-soil remains.

B. Remove any trimmed branches and dispose of off-site.

3.8 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.9 FIELD QUALITY CONTROL

A. Inspections: Review field conditions with NPS Horticulturist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.10 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Contracting Officer.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Contracting Officer.

B. Soil Aeration: Where directed by Contracting Officer’s Representative, 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.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off grounds.

END OF SECTION 01 56 39

SECTION 01 57 19.12 – NOISE AND ACCOUSTICS MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Special requirements for noise and acoustics management during **renovation** operations.

1.2 DEFINITIONS

A. Ambient noise level: The total noise associated with a given environment, being usually a composite of normal or existing sounds from all sources near and far, excluding the noise source at issue.

B. Daytime: The hours from 7 A.M. to 9 P.M. on weekdays and 9 A.M. to 9 P.M. on weekends and holidays.

C. Nighttime: All non-daytime hours.

D. Property line: The real or imaginary line along the ground surface and its vertical extension, which separates real property owned or controlled by one person from contiguous real property owned or controlled by another person or from any public right-of-way or from any public space.

E. Receiving noise area: Any real property where people live or work and where noise is heard, excluding the project or source area.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 NOISE MANGEMENT

A. Noise Control: Perform **renovation**operations to minimize noise. Perform noise-producing work in less sensitive hours of the day or week as directed by the Contracting Officer CO).

B. Repetitive and/or intermittent, high-level noise: Permitted only during Daytime.

1. Do not exceed the following dB(A) limitations at 50 feet:

Sound Level in dB(A)	Time Duration of Impact Noise
70	More than 12 minutes in any hour

80	More than 3 minutes in any hour

2. Maximum permissible construction equipment noise levels at 50 feet:

EARTHMOVING	dB(A)	MATERIALS HANDLING	dB(A)
Front Loaders	75	Concrete Mixers	75
Backhoes	75	Concrete Pumps	75
Dozers	75	Cranes	75
Tractors	75	Derricks Impact	75
Scrapers	80	Pile Drivers	95
Graders	75	Jack Hammers	75
Trucks	75	Rock Drills	80
Pavers, Stationary	80	Pneumatic Tools	80
Pumps	75	Saws	75
Generators	75	Vibrators	75
Compressors	75		

C. Ambient Noise:

1. Maximum noise levels (dB (decibel)) for receiving noise area at property line shall be as follows:

a. Residential receiving area
Daytime: 65 dB
Nighttime: 45 dB

b. Commercial/Industrial receiving area
Daytime: 67 dB
Nighttime: 65 dB

c. In the event the existing local ambient noise level exceeds the maximum allowable receiving noise level (dB), the receiving noise level maximum for construction operations shall be adjusted as follows:

d. Residential receiving area: Maximum 3 additional dB above the local ambient as measured at property line.

e. Commercial/Industrial receiving area: Maximum 5 additional dB above the local ambient as measured at the property line.

3.2 FIELD QUALITY CONTROL

A. Assess potential effects of construction noise on adjacent neighborsin accordance with ASTM E1686 and as follows:

1. Ambient noise measurement: Measure at property line at a height of at least four (4) feet above the immediate surrounding surface. Average the ambient noise level over a period of at least 15 minutes.
2. Ambient noise measurement at urban sites: Conduct during morning peak traffic hour between 7 A.M. and 9 A.M. and afternoon peak traffic hour between 4 P.M. and 6 P.M. In

addition, conduct a 24-hour measurement at the proposed project site to document the noise pattern throughout the day. Adjust and weight for seasonal and climatic variations.

B. Monitor noise produced from construction operations in accordance with ASTM E1780.

END OF SECTION 01 57 19.12

SECTION 01 57 23 - UNDER-AN-ACRE POLLUTION PREVENTION

PART 1 - GENERAL

1.1 SUMMARY

A. National Park Service (NPS) Standards and Guidelines require water quality be protected to ensure compliance with Organic Act. Contractor shall prepare an Under-An-Acre Pollution Prevention Plan (UPPP) for each project resulting in less than 1 acre of soil disturbance or not otherwise subject to requirements of NPDES program. (UPPP Guideline)

B. The work of this section consists of implementing measures to prevent discharges of pollutants, including temporary storm water pollution during construction activities, either through compliance with NPDES permit program, or in conformance with NPS guidance for UPPPs.

C. Work of this section consists of implementing measures to Temporary Storm Water Pollution during construction activities, either through compliance with NPDES permit program; or in conformance with NPS guidance for UPPPs.

1.2 DEFINITIONS

A. Definitions pertaining to sustainable development: As defined in ASTM E2114.

B. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of the environment for aesthetic, cultural, or historical purposes.

C. UPPP: Developed and implemented pollution prevention plan (including stormwater management measures, if needed) to protect environment from pollutants on construction projects with less than one acre of disturbance in conformance with NPS guidelines.

1.3 SUBMITTALS

A. After contract award and before pre-construction conference, prepare and submit:
   1. A UPPP in conformance with NPS guidelines and adherence to applicable construction storm water management practices.

B. Inspection Schedule: Submit schedule for inspection and monitoring of pollution prevention measures.

C. Erosion Control Products: Submit manufacturer's product information and installation recommendations for silt fence, filter fabric, erosion control blanket, straw bales, and other materials proposed for use on this project.

1.4 QUALITY ASSURANCE

A. Contractor shall prepare and submit a plan to Contracting Officer (CO) for review and concurrence.

B. Orientation Meeting: Contractor shall arrange and conduct an Erosion and Sediment Control meeting/briefing to inform parties, scheduled to be on-site during project, of measures to be implemented for proper erosion and sediment control (may be included as part of Pre-Construction Meeting).

   1. Installation of silt fences, storm drain protection, and other forms of erosion and sediment control shall not begin until after this meeting has occurred.

C. Orientation Meeting: Contractor shall be responsible for arranging and conducting Pollution Prevention meeting/briefing to inform parties scheduled to be on-site during project of measures to be implemented for proper pollution prevention and control (may be included as part of Pre-Construction Meeting).

   1. Installation of silt fences, storm drain protection, and other forms of pollution prevention controls shall not begin until after this meeting has occurred.

D. Pollution Prevention Manager: Contractor shall designate Pollution Prevention Manager who will be responsible for implementation, inspection, maintenance, and amendments to approved plan.

   1. Pollution Prevention Manager shall be familiar with UPPP procedures and Best Management Practices (BMPs) and shall ensure emergency procedures and plan are updated as needed and available for inspection.

   2. When changes in approved plan are required, Pollution Prevention Manager shall prepare and certify an amendment and submit to Contracting Officer for review and concurrence.

   3.

PART 2 - PRODUCTS

2.1 UNDER-AN-ACRE POLLUTION PREVENTION PLAN

A. Provide UPPP which conforms to NPS requirements (utilize UPPP template) and include:
   1. Responsible Parties
   2. General Information: Project Scope, Project Details, Site Information, and Spill Prevention
   3. Standards and Constraints
   4. Project Scheduling
   5. Known Data on Soil and Fill
   6. Activities with Potential to Generate Sediment
   7. Activities and Materials with Potential to Pollute Storm Water
   8. Management and Reporting BMPs
   9. Waste Management BMPs
   10. Non-Storm Water Pollution Control BMPs
   11. Soil Stabilization BMPs

12. Sediment Control BMPs
13. Other Pollution Control BMPs
14. References
15. Preparer's Certification
16. Appendices: Contact Information, Pollution Prevention Control Map or Sheet(s), Standard Installation Specifications for each BMP, and Blank forms.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION

A. Construction Zone: Arrange construction activities to minimize pollution (i.e., erosion, trash, etc.) to maximum practical extent.

1. Clearing, excavation, and grading shall be limited to those areas of project site necessary for construction. Minimize area exposed and unprotected.
2. Clearly mark and delineate limits of work activities.
3. Equipment shall not be allowed to operate outside limits of work or to disturb existing vegetation.
4. Excavation and grading shall be completed during dry season to maximum extent possible.
5. Material shall be stored away from locations where water is present to greatest extent practicable.

3.2 REGULATORY REQUIREMENTS

A. The Contractor shall be responsible for compliance with all associated conditions of approval.

B. Contracting Officer Notification: Contractor shall notify Contracting Officer in writing and by telephone of these events:

1. Erosion and sediment control meeting/briefing.
2. Following installation of required sediment control structures.
3. Prior to removal of or modification to sediment control structures.
4. Prior to removal of sediment control structures.

3.3 UNDER-AN_ACRE POLLUTION PREVENTION PLAN

A. Review and Acceptance: Contractor and Contracting Officer will jointly review draft Plan and agree to needed revisions. Contractor shall incorporate revisions, sign, and submit final Plan to Contracting Officer. Final Plan will be the document enforced on the project.

1. Accepted Plan will describe and ensure implementation of practices to be used to reduce pollutants in storm water discharges.
2. Contractor shall maintain current copy of Plan and associated records and forms at jobsite throughout duration of project.
3. Plan shall be available for public inspection and inspection and use of Contracting Officer.

4. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.

B. Implementation: Implement Plan as required throughout construction period and maintain erosion control elements in proper working order.

1. Do not perform clearing and grubbing or earthwork until Plan has been implemented.

3.4 SITE INSPECTIONS AND PLAN REVISIONS

A. Inspections: Contractor and Contracting Officer will perform a weekly inspection onsite.

1. Inspection shall include disturbed areas not completely stabilized, areas used for storage of materials, locations where vehicles enter or exit site, and other erosion and sediment controls included in the Plan.
2. Inspections shall be documented.
3. Inspection forms shall be retained onsite in Plan notebook throughout construction period.

B. Plan Revisions: It may be necessary to revise Plan during construction to make necessary improvements, revisions, or to respond to unforeseen conditions noted during construction or site inspections.

1. Plan shall specify mechanism whereby revisions may be proposed by Contractor or Contracting Officer.
2. Contractor and Contracting Officer will jointly review each revision to Plan before changes incorporated and implemented. Contractor will then provide revised copy of Plan to Contracting Officer.
3. Accepted modifications will be implemented within 7 calendar days following date of inspection when deficiencies or necessary corrections are first noted.

C. Negligence: Provide additional temporary erosion and pollution controls made necessary by Contractor's errors or negligence at no additional cost to Government.

3.5 HOUSEKEEPING AND SITE MANAGEMENT

A. Store materials onsite in conformance to Federal, state, local, and manufacturer's regulations and specifications. Use Best Management Practices to minimize risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.

B. Manage solid waste in conformance to Federal, state, and local regulations. Best Management Practices should be used to minimize risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.

C. Include a spill prevention and control plan with provisions placed in SWPPP.

D. Manage hazardous waste (including contaminated soil) in conformance to Federal, state, local and NPS regulations and guidelines.

3.6 EROSION CONTROL MEASURES

A. Erosion control measures shall consist of Best Management Practices for storm water discharges, including silt fencing, barrier protectors, straw bales, temporary soil retention blankets, excelsior drainage filters, sediment traps and berms.

B. Berms and excelsior drainage filters shall be used to form sediment traps and control run-on and run-off into other areas, including creeks, streams, marshes, access roads, well areas, and staging areas.

C. Erosion control measures shall be used to contain only direct precipitation in construction zone. Contained water shall be allowed to percolate into ground or drain slowly through drainage filter sediment traps.

D. Earthen sediment traps or holding ponds shall not be used unless accepted by Contracting Officer.

E. Reduce runoff velocity and direct surface runoff around and away from fuel containment, storage, and borrow areas.

F. Divert surface runoff around and away from cut and fill slopes.

G. Place drainage filters around catch basins to create sediment traps to control run-off from construction area.

H. Excess water used for dust control shall be contained within demolition areas by erosion control measures.

I. Contractor shall prevent deposition of materials onto paved areas. Contractor shall inspect paved areas for deposited materials weekly and remove materials immediately.

J. Furnish, install, maintain, and operate necessary control measures and other equipment necessary to prevent erosion as described in approved UPPP.

K. Before work begins, sufficient equipment shall be available on site to assure operation and adequacy of erosion control system can be maintained.

3.7 MAINTENANCE OF TEMPORARY FACILITIES

A. Ensure erosion and sediment control structures remain effective throughout excavation and grading operations. Relocate structures as necessary.

B. Inspect control structures after each significant rainfall. Promptly repair breaches which occur.

C. Contractor shall remove entrapped sediment from behind excelsior drainage filter after each storm.

3.8 REPORTING

A. If a discharge occurs or if project receives written notice or order from regulatory agency, Contractor shall immediately notify Contracting Officer and shall file written report to

Agency(ies) with Jurisdiction within 7 days of discharge event, notice, or order. Corrective measures shall be implemented immediately following discharge, notice, or order. The report to the Agency(ies) with Jurisdiction shall contain:

1. Date, time, location, nature of operation, and type of discharge, including cause or nature of notice or order.
2. Best Management Practices deployed before discharge event, or prior to receiving notice or order.
3. Date of deployment and type of Best Management Practices deployed after discharge event, or after receiving notice or order, including additional Best Management Practices installed or planned to reduce or prevent re-occurrence.
4. An implementation and maintenance schedule for affected Best Management Practices.

3.9 SEDIMENT DISPOSAL

A. .

B. Contractor shall place sediment removed from traps and other structures where it will not enter a storm drain or watercourse and where it will not immediately reenter the basin.

3.10 REMOVAL OF TEMPORARY POLLUTION CONTROL MEASURES

A. Temporary control measures shall be removed with permission of Contracting Officer within 20 working days after final acceptance of project, and/or once grading is complete and slopes have stabilized.

END OF SECTION 01 57 23

SECTION 01 67 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. 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; and environmental requirements.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes "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, current as of date of 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. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have 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. Definitions pertaining to sustainable development: As defined in ASTM E2114.

C. Biobased Materials: As defined in Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, "biobased" means a "commercial or industrial product (other than food or feed) composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials." Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000.

1. Biobased content: Amount of biobased carbon in material or product as a percentage of weight (mass) of total organic carbon in material or product.

D. Chain-of-Custody: Process whereby a product or material is maintained under physical possession or control during its entire life cycle.

E. Environmentally preferable products: Products and services with lesser or reduced effect on the environment in comparison to conventional products and services. Refer to Environmental Protection Agency's (EPA) Final Guidance on Environmentally Preferable Purchasing for more information.

F. Stewardship: Responsible use and management of resources in support of sustainability.

G. Sustainability: Maintenance of ecosystem components and functions for future generations.

1. Recycled Content Materials: Products containing pre-consumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent with International Organization for Standardization (ISO) 140001 Standard for the Use of Environmental Marketing Claims.
2. Rapidly Renewable Material: Material made from plants typically harvested within a ten-year cycle.
3. Regional Materials: Materials manufactured and extracted, harvested, or recovered within a radius of 500 miles from Project location.

1.3 SUBMITTALS

A. Record Submittals as specified in – Sustainable Design Close-Out Documentation, submit:

1. Affirmative Procurement Reporting Form. Submit on form in Appendix A of this Section, or similar form as approved by Contracting Officer (CO).
2. Submit environmental data in accordance with Table 1 of ASTM E2129 for these products:

a. Masonry
b. Joint Sealers
c. Paints & Coatings
d. Plumbing fixtures and equipment.
e. HVAC equipment
f. Lighting equipment

3. Safety Data Sheets (SDS): For each product required by OSHA to have a SDS, submit an SDS. SDS shall be prepared within the previous five years. Include information for SDS Sections 1 to 16 in accordance with ANSI Z400.1 and as follows:

a. Section 1: Chemical Product and Company Identification
b. Section 2: Composition/Information on Ingredients
c. Section 3: Hazards Identification
d. Section 4: First Aid Measures
e. Section 5: Fire Fighting Measures
f. Section 6: Accidental Release Measures
g. Section 7: Handling and Storage
h. Section 8: Exposure Controls/Person Protection
i. Section 9: Physical and Chemical Properties
j. Section 10: Stability and Reactivity Data
k. Section 11: Toxicological Information. Include data used to determine the hazards cited in Section 3. Identify acute data, carcinogenicity, reproductive effects, and

target organ effects. Provide written description of the process used in evaluating chemical hazards relative to preparation of the SDS.

l. Section 12: Ecological Information. Include data regarding environmental impacts during raw materials acquisition, manufacture, and use. Include data regarding environmental impacts in event of accidental release.

m. Section 13: Disposal Considerations. Include data regarding proper disposal of the chemical. Include information regarding recycling and reuse. Indicate whether or not product is considered to be "hazardous waste" according to United States EPA Hazardous Waste Regulations 40 CFR 261 (Code of Federal Regulations).

n. Section 14: Transportation Information. Identify hazard class for shipping.

o. Section 15: Regulatory Information. Identify federal, state, and local regulations applicable to the material.

p. Section 16: Other Information. Include additional information relative to recycled content, biobased content, and other information regarding environmental and health impacts. Identify the date SDS was prepared.

4. Chain of Custody: Submit chain-of-custody documentation for sustainable forestry for these products:

a. Rough Carpentry
b. Finish Carpentry
c. Wood Doors
d. Windows
e. Wood Flooring
f. Furnishings & Accessories

1.4 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.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that 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 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 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 Contract Documents. Ensure products are undamaged and properly protected.

5. Obtain materials in biodegradable or recyclable/reusable packaging which uses minimum amount of packaging possible.

C. Storage:

1. Allow for inspection and measurement of quantity or counting of units.
2. Store materials in manner to not endanger Project structure.
3. Store products subject to damage by the elements, under cover in weather tight 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.
8. Store loose granular materials in well-drained area on solid surfaces to prevent mixing with foreign matter.

1.6 PACKAGING

A. Where Contractor has option to provide one of listed products or equal, preference shall be given to products with minimal packaging and easily recyclable packaging as defined in ASTM D5834.

B. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.

C. Provide minimum 45 percent post-consumer recycled content and minimum 100 percent recovered fiber content of industrial paperboard in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.

D. Provide minimum 10 percent post-consumer recycled content and minimum 10percent recovered fiber content of carrier board in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.

E. Provide minimum 5percent post-consumer recycled content and minimum 5 percent recovered fiber content of brown papers (e.g., wrapping papers and bags) in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.

1.7 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to greatest extent possible.

1. To greatest extent possible, provide products and materials with a lesser or reduced effect on the environment considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and/or disposal of the product.
2. Eliminate use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either Montreal Protocol and Title VI or Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account life cycle impacts.

3. Use products meeting or exceeding EPA's recycled content recommendations for EPA-designated products. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of total value of the materials in project.

1.8 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for product specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare written document containing appropriate terms and identification, ready for execution. Submit 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 Specifications, prepare written document using appropriate form properly executed.
3. Refer to Divisions 2 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products to comply with Contract Documents, undamaged and, unless otherwise indicated, 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 produced and used successfully in similar situations on other projects.
3. Government reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
4. Where products are accompanied by term "as selected," Contracting Officer will make selection.
5. Where products are accompanied by term "match sample," sample to be matched is Governments.

6. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Product: Where Specifications name recommended products and manufacturers, provide product that complies with requirements or a product of equal salient characteristics.
2. Manufacturer/Source: Where Specifications name recommended manufacturers or sources, provide product(s) by a manufacturer or source that complies with product requirements, or product of equal salient characteristics.
3. Products: Where Specifications include list of names of both recommended products and manufacturers, provide a product that complies with requirements, or product of equal salient characteristics.
4. Manufacturers: Where Specifications include list of recommended manufacturers' names, provide a product that complies with requirements, or product of equal salient characteristics.
5. Available Products: Where Specifications include list of names of both recommended products and manufacturers, provide a product – or an unnamed product – that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include recommended manufacturers, provide a product that complies with requirements or product of equal salient characteristics. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide specified product, system, or product or system of equal salient characteristics.
8. Basis-of-Design Product: Where Specifications name product and include a list of manufacturers, provide specified product or a comparable product by one of the other named manufacturers, or a product of equal salient characteristics. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics based on the product named.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select product that complies with requirements and matches Architect's sample. Contracting Officers 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.

10. Visual Selection Specification: Where Specifications include 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 phrase "standard range of colors, patterns, textures" or similar phrase, Contracting Officer will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include phrase "full range of colors, patterns, textures" or similar phrase, Contracting Officer will select color, pattern, density, or

texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions: Contracting Officer will consider Contractor's request for comparable product when the following conditions are satisfied. If following conditions are not satisfied, Contracting Officer will return requests without action, except to record noncompliance with these requirements:

1. Evidence proposed product does not require revisions to Contract Documents, that it is consistent with Contract Documents and will produce indicated results and is compatible with other portions of Work.
2. Detailed comparison of significant qualities of proposed product with those named in Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence 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

3.1 PROTECTION AFTER INSTALLATION

A. Provide adequate coverings as necessary to protect installed materials from damage resulting from natural elements, traffic, and subsequent construction. Remove when no longer needed.

END OF SECTION 01 67 00

AFFIRMATIVE PROCUREMENT REPORTING FORM
Recycled Content Materials & Biobased Content Materials

Project Name: _____ Project Number: _____

Contractor Name: _____ License Number: _____

Contractor Address: _____

Product	Total $ value provided	Total $ value with recycled content Pre-consumer	Total $ value with recycled content Post-consumer	Total $ value with biobased content	Exempted indicate 1,2,3,4	Comments
Hydraulic Mulch (paper based)						
Hydraulic Mulch (wood based)						
Compost						
Parking Stops (Concrete w/ fly ash, slag cement or low cement content)						
Parking Stops (Plastic/Rubber)						
Patio Blocks/Rubber						
Patio Blocks/Plastic						
Playground Surfaces						
Concrete with fly ash						
Concrete with slag cement						
Concrete with low cement content						
Plastic lumber						
Building Insulation						
Rock Wool						
Fiber glass						
Cellulose						
Perlite Comp Board						
Plastic Rigid Foam						
Glass Fiber Reinforced Foam						
Phenolic Rigid Foam						
Ceramic tile						
Resilient flooring						
Floor Tiles/Rubber						
Floor Tiles/Plastic						
Running Tracks						
Carpet (PET)						
Paint						

Reprocessed Latex Paint White & Light Colors						
Reprocessed Latex Dark Colors						
Consolidated Latex Paint						
Toilet/Shower partitions (plastic or steel)						
Other						

CERTIFICATION

I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

1. The product does not meet appropriate performance standards.
2. The product is not available within a reasonable time frame.
3. The product is not available competitively (from two or more sources).
4. The product is only available at an unreasonable price (compared with a comparable non-recycled content product.)

Signature: _____ Date: _____

END OF
AFFIRMATIVE PROCUREMENT REPORTING FORM
Recycled Content Materials & Biobased Content Materials

SECTION 01 73 40 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general procedural requirements governing execution of Work including:

1. Coordination with utility service providers
2. Construction layout
3. Field engineering and surveying
4. General installation of products
5. Progress cleaning
6. Starting and adjusting
7. Protection of installed construction
8. Correction of the Work

1.2 SUBMITTALS

A. Certificates: Submit certificate signed by **professional engineer** certifying location and elevation of improvements comply with requirements.

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

C. Certified Surveys: Submit **two**copies signed by **professional engineer**.

D. Quantity Surveys: Submit **2**copies showing quantities of work performed and actual construction completed in place.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: Professional **professional engineer** legally qualified to practice in jurisdiction where Project is located and-is experienced in providing land-surveying services of kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: Existence and location of site improvements and other construction indicated as existing are not guaranteed.

1. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

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

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

1. Before construction, verify 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. 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.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 COORDINATION WITH UTILITY SERVICE PROVIDERS

A. Coordination with Utility Service Providers: Contact following Utility Service providers, sufficiently in advance to avoid delaying the work, to coordinate Contractor's portion of Work, testing requirements, inspections, etc.

1. Electrical: Service Contact: Contact Peco to coordinate Electrical service requirements.

2. Water Service Contact: Contact Philadelphia Water Department to coordinate Water service requirements.

3.3 PREPARATION

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

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

C. Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of the Contract Documents caused by differing field conditions outside control of Contractor, submit request for information to Contracting Officer in accordance with Section 01 31 00 "Project Management and Coordination."

3.4 CONSTRUCTION LAYOUT

A. Verification: Verify layout information shown on Drawings, in relation to the existing benchmarks before proceeding to lay out Work. Notify Contracting Officer promptly if discrepancies are discovered.

B. General: Engage a **professional engineer** to lay out Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines 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 location, level and plumb, of every major element as Work progresses.
5. Notify Contracting Officer 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 established standard.**

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 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 log available for review by National Park Service (NPS).

3.5 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning Work. Preserve and protect permanent benchmarks and control points during construction operations. Controls destroyed by Contractor will be replaced by Contractor at their expense.

1. Existing Monuments: All benchmarks, land corners, and triangulation points, established by other surveys, existing within construction area shall be preserved. If existing monuments interfere with Work, secure written permission before removing them.

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

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

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

3.6 INSTALLATION

A. General: Locate Work and components of 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.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions for 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 parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm 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 Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Contracting Officer.
2. Allow for building movement, 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 integral anchors to be embedded in concrete or masonry. Deliver 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 best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials not considered hazardous.

J. Quantity surveys: Shall be conducted, and data derived from these surveys shall be used in computing quantities of work performed and actual construction completed and in place.

1. Contractor shall conduct original and final surveys and surveys for any periods for which progress payments are requested. These surveys shall be conducted under direction of a representative of the Contracting Officer, unless Contracting Officer waives requirement in a specific instance. Government shall make such computations as are necessary to determine quantities of work performed or finally in place. Contractor shall make computations based on surveys for any periods for which progress payments are requested.
2. Promptly upon completing a survey, Contractor shall furnish originals of field notes and other records relating to survey or layout of Work to Contracting Officer. Contractor shall retain copies of all such material furnished to Contracting Officer.

3.7 PROGRESS CLEANING

A. General: Clean Project site, work areas, and common areas daily. 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 National Fire Protection Association (NFPA) 241 for removal of combustible waste materials and debris at the end of every work session.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees Fahrenheit (27 degrees Celsius).
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 level of cleanliness necessary for proper execution of Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of Work, broom-clean or vacuum entire work area, as appropriate.
3. Contractor shall provide progress cleaning that minimizes sources of food, water, and harborage available to pests.

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 not hazardous to health or property and will not damage exposed surfaces.

1. Utilize non-toxic cleaning materials and methods.

a. Comply with Green Seal Standard (GS) 37 for general purpose cleaning and bathroom cleaning.
b. Use natural cleaning materials where feasible. Natural cleaning materials include:

1) Abrasive cleaners: substitute 1/2 lemon dipped in borax.
2) Ammonia: substitute vinegar, salt and water mixture, or baking soda and water.
3) Disinfectants: substitute 1/2 cup borax in gallon water.
4) Drain cleaners: substitute 1/4 cup baking soda and 1/4 cup vinegar in boiling water.
5) Upholstery cleaners: substitute dry cornstarch.

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

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. Clean and protect construction in progress and adjoining materials already in place during handling and installation. 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 remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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

K. Final Cleaning: At completion of Work, remove remaining waste materials, rubbish, tools, equipment, machinery and surplus materials. Clean exposed surfaces and leave Project clean and ready for occupancy.

1. Provide final cleaning in accordance with ASTM E1971.

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 factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 01 40 00 "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.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 01 73 29 "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 specified condition.

C. Remove and replace damaged surfaces 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 01 73 40

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

1.2 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: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Solid Waste: Garbage, debris, sludge, or other discharged material (except hazardous waste) including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations.

D. Debris: Non-hazardous solid waste generated during construction, demolition, or renovation of a structure which exceeds 2.5 inch (60 millimeter) particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders). A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if mixture is comprised primarily of debris by volume, based on visual inspection.

E. 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.

F. Environmental Pollution and Damage: Presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of environment for aesthetic, cultural, or historical purposes.

G. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

H. Hazardous Materials: Material regulated as a hazardous material in accordance with 49 CFR 173 (Code of Federal Regulations), requires Safety Data Sheets (SDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets

or has components which meet or have potential to meet the definition of Hazardous Waste in accordance with 40 CFR 261.

I. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

J. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

K. Single-use plastic products: Plastic items intended to be disposed of immediately after use, including plastic and polystyrene food and beverage containers, bottles, straws, cups, cutlery, and disposable plastic bags.

1.3 PERFORMANCE REQUIREMENTS

A. General: Project shall minimize creation of construction, deconstruction, and demolition waste to protect and restore natural habitat and resources. Minimize factors contributing to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, single-use plastic products, and contamination. A Waste Management Plan shall be developed to ensure that existing site and building materials are reused, salvaged, or recycled. Minimize waste disposal in landfills.

B. Salvage /Recycle Requirements: Develop waste management plan resulting in end-of-Project rates for salvage/recycling of 50percent by weight of total waste generated by the Work. The following waste categories, at a minimum, shall be diverted from a landfill:

1. Land clearing debris (chipped debris can be used on site for mulch or erosion control)
2. Clean dimensional wood, palettes
3. Plywood, OSB (oriented strand board), and particle board
4. Concrete (can be ground and used for fill on site)
5. Asphaltic concrete (can be ground and used for fill on site)
6. Cardboard, paper, packaging, newsprint
7. Metals (from banding, stud trim, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze)
8. Non-hazardous paint and paint cans
9. Beverage containers: Aluminum, glass, and plastic containers
10. Wiring
11. Other mixed construction and demolition waste as appropriate.

C. If waste materials encountered during deconstruction/demolition or construction phase are found to contain lead, asbestos, polychlorinated biphenyls (PCBs), (such as fluorescent lamp ballasts), or other harmful substances, they are to be handled and removed in accordance with local, state, and federal laws and requirements concerning hazardous waste.

D. Existing items and material to be removed during deconstruction/demolition phase shall be reused in construction phase of the Project. Items that cannot be reused shall be recycled. Items considered for reuse must be in refurbishable condition and must meet quality standards set forth in these specifications. Contractor shall ensure quality of the item(s) in question will meet or exceed accepted industry or trade standards for first quality commercial grade application. During

construction, deconstruction, or demolition Contracting Officer (CO) may designate other objects or materials for reuse.

E. Salvage/Recycle Requirements: Government goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:

1. <Insert list of demolition and construction waste that is to be salvaged or recycled.>

1.4 SUBMITTALS

A. Waste Management Plan: After award of contract and prior to scheduled Pre-Construction Conference, Contractor shall submit a draft Waste Management Plan to Contracting Officer for approval. Submit [3] copies of plan. Revise and resubmit Plan as required by Contracting Officer. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.

B. Progress Documentation: Supplemental to Waste Management Plan, document solid waste disposal, diversion, and cost/revenue analysis and submit completed worksheet on a monthly basis. See Project Waste Management Plan Worksheet Sample, attached to the end of the Division 1 Specifications, and report totals to date for column headings.

C. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

D. Qualification Data: For Waste Management Coordinator.

E. Progress payment requirements:

1. With each Application for payment, submit an updated Project Waste Management Plan worksheet for solid waste disposal and diversion.
2. With each Application for Payment, submit manifests, weight tickets, receipts, and invoices specifically identifying the Project and waste material.

F. Closeout Submittals

1. With Closeout Submittals, submit a summary of a Project Waste Management Plan worksheet for solid waste disposal and diversion.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with record of successful waste management coordination of projects with similar requirements, that employs a LEED™-Accredited Professional, certified by USGBC, as waste management coordinator

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Meeting: Conduct separate meeting or cover in Pre-Construction Conference and comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including:

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 procedures for reduction of single-use plastic products on site.
6. Review waste management requirements for each trade.

PART 2 - PRODUCTS

2.1 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification and waste reduction work plan. 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 salvaged and reused in Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials sold to individuals and organizations, include list of names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials donated to individuals and organizations, include list of 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 used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
7. Reduction of single-use plastic products: Include methods for water distribution to include bottle refilling stations if available for personnel.

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:

1. Landfill tip fees per ton.
2. If diverted, tip fee savings from landfill diversion.
3. Costs of recycling, salvage, or reuse.
4. Revenue from recycling, salvage, or reuse.
5. Total cost or savings from diversion. (Calculate by using tip fee savings and subtracting costs of recycling or adding revenue from recycling.)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Contracting Officer. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during entire duration of Contract.

B. Waste Management Coordinator: Engage waste management coordinator 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. Contractor shall establish contacts with local recycling and reuse companies to set up lines of responsibility. Contractor shall be responsible for coordination in terms of identifying materials, pickup schedules, and standard quality for recycled materials.

D. 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 begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

E. 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.

F. Separation facilities:

1. Contractor shall designate and Contracting Officer shall approve specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return.
2. Place waste and recycling bins near each other, and close to point of waste generation but out of traffic pattern.
3. Keep recycling and waste bin areas neat, clean, and clearly marked in order to avoid co-mingling of materials.
4. Protect bins during non-working hours from off-site contamination.
5. Check garbage dumpsters periodically for recyclables being thrown away and undocumented materials that could be recycled.

G. Materials handling procedures: Material to be recycled shall be protected from contamination and shall be handled, stored, and transported in a manner that meets requirements set by designated

facilities for acceptance. Establish defined area for operations of each trade, especially woodcutting so off-cuts are kept in one area and can be sorted by dimension for future reuse.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Governments Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Allow for inspection if necessary.
4. Store items in secure area until delivery to Government.
5. Transport items to storage area off-site designated by Government.
6. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include:

1. <Insert names and telephone numbers of local recycling receivers and processors of recyclable materials.>

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until 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 ground and protect from weather.
5. Remove recyclable waste off Government property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.

1. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earth Moving".

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 4 inch (100 millimeter) size.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
1. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

G. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

H. Lighting Fixtures: Separate lamps by type and protect from breakage.

I. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

J. Conduit: Reduce conduit to straight lengths and store by type and size.

K. Electronic Products: Ensure non-usable electronic products are reused, donated, sold, or recycled using environmentally sound management practices at end of life.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in 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 not containing painted or treated wood.

3.6 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 in landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials to accumulate on-site.
2. Remove and transport debris in manner preventing spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials allowed only at designated areas on Government property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Transport waste materials off Government property and legally dispose of them.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including:

1. Project Record Drawings
2. Closeout Submittals
3. Substantial Completion and Final Inspection
4. Permit Closure and Transfer
5. Final Acceptance of the Work
6. Warranties

1.2 PROJECT RECORD DRAWINGS

A. Maintain one complete full-size set of contract drawings and one full-size set of vendor-supplied drawings. Clearly mark changes, deletions, and additions using National Park Service (NPS) drafting standards to show actual construction conditions. Show additions in red, deletions in green and special instructions in blue.

B. Keep record drawings current. Make record drawings available to Contracting Officer (CO) for inspection at the time of monthly progress payment requests. If project record drawings are not current, Contracting Officer may retain an appropriate amount of progress payment.

C. Submit complete record drawings on completion of total project. Include shop drawings, sketches, and additional drawings to be included in final set, with clear instructions showing the location of these drawings.

1.3 CLOSEOUT SUBMITTALS

A. A list of closeout requirements has been attached at the end of the Division 1 Specifications for your convenience. The intent is to provide an overall summary of requirements and not a comprehensive list. Terms and conditions of the contract require satisfaction of requirements of individual specification sections regardless of what is shown on the list. Submit the following before requesting final inspection:

1. Specific warranties, guarantees, workmanship bonds, final certifications, and similar documents.
2. NPS required forms for occupancy, Fire Sprinkler/Alarm acceptance, and other similar forms or certificates.
3. Project Record Documents, operation and maintenance manuals, final completion construction digital images recorded on CD-R (compact disc-recordable) or DVD-R

(digital video disc-recordable) with index and descriptions, and similar final record information.

4. Deliver tools, spare parts, extra materials, and similar items to location designated by Contracting Officer. Label with manufacturer's name and model number where applicable.

    a. Special Tools: One set of special tools required to operate, adjust, dismantle, or repair equipment. Special tools are those not normally found in possession of mechanics or maintenance personnel.

5. Terminate and remove temporary facilities, mockups, construction tools, and similar elements from Project site, complete final cleaning requirements, including touchup painting.
6. Touch up and repair and restore marred exposed finishes to eliminate visual defects.
7. Instruct NPS personnel in operation, adjustment, and maintenance of products, equipment, and systems. **Submit demonstration and training videos.**

1.4 FINAL INSPECTION, SUBSTANTIAL COMPLETION AND ACCEPTANCE PROCEDURES

A. Request final inspection in writing when project or designated portion of project is substantially complete. Contracting Officer will proceed with inspection within 10 days of receipt of written request or will advise Contractor of items that prevent project from being substantially complete.

B. If work is determined substantially complete, following final inspection, Contracting Officer will prepare Punch List and issue a Letter of Substantial Completion.

C. If work is not determined substantially complete following final inspection, Contracting Officer will notify Contractor in writing. Contractor shall request new final inspection after completing work. Re-inspection costs may be charged against Contractor in accordance with Inspection of Construction contract clause.

D. Contractor shall complete Punch List within 30 calendar days, documented weather permitting.

E. If Contractor completes items of work on Punch List and contractually required items, Contracting Officer will issue Letter of final acceptance of work.

F. If Contractor fails to complete work within the time frame, Contracting Officer may correct work with an appropriate reduction in contract price or charge for re-inspection costs in accordance with Inspection of Construction contract clause.

1.5 PERMIT CLOSURE AND TRANSFER

A. When work covered by the permits is complete, create list of tasks required to close or transfer permits to Park. Submit to Contracting Officer for approval.

B. After substantial completion and Punch List completion, permits shall be closed and documented by Agency(ies) with Jurisdiction for the permit.

C. If responsibility for permits is to be transferred to Park, Park shall be informed of permit provisions completed and responsibilities transferring to Park staff.

1.6 WARRANTIES

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

B. Organize warranty documents into an orderly sequence based on table of contents of 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 (215 by 280 millimeters) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify product or installation. Provide typed description of product or installation, including name of product and name, address, and telephone number of Installer.
3. Identify each binder on front and spine with typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF (portable document format) file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. See Division 1 Specification Section "Execution" for information on cleaning agents.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Conduct final 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 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 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 dirt-free condition, free of stains, films, and foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to 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. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo, soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and vision-obscuring materials. Replace chipped or broken glass and transparent materials. Polish mirrors and glass.
k. Remove labels that are not permanent.
l. Touch up, repair, and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" (Underwriters Laboratories) and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical 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 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 light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out and noticeably dimmed bulbs, and defective or noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Pest Control: Engage experienced, licensed exterminator to make a final inspection and rid project of rodents, insects, and other pests. Provide Government with report.

D. Waste Disposal: Comply with requirements of Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

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

1. Manuals, general
2. Emergency manuals
3. Operation manuals for systems, subsystems, and equipment
4. Maintenance manuals for care and maintenance of **products, materials, and finishes** and **systems and equipment**

B. See Divisions 2 through 49 Sections for additional operation and maintenance manual requirements for Work in those Sections.

1.2 SUBMITTALS

A. Manual: Submit **two** copies of each manual in draft form or **one** electronic copy at least **15** days before final inspection. Contracting Officer (CO) will return copy or edit version with comments within **15** days of receipt.

B. Format: Submit operations and maintenance manuals in following format:

1. PDF (portable document format) electronic file. Assemble each manual into composite electronically indexed file. Submit on digital media acceptable to Contracting Officer.

    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. Hard copy manual: In accordance with Part 2 of this Section.

3. Correct or modify each manual to comply with Contracting Officers comments. Submit 4 copies of each corrected manual within 15 days of receipt of Contracting Officers comments.

1.3 QUALITY ASSURANCE

A. Coordinate with Section 01 91 14 "Total Building Commissioning." Commissioning Agent shall review Operation and Maintenance Manuals for commissioned systems.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system. Manual shall contain title page, table of contents, and manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include:

1. Project Title
2. Location
3. Park
4. Contract Number
5. Prime Contractors Name and Address
6. Date of Substantial Completion
7. Binder Volume Number

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

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

1. Binders: White, commercial quality, hard back, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 by 11 inch (215 by 280 millimeter) paper; with clear plastic window sleeve on front and spine to hold label describing contents and pockets inside covers to hold folded oversize sheets.

a. Cover Sheet: Identify binders on front and spine, with project title, location, park, contract number, prime contractor's name and address, date of substantial completion, and binder volume number. Insert cover sheet into clear plastic view pocket on front of binder. Insert sheet into clear plastic view pocket on spine with title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Data: Fill binders to no more than 75 percent of capacity. Punch holes shall not obscure any data. When contents of a single tabbed section cover more than one item, provide colored paper sheets to separate the data for each item.

a. Manufacturers' Data: Provide originals for color or copyrighted data. Black and white data may be originals or clean, good quality reproductions. No copies produced by facsimile transmission and sheets with stamps, such as submittal approval stamps. Include only sheets that apply to items installed; cross out inapplicable data.
b. Vendor Furnished As-Built Drawings: Maximum 24 inch by 36 inch sheets with minimum character or lettering size of 1/8 inch. Reduced-size reproductions may be provided instead of full-size drawings if reproductions are clear and legible. If

reduced-size drawings are used, identify as "REDUCED SIZE" and provide graphic scales, if applicable.

c. Custom Data: Data supplemented by drawings and schematics necessary to describe systems adequately.
d. Equipment Data Sheet: Data, using form at end of this section.
e. Schedules: Schedules reflecting final, as-installed conditions.
f. Poorly reproduced or illegible data will be rejected.

3. Dividers: Divider sheets with Mylar reinforced edges and pre-printed numbered tabs aligned with numbers and title lines on index sheet. Include typed list of products and major components of equipment included in section on each divider, cross-referenced to Specification Section number and title of Project Manual.
4. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
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.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into separate section for type of emergency, emergency instructions, and 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 for **flood**, **water leak**, **power failure**,**water outage**, and **equipment failure**.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of National Park Service (NPS) operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION AND MAINTENANCE MANUALS

A. Operation Requirements

1. Content: In addition to requirements in Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.
2. Descriptions: Include:

a. Product name and model number
b. Manufacturer's name
c. Equipment identification with serial number of each component
d. Equipment function
e. Operating characteristics
f. Limiting conditions
g. Performance curves
h. Engineering data and tests
i. Complete nomenclature and number of replacement parts

3. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
4. Systems and Equipment Controls: Describe sequence of operation, and diagram controls as installed.
5. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

B. Maintenance Requirements for Systems and Equipment

1. 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, and equipment data sheets as described below.
2. 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.
3. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:
4. Maintenance Procedures: Test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, **and demonstration and training videotape if available,** detailing essential maintenance and environmental procedures.
5. Maintenance and Service Schedules: Service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
6. Spare Parts List and Source Information: 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.
7. Warranties and Bonds: Copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into 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:

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. Environmental Requirements

1. Identify environmentally preferable products incorporated into Project. Include: product model; manufacturer’s name, address, phone, and website; and local technical representative.

a. Verify plastic products to be incorporated into Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.

1) Type 1: Polyethylene Terephthalate (PET, PETE)
2) Type 2: High Density Polyethylene (HDPE)
3) Type 3: Vinyl (Polyvinyl Chloride or PVC)
4) Type 4: Low Density Polyethylene (LDPE)
5) Type 5: Polypropylene (PP)
6) Type 6: Polystyrene (PS)
7) Type 7: Other. Use of this code indicates that package in question is made with a resin other than the six listed above or is made of more than one resin listed above and used in a multi-layer combination.

b. Describe maintenance procedures associated with environmentally preferable materials and systems. Provide cleaning recommendations in accordance with ASTM E1971 and approved Integrated Pest Management (IPM) plan.

1) Include potential environmental impacts of recommended maintenance procedures and materials.
2) Include potential indoor air quality impacts of recommended maintenance procedures and materials.

c. Safety Data Sheets (SDS): Include SDSs as specified.

2. Develop environmental management programs for facility as follows:

a. Waste management program: Develop in accordance with ASTM E1609. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.
b. Water management program: Develop water monitoring program for surface and ground water on project site in accordance with ASTM D5851 and consistent with water management program utilized during construction operations.

E. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

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 and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard 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 and items detailing 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 video recording

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 affect validity of warranties or bonds.

1. Include procedures and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 GENERAL

A. At start of project, begin accumulating operation and maintenance data and initiate index. Install and index data in binders within 30 days after delivery of items. As custom written data and test results are produced, add to operation and maintenance data file.

B. List of Operation and Maintenance requirements has been attached at end of the Division 1 Specifications for your convenience. Intent is to provide an overall summary of requirements and not a comprehensive list. Terms and conditions of the contract require satisfaction of requirements of individual specification sections regardless of what is shown on the list.

C. Keep operation and maintenance data current. Make operation and maintenance binders available to Contracting Officer for inspection at time of monthly progress payment requests. If operation and maintenance binders are not current, Contracting Officer may retain an appropriate amount of the progress payment.

3.2 MANUAL PREPARATION

A. Manual Types

1. Emergency Manual: Assemble complete set of emergency information indicating procedures for use by emergency personnel and by NPS operating personnel for types of emergencies indicated.
2. Product Maintenance Manual: Assemble complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into Work.

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

B. Manual Contents: Including:

1. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark sheet to identify product or component incorporated into Work. If data include more than one item in a tabular format, identify each item using appropriate references from Contract Documents. Identify data applicable to Work and delete references to information not applicable.
2. Custom Written Data: For data not in manufacturer's standard literature, provide text, drawings, and schematics specifically applicable to installed systems. Include step-by-step descriptions of operating procedures; identification of individual components and their functions; descriptions of how system components relate to one another and operate together to accomplish a common process or function; and sequence of operation for system control circuits. For seasonally operated systems, provide start-up and shutdown instructions.
3. Equipment Data Sheets: For each item of equipment included in operation and maintenance data, provide Equipment Data Sheet using form at the end of this section. For equipment consisting of a driven machine and a driver (for example, a pump and a motor), equipment data shall cover both the driven machine and the driver. For similar type equipment (for example, multiple exhaust fans of the same model and type), provide a single equipment data sheet with an attached schedule listing individual equipment items.
4. Vendor Furnished As-Built Drawings: Provide for each electrical and each mechanical control system.

    a. For each control system, provide control circuit schematic drawings. Identify each wire and terminal block number. Show terminal numbers on control devices. Show control wires and devices remote from control panel.
    b. For each control panel, provide general arrangement drawing showing location of each control component and terminal block on the panel front and interior. Include materials list of panel-mounted control components as well as field-installed control components remote from the panel, identifying components, manufacturer, model number, and initial set points or sensing ranges of devices where applicable.
    c. For packaged equipment systems, provide general arrangement drawings showing interrelationships of the various items of equipment and components.
    d. In addition to control wiring schematic, provide power wiring schematic drawing showing power flow to each motor. Identify each power conductor. Show over-current protection and motor starting devices.

C. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

EQUIPMENT DATA SHEET	
Equipment Item: _____ Designation: _____ Function: _____ Location: _____ Project: _____ Model Number: _____ Serial Number: _____	
Manufacturer Address and Phone:	Supplier Address and Phone:
Preventive Maintenance Tasks:	
Nameplate Data:	
Spare Parts Furnished and Other Information:	

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing National Park Service (NPS) personnel, including:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment, including environmental considerations.
3. Demonstration and training video.

B. See Divisions 2 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 GENERAL REQUIRMENTS

A. List of System Demonstration and Training requirements has been attached at end of Division 1 Specifications for your convenience. Intent is to provide overall summary of requirements and not a comprehensive list. Terms and conditions of contract still require satisfaction of requirements of individual specification sections regardless of what is shown on list.

1.3 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including 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. For each training session, Contractor shall submit for approval a proposed outline of subjects to be covered. Training shall not be conducted until outline is approved.

1.4 QUALITY ASSURANCE

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

B. Instructor Qualifications: Factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

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 Contracting Officer (CO).

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and:

1. Irrigation controls
2. Environmental Topics

a. Overview of environmental issues related to building industry.
b. Overview of environmental issues related to Project.
c. Review of site-specific procedures and management plans implemented during construction:

1) Regulatory Requirements
2) Noise and Acoustics Management
3) Environmental Management
4) Construction Waste Management

d. Review of site-specific procedures and management plans to be implemented during operation and maintenance.

1) Include review of environmentally related aspects of Operations and Maintenance Manual.
2) Integrated Pest Management (IPM)

B. Training Modules: Develop a learning objective and teaching outline for each module. Include description of specific skills and knowledge that participant is expected to master. For each module, include instruction for:

1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
3. Emergencies: Instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
4. Operations: Startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.

5. Adjustments: Alignments and checking, noise, vibration, economy, and efficiency adjustments.
6. Troubleshooting: Diagnostic instructions and test and inspection procedures.
7. Maintenance: Inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
8. Repairs: Diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Contracting Officer for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct NPS personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. 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 NPS through Contracting Officer with at least seven days' advance notice.
2. Conduct training sessions after equipment or system has been accepted and turned over to Government. Coordinate with commissioning requirements.
3. Coordinate with Integrated pest management requirements. Refer to specifications section and approved IPM plan.
4. Individual sections specify duration of training required. If no duration is listed, provide training of sufficient duration to adequately cover subjects.

END OF SECTION 01 79 00

SECTION 02 01 00 – PROTECTION OF EXISTING UTILITIES

PART 1 - GENERAL

Because of the highly-technical-use of the buildings in the project vicinity, protection of existing utilities and facilities is absolutely critical and is the Contractor's responsibility. Protection of existing utilities will require close coordination with the Contracting Officer Representative and utility purveyors and careful excavation. These measures are the responsibility of the Contractor.

1.1 SCOPE OF WORK

A. Contact "Pennsylvania One-Call," service at 1 (800) 242-1776 and Contracting Officer Representative prior to construction.

B. Identification and field mark out of all on-site utility lines.

C. Submission of procedures to be used to ensure the safety of the utilities.

D. Repair of any damage during construction operations.

E. Excavate test pits using soft-dig techniques at all utility crossings prior to construction.

F. Temporary utility re-routing, as required.

G. Close coordination with the Contracting Officer Representative and onsite facilities personnel.

H. Review of all contract documents and historic utility drawings.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Contract Drawings and Specifications

1.3 REFERENCE STANDARDS

A. Pennsylvania One-Call

1.4 QUALITY ASSURANCE

A. The Contractor is responsible for maintaining and protecting all on-site existing utilities and keeping the existing facilities operational.

1.5 SUBMITTAL

A. Within ten days after award of the contract, the Contractor shall submit to the Contracting Officer Representative and Engineer a schedule detailing the sequence, and time of completion of all phases of work under this section.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of capped utilities and utility lines encountered during construction.

1.7 REGULATORY REQUIREMENTS

A. Contractor shall notify all affected utility companies, agencies, authorities, etc. at least 48 hours prior to the commencement of work and shall comply with their requirements.

B. Contractor shall contact the "Pennsylvania One Call," 1(800) 242-1776 service for an official utility mark out.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate all existing on-site utilities which are to remain in service during construction as shown on the Construction Drawings or as identified by other sources if not shown on Drawings.

B. Contractor shall be responsible for private utility mark-out and coordinate with job Project Site Administrator and Facilities personnel to confirm all locations prior to any excavation.

3.2 PROTECTION

A. Flag, barricade or suitably protect existing utilities during construction operations and equipment movement. Install shoring and bracing as required.

B. Hand dig or soft-dig around existing utilities as necessary to avoid damage to existing utilities.

C. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction and the Contracting Officer Representative.

3.3 LATERAL DISCONNECTION

A. Where a utility line is to be disconnected from portions to remain, the lateral services shall be cut, suitably filled and plugged/capped in accordance with the Contract Drawings and applicable utility or agency requirements. Coordinate with utility company and Contracting Officer Representative.

3.4 REPAIRS

A. Any damage to existing, operational utilities by Contractor or its subcontractors during the on-going construction operation shall be immediately repaired to operational standards at Contractor's expense. If the repairs are not immediately addressed by contractor, utility owner or Contracting Officer Representative shall contract for the repair at Contractor's expense.

END OF SECTION 02 01 00

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of on grade concrete paving, walks and plaza
2. Demolition of site unit pavements and salvage of unit pavers for reuse
3. Removal and storage of stone furnishings for reinstallation.
4. Removal and storage of interpretive sign panels
5. Option No. 2 Demolition and removal of brick walls interpretive structures

B. Related Sections:
1. See Section 013591 Historic Preservation Treatment Procedures for salvaging procedures and quality assurance.
2. See Section 013591.1 for Sculptural Removal and Reinstallation procedures.

1.2 DEFINITIONS

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

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner or prepare/clean for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, clean and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

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

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

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

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

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

B. Schedule of selective demolition activities with starting and ending dates for each activity.

C. Predemolition photographs or video.

D. Methods for schedule of stone paving removal and reconstruction

1.6 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

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

B. Notify Contracting Officer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If suspected hazardous materials are encountered, do not disturb; immediately notify Contracting Officer and Owner.

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

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

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

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Review record documents of existing site conditions provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
   1. Field verify survey points and elevations for accuracy with provided survey of record, notify the Contracting Officer of any inaccuracies or deficiencies in the survey that will affect construction of site improvements or result in project delay.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
   1. Comply with requirements specified in Division 01 Section "Photographic Documentation."
   2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
   3. Before selective demolition or removal of existing site features and/or elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
      a. Submit record drawings with Contracting Officer and secure approval prior to demolition or removal of pavements to be reconstructed.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Contracting Officer

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

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

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

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

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

3.3 PROTECTION

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

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

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

3.4 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Recognize work is being undertaken on an Historic Property and historic materials are to be retained and protected to the highest degree possible. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
5. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

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

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

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

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

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

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

E. Removed and Salvaged Unit Brick Pavers:

1. Document unit paver pattern and orientation including borders for use in reconstruction of unit brick paving.
2. Remove unit brick without damaging units that are fully in-tact and may be reused for walk reconstruction.
3. Dispose of brick units that are damaged, broken, or exhibit fractures, fishers or are structurally unstable.
4. Clean unit brick pavers of excess setting material, organic debris and other elements that render the unit paving non-usable for resetting of paved walks.
5. Stockpile brick on wooden pallets and strap securely to be stored between demolition and walk reconstruction operations.
6. Protect palled paving from being soiled by construction operations or unnecessarily wet. Cover with water retardant tarps or plastic sheeting.
7. Store items in a secure area on site. Review location with Contracting Officer for approval

8. Demolish concrete base and subbase material in its entirety, remove and dispose of legally off site.
9. Where there is no concrete base, remove setting bed and base material under unit pavers to be reconstructed until a stable subgrade is reached. Remove excavated materials and legally dispose of off site.

F. Removed and Reinstall Stone Bench:

1. Review historic stone bench drawings and make field observations for determination of the best method for disassembly, removal and storage of the bench for reinstallation.
   a. Benches are to be carefully removed and stored for reinstallation.
   b. Or at the Contractors risk, be removed as a single unit and stored.
2. Make a record of any existing damage or permanent staining of the stone bench, and review with the Contracting Officer prior to removal and storage.
3. Clean stone of all mortar and setting material including debris and organic soiling.
4. Pack or crate items after cleaning and repairing.
5. Protect items from damage during transport and storage.
6. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

G. Remove and salvage interpretive signs
1. Remove interpretive sign panel for reinstallation
2. Make a record of any existing damage and review with the Contracting Officer prior to removal and storage.
3. Clean the panel using a mild detergent to remove surface debris and organic soiling.
4. Pack or crate items after cleaning.
5. Protect items from damage during transport and storage.
6. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide foundation, connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

H. Option No. 2 Demolish and Remove Brick Walls:

1. Document brick pattern and construction section of existing steps and riser
2. Carefully remove molded brick wall cap corner and end units. Measure units for remolding purposes. Clean units of mortar and organic materials, Pack or crate items after cleaning. Identify contents of containers for re-use in wall reconstruction.
3. Demolish brick steps and sidewalls in their entirety including concrete sub-straight, retaining walls step and paving foundation materials
4. Protect tree roots of trees to remain during demolition operations. Employ tree protection measures and root pruning procedures as outlined in the Temporary Tree and Plant Protection Specification Section 015639.
5. Remove and dispose of legally off site.

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

3.6 CLEANING

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

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

END OF SECTION 024119

SECTION 03 3000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Requirements:

1. 01 74 19 – Construction and Demolition Waste Management.

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Semirigid joint fillers.
d. Vapor-retarder installation.
e. Anchor rod and anchorage device installation tolerances.
f. Cold and hot weather concreting procedures.
g. Concrete finishes and finishing.
h. Curing procedures.
i. Forms and form-removal limitations.
j. Concrete repair procedures.
k. Concrete protection.
l. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
m. Protection of field cured field test cylinders.

1.4 DEFINITIONS

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

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement
7. Aggregates.
8. Admixtures:

    a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

9. Vapor retarders.
10. Curing materials.

    a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.

11. Joint fillers.
12. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
11. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.

12. Intended placement method.
13. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

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

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Formed Surface Finish designation and final finish.
4. Curing process.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

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

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Adhesives.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Aggregates.
7. Admixtures:

a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

E. Preconstruction Test Reports: For each mix design.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

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

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

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

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality Control Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as an ACI Concrete Field-Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M).

C. Existing Concrete Repair: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1. All products shall be applied at substrate and ambient temperatures of 40 degrees F or above.
2. A minimum ambient and substrate temperature of 40 degrees F shall be maintained 24 hours after completion of work.
3. Protect application from precipitation and high wind for a period of 8 hours after installation.
4. Do not apply products to frozen surfaces.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type II.

2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Silica Fume: ASTM C1240 amorphous silica.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).

2. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
7. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.
8. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
9. Permeability-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, permeability-reducing crystalline admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).
   a. Permeability: No leakage when tested in accordance with U.S. Army Corps of Engineers CRD C48 at a hydraulic pressure of 200 psi (1.28 MPa) for 14 days.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, not less than 15 mils (0.38 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING MATERIALS

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

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

D. Curing Paper: Eight-feet- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

E. Water: Potable or complying with ASTM C1602/C1602M.

F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.

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

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

1. Types I and II, nonload bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).

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

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

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
5. Use permeability-reducing admixture in concrete mixtures where indicated.

2.7 CONCRETE MIXING

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

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 JOINTS

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

B. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

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

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Contracting Officer’s Representative and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Contracting Officer’s Representative in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3.7 FINISHING FORMED SURFACES

A. Related Unformed Surfaces:

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

3.8 FINISHING SLABS

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

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Construct concrete bases 6 inches (150 mm) high unless otherwise indicated on Drawings, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1,) before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

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

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

3.11 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month.
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Contracting Officer’s Representative.
2. Remove and replace concrete that cannot be repaired and patched to Contracting Officer’s Representative's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

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

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.

   a. Limit cut depth to 3/4 inch (19 mm).
   b. Make edges of cuts perpendicular to concrete surface.
   c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
   d. Fill and compact with patching mortar before bonding agent has dried.
   e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
b. Compact mortar in place and strike off slightly higher than surrounding surface.

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

D. Perform structural repairs of concrete, subject to Contracting Officer's Representative's approval, using epoxy adhesive and patching mortar.

E. Repair materials and installation not specified above may be used, subject to Contracting Officer's Representative's approval.

3.14 EXISTING CONCRETE REPAIR

A. Locate areas of deteriorated or delaminated concrete using hammer sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb unless otherwise indicated.

B. Pachometer Testing: Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer using depth of cover measurements, and verify depth of cover in removal areas using pachometer.

C. Installation shall be performed strictly in accordance with manufacturer's current product data bulletin.

D. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

E. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas and landscaping from contact due to mixing, handling, and application of materials.

F. Preparation:
1. Ensure that supervisory personnel are on-site and on duty when concrete maintenance work begins and during its progress.
2. Preparation for Removal of Deteriorated Concrete: Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.
3. Concrete Removal:

a. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch. Taper cuts to form a key and no deeper than cover on reinforcement.
b. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
c. Remove additional concrete if necessary to provide a depth of removal of at least 1/2 inch over entire removal area.
d. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least a 3/4-inch clearance around bar.

e. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
f. Provide surfaces with a fractured profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level unless otherwise directed.
g. Thoroughly clean removal areas of loose concrete, dust, and debris.

4. Reinforcing-Bar Preparation:

a. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in two or more adjacent bars, notify Engineer immediately. Repair to include cutting bars, remove and replace as directed by Engineer. Remove additional concrete as necessary to provide at least 3/4-inch clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318 by lapping, welding, or using mechanical couplings.

5. Placing Patching Mortar:

a. Provide forms where necessary to confine patch to required shape.
b. Wet substrate and forms thoroughly and then remove standing water.
c. Retain "Pretreatment" Subparagraph below if required. If retaining more than one option, indicate location of each on Drawings or by inserts.
d. Pretreatment: Apply specified bonding agent and slurry coat.
e. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
f. Place material in lifts of not more nor less than thickness recommended by manufacturer. Do not feather edge.
g. After each lift is placed, consolidate material and screed surface.
h. Where multiple lifts are used, score surface of lifts to provide a rough surface for placing subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
i. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a surface matching adjacent concrete.
j. Wet-cure cementitious patching materials, including polymer-modified cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: **Contractor** will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: **Contractor** will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Contracting Officer's Representative, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Contracting Officer's Representative, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Contracting Officer's Representative.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

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

2. Slump: ASTM C143/C143M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of four 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
    b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39/C39M.

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

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Contracting Officer's Representative but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Contracting Officer's Representative.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Contracting Officer's Representative.

        1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.

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

3.16 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 033000

SECTION 040110 - MASONRY CLEANING (WALLS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning the following:

1. Unit masonry surfaces. (Brick)
2. Stone surfaces. (Soapstone)

1.2 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

B. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

C. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Cleaning: Clean an area approximately 25 sq. ft. (2.3 sq. m) for each type of masonry and surface condition.

a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.

B. Repair masonry units and repoint mortar joints only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.

C. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing unless otherwise indicated:

1. Mortar is not to be installed when air temperature is below 40 deg F.
2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.

D. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.

E. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.7 COORDINATION

A. Coordinate masonry restoration and cleaning with public circulation patterns at Project site. Plan and execute the Work accordingly.

1.8 SEQUENCING AND SCHEDULING

A. Perform masonry restoration work in the following sequence:

1. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
2. Remove paint/stain.
3. Clean masonry surfaces.
4. Repair masonry work.
5. Rake out mortar from joints to be repointed.
6. Point mortar joints.
7. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
8. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
9. Clean masonry surfaces.

PART 2 - PRODUCTS

2.1 PAINT REMOVERS

A. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinseable, solvent-type paste, gel, or foamed emulsion formulation, for removing paint coatings from masonry; containing no methanol or methylene chloride.

2.2 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.

D. Mold, Mildew, and Algae Remover: pH-neutral quaternary ammonium solution with surfactants.

E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.

F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

2.3 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents according to manufacturer's written instructions. Do not apply liquid strippable masking

agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

3.2 CLEANING MASONRY, GENERAL

A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.

B. Proceed with cleaning in an orderly manner; work from top to bottom Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

C. Use only those cleaning methods indicated for each masonry material and location.

1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.

    a. Equip units with pressure gages.
    b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
    c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
    d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.

D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.

E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.

F. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

G. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush application. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

H. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.

1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

3.3 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, calking, asphalt, and tar.

1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
2. Remove paint and calking with alkaline paint remover.

    a. Comply with requirements in "Paint Removal" Article.
    b. Repeat application up to two times if needed.

3. Remove asphalt and tar with solvent-type paste paint remover Insert requirement.

    a. Comply with requirements in "Paint Removal" Article.
    b. Apply paint remover only to asphalt and tar by brush without prewetting.
    c. Allow paint remover to remain on surface for 10 to 30 minutes.
    d. Repeat application if needed.

3.4 PAINT REMOVAL

A. Paint-Remover Application, General: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

B. Paint Removal with Solvent-Type Paste Paint Remover:

1. Remove loose and peeling paint using medium-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply thick coating of paint remover to painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush. Apply in one or two coats according to manufacturer's written instructions.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with cold water applied by medium-pressure spray to remove chemicals and paint residue.

3.5 CLEANING MASONRY

A. Detergent Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with cold water applied by medium-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

B. Mold, Mildew, and Algae Removal:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with cold water applied by medium-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

C. Nonacidic Gel Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
3. Let cleaner remain on surface for period established by mockup.
4. Remove bulk of gel cleaner.
5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

END OF SECTION 040110

SECTION 04 01 10.10 – MARBLE PLINTH CONSERVATION

PART 1 - GENERAL

1.1 SUMMARY

A. The goal of the conservation work is to remove deleterious materials and visible signs of vandalism from historic marble masonry of the Robert Morris statue marble plinth and steps using methods consistent with the historic nature and character of landscape elements within Independence National Historical Park. The Contractor will provide all materials, equipment, labor, services, and supervision required to complete the work of this Section, as indicated on the project drawings and in these specifications. The work shall take place in a designated off-site storage facility on marble elements that have been temporarily removed from the project site.

B. Work shall include but not be limited to the following:

1. General marble cleaning.
2. Localized removal of wax deposits.
3. Localized removal of corrosion staining.
4. Localized removal of biological growth.
5. Localized removal of graffiti vandalism.

C. Related work described elsewhere:

1. Division 1 Section 013591 “Historic Preservation Treatment Procedures” for Historic Preservation Treatment Plan, protection of historic elements, and salvaged items.
2. Division 1 Section 013591.01 “Removal and Reinstallation of Bronze Sculpture” for the temporary removal, storage, and reinstallation of the historic Robert Morris statue.
3. Division 4 Section 04 01 40.61 “Stone Repair and Replacement” for repairs to the marble plinth and steps of the Robert Morris statue.
4. Division 5 Section 05 70 00 “Bronze Sculpture Conservation” for conservation treatment of the bronze Robert Morris statue.

1.2 REFERENCES

A. Technical Reports:

1. Appendix C “Robert Morris Statue Assessment & Cleaning Tests Report” by EverGreene Architectural Arts. Submitted to Mills + Schnoering Architects, LLC August 11, 2023.

1.3 DEFINITIONS

A. Marble conservation refers to material treatments undertaken by qualified conservation practitioners to address visual and material deficiencies without harming historic stone, using methods and procedures in compliance with the Code of Ethics and Guidelines for Practice of the American Institute for Conservation (AIC).

B. Treatments executed as part of this contract shall be designed and executed in a manner respectful of the historic nature and character of the marble.

1.4 QUALITY ASSURANCE

A. The work shall be performed by a Conservation Contractor with experience in the treatment of historic marble monuments and statuary. The Contractor must have a minimum of five (5) years of experience and must demonstrate three similar projects that were completed satisfactorily. References from these projects must be submitted to the Contracting Officer's Representative for approval.

B. Standards:

1. U.S. Department of the Interior, National Park Service, "Secretary of the Interior's Standards for the Treatment of Historic Properties" (latest edition).
2. "Code of Ethics and Guidelines for Practice" of the American Institute for Conservation (AIC).
3. American Society for Testing of Materials (ASTM).
4. Manufacturer's printed instructions.

C. Source of Materials: Materials shall be obtained only from manufacturers who will, if requested, send a qualified technical representative to the work site, for the purpose of advising the Contractor of the procedures and precautions for the use of the materials.

D. Cleaned Appearance Standard: cleaned surfaces are to have a uniform appearance as viewed from 10 feet away by the Contracting Officer's Representative. No streaking or secondary staining.

E. The Contractor shall replace all broken, lost and damaged masonry or other materials resulting from conservation activities at no expense to the Contracting Officer's Representative.

F. In acceptance or rejection of the work of this Section, no allowances shall be made for lack of skill on the part of the mechanics.

1.5 SUBMITTALS

A. Contractor shall submit a work plan including detailed description of how the work of this Section will be accomplished. This should include: methods and equipment to be utilized; if alternate materials or methods are proposed, include descriptions of how and why the substitutions are requested.

B. Manufacturers' instructions for handling, storage, and application of products.

1. Removal of general soiling.
2. Removal of wax deposits.
3. Removal of corrosion stains.
4. Removal of biological growth.
5. Removal of graffiti vandalism.

1.6 DOCUMENTATION

A. Reports and Photographs.

1. Complete a conditions survey of marble elements prior to treatment, noting locations and extent of deterioration on measured drawings provided by the Architect.
2. Provide photographic documentation of marble plinth and step elements before, during, and after conservation treatment. Photographs shall be in color/digital, Jpeg 300 dpi minimum.
3. Upon completion of work, provide a written conservation treatment report describing conditions prior to treatment and materials and procedures used in treatments, illustrated with photographs depicting conditions before, during, and after treatment.

1.7 MOCK-UPS

A. Mock-ups: Prior to the start of any work under each item in the Section, the Contractor shall prepare the following mock-ups and demonstrations of all conservation procedures for approval. Each mock-up shall be prepared in a representative location, selected in consultation with the Contracting Officer's Representative as listed under each item. Samples shall demonstrate technique and quality of workmanship. No work shall proceed without the Contracting Officer's Representative's acceptance of the demonstration or mock-up. See under each item for specific directions on mock-up and demonstration requirements. The Contractor shall use the materials and methods specified for the work and prepare samples under conditions that reflect actual working conditions. If it is unacceptable, the Contractor shall provide additional samples as requested.

1. General masonry cleaning, approximately 1' x 1' area in at least two (2) locations. One of the locations should be in an area of particularly heavy soiling.
2. Wax removal, approximately 6" x 6" area.
3. Corrosion stain removal, approximately 6" x 6" area.
4. Biological growth cleaning, approximately 1' x 1' area.
5. Graffiti vandalism removal, approximately 6" x 3" area.

B. Upon acceptance, all mock-ups shall serve as standards for acceptable technique, appearance and material quality for marble conservation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to the work facility in factory sealed containers clearly labeled as to product, manufacturer, color and other pertinent characteristics.

B. All materials for use in the work of this Section shall be stored under environmental conditions recommended by the manufacturer.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Materials shall be used only at the Manufacturer's recommended tolerances for temperature, and humidity, and weather.

B. Outdoor Work / Unconditioned Indoor Spaces:

1. Conservation work may only be performed as long as the temperature remains above 40° Fahrenheit and below 90° F. If, in any given 24-hour period, the temperature drops or is expected to drop below 40° Fahrenheit or rise above 90° F, conservation work must stop. In the event that the temperature drops below 40° Fahrenheit at any time, work will not recommence until a constant temperature of 40° Fahrenheit or higher is projected for a minimum period of 72 hours.
2. The work shall be protected during hot weather from rapid drying or early curing by using dampened non-staining fabric covers and/or 6 mil plastic secured to the work area with non-staining tape or other approved methods.

PART 2 - MATERIALS

2.1 GENERAL

A. The Contractor shall furnish all materials and equipment necessary to accomplish all aspects of this Section.

B. The following requirements apply to product selection:

1. Available products: subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, products specified.

2.2 CLEANING MATERIALS

A. Atmospheric and particulate soiling remover: non-ionic, non-acidic detergent, volumetric mixture with water, diluted to 1% to 3% detergent.

B. Wax buildup remover: solvent cleaners. Products include:

1. Mineral spirits for wax removal.
2. Denatured alcohol to clear residue after wax removal
3. Or equivalent.

C. Cuprous corrosion stain remover, applied as a poultice: Two-part poultice system designed to remove copper stains from masonry surfaces.

D. Biological soiling remover: Quaternary ammonium salt biocide diluted one part concentrate to approximately 4 parts water.

E. Graffiti remover: Solvent-based, water-rinsible thixotropic paint and varnish remover formulated without methylene chloride.

2.3 EQUIPMENT

A. Pressure washer capable of variable pressure, equipped with a 40° fan tip.

B. Stainless steel hot water boiler.

C. Brushes shall be nylon or natural bristle without metal ferrules.

D. Scrapers shall be plastic or wood only, use no metal.

E. Tape shall be a safe release painter's type tape, no duct tape shall be adhered directly to the marble.

F. Picks shall be wood, no metal shall be used.

PART 3 - EXECUTION

3.1 INSPECTION

A. The Contractor shall examine all marble elements to be addressed in this Section prior to commencing work. Any condition that varies from or appears to be in addition to the contract documents shall be immediately brought to the attention of the Contracting Officer's Representative prior to commencing work. Do not proceed with work in such areas until all discrepancies have been resolved.

3.2 MARBLE CONSERVATION, GUIDELINES

A. The cleaning systems and methods employed shall not damage, etch, burn, bleach, scour, abrade, streak or discolor any marble masonry surface.

B. Use only those cleaning methods and materials indicated for each masonry condition and location.

C. No wire brushes or scrapers shall be used. For chemical cleaning, use only brushes that are resistant to chemical cleaners being used.

D. Each cleaning approach should be tested as outlined in Section 1.7 - Mock-ups, in the approved area prior to application on all surfaces.

E. Perform each cleaning / stain removal method indicated in a manner that results in uniform coverage of all surfaces, including corners and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

F. Apply materials in strict compliance with the manufacturer's written instructions and as specified.

G. To avoid streaking on vertical surfaces, care should be taken to keep all surfaces immediately below the area being cleaned wet and rinsed free of cleaner rundown and residue.

H. Rinsing should commence at the bottom of a given element and proceed upward, unless specified otherwise. The mechanic shall operate the pressure washer wand in steady, even passes and maintain a consistent distance from the marble feature.

I. Contractor shall flush heated water through the system for at least one minute prior to rinsing, so that no iron deposits from within the boiler are deposited on marble elements.

3.3 AQUEOUS CLEANING

A. All above ground marble shall be cleaned using general masonry cleaning methods, including all corners, interstices, and moldings; and stairway risers and treads.

1. Atmospheric soiling: Shall be cleaned using a gentle detergent and pressurized water, and/or pressurized and heated water. Gentle non-ionic detergent shall be mixed according to the appropriate dilution, applied and surface gently scrubbed. Only non-metallic, soft, natural or nylon bristle brushes shall be used. Do not exceed manufacturer's recommended dwell time. The detergent shall not be allowed to dry on the masonry surface. If the surface shows signs of drying, rinse and reapply as needed. Reapply cleaner as necessary (not to exceed two applications) until the masonry is cleaned to the level approved by the Contracting Officer's Representative. Thoroughly rinse the surface with low pressure, heated water (600-800 psi.).
2. Biological soiling: Residual biological soiling shall be removed using a quaternary ammonium salt antimicrobial detergent and pressurized, heated water. Microbial detergent shall be mixed according to the appropriate dilution, applied and gently scrubbed. Only non-metallic, soft, natural or nylon bristle brushes shall be used. Do not exceed manufacturer's recommended dwell time. The detergent shall not be allowed to dry on the masonry surface. If the surface shows signs of drying, rinse and reapply as needed. Reapply cleaner as necessary (not to exceed two applications) until the masonry is cleaned to the level approved by the Contracting Officer's Representative. Thoroughly rinse the surface with low pressure, heated water (600-800 psi).

3.4 SOLVENT CLEANING

A. Deposits of built-up wax will be removed locally. Wax deposits shall be treated locally through specific methods until the approved level of clean is achieved, as previously determined through approved mock-ups.

1. Apply mineral spirits to areas of wax buildup and agitate with natural bristle brushes. Wipe up residue with cotton rags.
2. Repeat this process as necessary to remove wax buildup from stone, and then apply denatured alcohol with a saturated cotton rag to remove oily residue from the surface of the working area.

3.5 CUPROUS CORROSION STAIN REMOVAL

A. Cuprous corrosion stains will be removed over the entire surface of the marble plinth.

B. Mix corrosion stain remover poultice according to manufacturer's instructions and apply to marble surface in an even coat at least 1/8" thick. Cover with 6 mil polyethylene sheeting and allow to dwell 24 hours. Remove the plastic sheeting to allow poultice to fully dry before rinsing.

C. Remove dried poultice material with a plastic scraper and bamboo skewers. Rinse poultice material from marble surface using water at hose pressure and nylon bristle brushes, ensuring all poultice residue is removed from the stone.

D. Repeat the process as necessary to achieve level of stain removal established in approved mock-up.

3.6 GRAFFITI REMOVAL

A. Graffiti vandalism will be removed locally where it is found on marble surfaces.

B. Apply paint remover using a natural bristle chip brush, ensuring a thick and even coating across the affected area. Cover with 6 mil polyethylene sheeting and allow to dwell for at least 8 hours or overnight.

C. Remove plastic sheeting and then scrape paint remover away with a plastic spatula. Rinse paint remover from marble surface using water at hose pressure and nylon bristle brushes, ensuring all residue is removed from the stone.

D. Repeat the process as necessary to achieve level of graffiti removal established in approved mock-up.

END OF SECTION 04 01 10.10

SECTION 040120.63 - BRICK MASONRY REPAIR

GENERAL

1.1 SUMMARY

A. Section includes repairing brick masonry including brick replacement, composite patching, and crack repairs.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1.3 DEFINITIONS

A. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of replacement bricks on the structure.
2. Show provisions for expansion joints or other sealant joints.

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

1.6 INFORMATIONAL SUBMITTALS

A. Quality-control program.

1.7 QUALITY ASSURANCE

A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

C. Mockups: Prepare mockups of brick masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.

1. Masonry Repair: Prepare sample areas for each type of masonry repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.

B. Repair masonry units and repoint mortar joints only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.

C. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing unless otherwise indicated:

1. Mortar is not to be installed when air temperature is below 40 deg F.
2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.

D. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: As required to complete brick masonry repair work.

1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.

a. Physical Properties: According to ASTM C67

b. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.

2. Special Shapes:

a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.

B. Building Brick: ASTM C62, Grade SW where in contact with earth or Grade SW, MW, or NW for concealed backup; and of same vertical dimension as face brick, for masonry work concealed from view.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Sand: ASTM C144.

1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

D. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.

E. Water: Potable.

2.3 MANUFACTURED REPAIR MATERIALS

A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.

1. Use formulation that is vapor and water permeable (equal to or more than the brick), exhibits low shrinkage, has lower modulus of elasticity than bricks being repaired, and develops high bond strength to all types of masonry.

2. Formulate patching compound in colors and textures to match each brick being patched.

2.4 ACCESSORY MATERIALS

A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of bricks, less the required depth of pointing materials unless removed before pointing.

B. Helical Stitch Anchors: 8mm- Stainless steel, Type 304

C. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:

1. Previous effectiveness in performing the work involved.
2. Minimal possibility of damaging exposed surfaces.
3. Consistency of each application.
4. Uniformity of the resulting overall appearance.
5. Do not use products or tools that could leave residue on surfaces.

2.5 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:

1. Rebuilding (Setting) Mortar by Volume: ASTM C270, Proportion Specification, 1 part portland cement, 1 part lime, and 6 parts sand.
2. Pigmented, Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors required.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect adjacent construction during work.

3.2 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

B. Support and protect remaining masonry that surrounds removal area.

C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

E. Remove in an undamaged condition as many whole bricks as possible.

1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.

F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.

G. Replace removed damaged brick with other removed brick in good condition, where possible, matching existing brick. Do not use broken units unless they can be cut to usable size.

H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

1. Maintain joint width for replacement units to match existing joints.
2. Use setting buttons or shims to set units accurately spaced with uniform joints.

I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.) Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.

1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
2. Rake out mortar used for laying brick before mortar sets according to Section 040120.64 "Brick Masonry Repointing." Point at same time as repointing of surrounding area.
3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.

J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.3 BRICK MASONRY PATCHING

A. Patching Bricks:

1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch (6 mm) thick, but not less than recommended in writing by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of brick.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.

3.4 CRACK REPAIRS

A. Where indicated for helical stitch anchor repair, rake mortar joints 1 ¼” deep for 12” on each side of crack according to Section 040120.64 “Brick Masonry Repointing”.

B. Install helical stich anchors spaced at 12” O.C. vertically in open joints.

C. Repoint mortar joint. Point at same time as repointing of surrounding area.

3.5 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION 040120.63

SECTION 040120.64 - BRICK MASONRY REPOINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repointing joints with mortar.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1.5 INFORMATIONAL SUBMITTALS

A. Quality-control program.

1.6 QUALITY ASSURANCE

A. Brick Masonry Repointing Specialist Qualifications: Engage an experienced brick masonry repointing firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repointing work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

C. Mockups: Prepare mockups of brick masonry repointing to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Repointing: Rake out joints in two separate areas, each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide, unless otherwise indicated, for each type of repointing required, and repoint one of the areas.
    a. Allow a waiting period of not less than seven days after completion of repointing samples to permit a study for color change or other negative reactions.
    b. Repointing mockup is subject to the review and review and approval should be factored into schedule.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.

D. Store lime putty covered with water in sealed containers.

E. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.

B. Repair masonry units and repoint mortar joints only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.

C. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing unless otherwise indicated:

    1. Mortar is not to be installed when air temperature is below 40 deg F.
    2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.

D. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.

E. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.9 COORDINATION

A. Coordinate masonry restoration and cleaning with public circulation patterns at Project site. Plan and execute the Work accordingly.

1.10 SEQUENCING AND SCHEDULING

A. Perform masonry restoration work in the following sequence:

1. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
2. Remove paint/stain.
3. Clean masonry surfaces.
4. Repair masonry work.
5. Rake out mortar from joints to be repointed.
6. Point mortar joints.
7. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
8. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
9. Clean masonry surfaces.

PART 2 - PRODUCTS

2.1 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Sand: ASTM C144.

1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
2. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

D. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.

E. Water: Potable.

2.2 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:

1. Pointing Mortar by Volume: ASTM C270, Proportion Specification, 1 part portland cement, 1 part lime, and 6 parts sand. Add mortar pigments to produce mortar colors required.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.

1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.

B. Prevent mortar from staining face of surrounding masonry and other surfaces.

1. Cover sills, ledges, and projections to protect from mortar droppings.
2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
3. Immediately remove mortar in contact with exposed masonry and other surfaces.
4. Clean mortar splatters from scaffolding at end of each day.

3.2 REPOINTING

A. Rake out and repoint joints to the following extent:

1. All joints in areas indicated.
2. Joints indicated as sealant-filled joints. Seal joints according to Section 079200 "Joint Sealants."
3. Joints at locations of the following defects:

a. Holes and missing mortar.
b. Cracks that can be penetrated 1/4 inch (6 mm) or more by a knife blade 0.027 inch (0.7 mm) thick.
c. Cracks 1/8 inch (3 mm) or more in width and of any depth.
d. Hollow-sounding joints when tapped by metal object.
e. Eroded surfaces 1/4 inch (6 mm) or more deep.
f. Deterioration to point that mortar can be easily removed by hand, without tools.
g. Joints filled with substances other than mortar.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows, according to procedures demonstrated in approved mockup:

1. Remove mortar from joints to depth of 2-1/2 times joint width and not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than 2 inches (50 mm) deep; consult Architect for direction.
2. Remove mortar from brick and other masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of brick or other masonry units or widen joints. Replace or patch damaged brick or other masonry units as directed by Architect.

D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.
3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.

4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
6. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

F. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.3 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION 040120.64

SECTION 04 01 40.61 - STONE REPAIR AND REPLACEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. The goal of this work is to stabilize and repair stone masonry (marble) of the Robert Morris statue marble plinth and steps using methods consistent with the historic nature and character of landscape elements within Independence National Historical Park. The Contractor will provide all materials, equipment, labor, services, and supervision required to complete the work of this Section, as indicated on the project drawings and in these specifications. The work shall take place in a designated off-site storage facility on marble elements that have been temporarily removed from the project site.

B. Work shall include but not be limited to the following:

1. Repair large spalls and losses with marble dutchmen.
2. Patch small spalls with composite repair material to match adjacent profiles and colors as specified. The patching material for the newly installed work is to match existing cleaned stone masonry (marble) surfaces in color, veining, and texture.
3. Complete all other work and supply all materials as may be reasonably inferred and needed to make the work of this Section complete.

C. Related work described elsewhere:

1. Division 1 Section 013591 “Historic Preservation Treatment Procedures” for Historic Preservation Treatment Plan, protection of historic elements, and salvaged items.
2. Division 1 Section 013591.01 “Removal and Reinstallation of Bronze Sculpture” for the temporary removal, storage, and reinstallation of the historic Robert Morris statue.
3. Division 4 Section 04 01 10.10 “Marble Plinth Conservation” for conservation treatments to the marble plinth and steps of the Robert Morris statue.
4. Division 5 Section 05 70 00 “Bronze Sculpture Conservation” for conservation treatment of the bronze Robert Morris statue.

1.2 REFERENCES

A. Technical Reports:

1. Appendix C “Robert Morris Statue Assessment & Cleaning Tests Report” by EverGreene Architectural Arts. Submitted to Mills + Schnoering Architects, LLC August 11, 2023.

1.3 DEFINITIONS

A. Treatments executed as part of this contract shall be designed and executed in a manner respectful of the historic nature and character of the stone masonry (marble). These treatments should have minimal visual impact and will include patching losses.

B. Dutchman repair may be taken to mean the installation of an approved replacement stone to restore surfaces and profiles where stone masonry (marble) damage is present.

1.4 QUALITY ASSURANCE

A. The work shall be performed by a Masonry Restoration Specialist Contractor with experience in stone masonry (marble). The Contractor must have a minimum of five (5) years of experience and must demonstrate three similar projects that were completed satisfactorily. References from these projects must be submitted to the Contracting Officer's Representative for approval.

B. Sub-contractors must have a minimum of five (5) years of experience and must demonstrate three similar projects that were completed satisfactorily. References from these projects must be submitted to the Contracting Officer's Representative for approval.

C. Standards:

1. U.S. Department of the Interior, National Park Service, “Secretary of the Interior’s Standards for the Treatment of Historic Properties” (latest edition).
2. “Code of Ethics and Guidelines for Practice” of the American Institute for Conservation (AIC).
3. American Society for Testing of Materials (ASTM).
4. Manufacturer’s printed instructions.

D. Source of Materials: Materials shall be obtained from manufacturers who are locally sourced to the best of the Contractors capabilities.

E. Repair Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 10 feet away by the Contracting Officer's Representative.

F. The Contractor shall replace all broken, lost and damaged masonry or other materials resulting from repair, removal, transportation, cleaning, or storing at no expense to the Government.

G. In acceptance or rejection of the work of this Section, no allowances shall be made for lack of skill on the part of the mechanics.

1.5 SUBMITTALS

A. Repair Methodology: Prior to preparing mock-ups, Contractor shall submit a work plan including detailed description of how the work of this Section will be accomplished. This should include materials, methods and equipment to be utilized. If alternate materials or methods are proposed, include descriptions of how and why the substitutions are requested. Only submitted and approved products will be tested.

B. Samples:

1. Contractor shall submit prior to the start of any stone masonry (marble) dutchman samples to the Contracting Officer's Representative for approval. Sample sets of at least 6x6-inch to show the full range of the of color, grain, tooling, and texture of said samples.

2. Prior to the start of any patching work, the Contractor shall submit colored patch samples to the Architect for approval of colors and textures. Submit cured patches to demonstrate ranges of colors and textures. The Contractor shall be notified in writing by the Contracting Officer's Representative of the final selections of patching materials, formulations, and colors.
3. The Contractor will be required to submit additional or modified samples as required by the Contracting Officer's Representative. The Contractor shall be notified in writing by the Contracting Officer's Representative of the final dutchman repair materials, formulations and color selections.

C. Manufacturers' instructions for handling, storage, and application of products.

1. Adhesive products and related materials.
2. Marble patching materials.
3. Marble pinning and anchoring devices.

1.6 DOCUMENTATION

A. Reports and Photographs:

1. Complete a conditions survey of marble elements prior to treatment, noting locations and extent of deterioration on measured drawings provided by the Architect.
2. Provide photographic documentation of marble plinth and step elements before, during, and after marble repairs. Photographs shall be in color/digital, Jpeg 300 dpi minimum.
3. Upon completion of work, provide a written report describing conditions prior to treatment and materials and procedures used in marble repairs, illustrated with photographs depicting conditions before, during, and after repairs.

1.7 MOCK-UPS

A. Mock-ups: Prior to the start of any work under each item in the Section, the Contractor shall prepare the following *in situ* mock-ups and demonstrations of all masonry restoration procedures for approval. Each mock-up shall be prepared in a representative location, selected in consultation with the Contracting Officer's Representative as listed under each item. Samples shall demonstrate technique and quality of workmanship. No work shall proceed without the Contracting Officer's Representative's acceptance of the demonstration or mock-up. See under each item for specific directions on mock-up and demonstration requirements. The Contractor shall use the materials and methods specified for the work and prepare samples under conditions that reflect actual working conditions. If it is unacceptable, the Contractor shall provide additional samples as requested.

B. Prior to executing work, provide, in situ, mockups/samples of the damaged stone removal process, dutchman pinning, patching, and cutting-tooling for approval by the Contracting Officer's Representative. Samples shall be executed according to the methods and materials herein specified. Samples shall be approved for color, texture, surface finish and profile. Sample area must be approved by the Contracting Officer's Representative before work commences.

1. Removal of damaged stone, including surface preparation for dutchman or composite patch.

2. Pin location for dutchman repair.
3. Tooling or finish sample of dutchman material.
4. Tooling or finish sample of composite patch repair.
5. Prepare additional samples as required by the Contracting Officer's Representative until satisfactory appearance and/or techniques are established.
6. Stone and patch samples should be matched based on cleaned historic stone only.
7. Do not proceed with work of this Section until sample is approved by the Architect.

C. Approved samples and methods of application will become the standard of work of this Section and may be incorporated into the final work.

D. All samples and mockups must be installed by the same mechanics that will do the work of the job.

1.8 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to the work facility in factory sealed containers clearly labeled as to product, manufacturer, color and other pertinent characteristics.

B. All materials for use in the work of this Section shall be stored under environmental conditions recommended by the manufacturer. Materials should be kept dry, well-ventilated and free of foreign matter. Temperatures must be monitored for any sensitive materials.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Materials shall be used only at the Manufacturer's recommended tolerances for temperature, humidity, and weather.

B. Outdoor Work / Unconditioned Indoor Spaces:

1. Masonry restoration work may only be performed as long as the temperature remains above 40° Fahrenheit and below 90° F. If, in any given 24-hour period, the temperature drops or is expected to drop below 40° Fahrenheit or rise above 90° F, masonry work must stop. In the event that the temperature drops below 40° Fahrenheit at any time, work will not recommence until a constant temperature of 40° Fahrenheit or higher is projected for a minimum period of 72 hours.

C. The work shall be protected during hot weather from rapid drying or early curing by using dampened non-staining fabric covers and/or 6 mil plastic secured to the work area with non-staining tape or other approved methods.

PART 2 - PART 2 - MATERIALS

2.1 GENERAL

A. Contractor shall furnish all materials and equipment necessary to accomplish all aspects of this Section.

2.2 MASONRY MATERIALS

A. Water: Clean and free of deleterious impurities, acids, alkalis or organic matter. Water shall be potable, from city mains.

B. Pigment: If needed to achieve color to replicate join color between historic stone masonry (marble) and dutchman repair, alkali stable mineral-based pigments may be used.

C. Anchor adhesive: A high modulus, high strength moisture-insensitive epoxy adhesive.

D. Stone (Marble) Dutchmen: The color, veiling, and finish of the dutchman insert shall match the adjacent historic stone. Colors shall be pure, non-fading pigments, mildew-proof, sun-proof, finely ground in approved medium, and shall not be restricted to the manufacturer's standard colors.

E. Commercial Composite Patching Materials: Pre-formulated, UV-stable, non-staining patching material not exceeding the compressive strength of the adjacent marble stone.

2.3 MASONRY EQUIPMENT/TOOLS

A. Chisels and hand tools for the removal of deteriorated stone and existing mortar: Use of rotary power saws, power chisels, or any other power tool is permitted only after mechanic to use said tool has demonstrated proficiency to Contracting Officer's Representative with that particular tool. Provide chisels sized for width of historic mortar joints. Make chisels available to Contracting Officer's Representative for approval, if requested.

B. Hand-held tools of stainless steel or plastic are to be used for placement of patching mix or adhesive.

C. Hand-held polisher for matching surface of patch to surrounding marble.

D. Hand-held drill to make holes if required for pinning.

E. Brushes shall be nylon or natural bristle without metal ferrules.

F. Tape shall be safe release painter’s tape; no duct tape shall be adhered directly to marble.

2.4 PINS

A. Stainless Steel Threaded Rod, 1/8 to 1/4 Inch: All pins are to be stainless steel and the most appropriate size (length and diameter) for each specific location.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to the start of stone (marble) dutchman repair, inspect each section of work to verify the elements scheduled to be repaired and distinguish those elements to be replaced from those which

are to be repaired. Immediately report any discrepancies and additions to the Contracting Officer's Representative. Do not proceed with repair work in such areas until all discrepancies have been resolved.

B. Failed stone can be removed prior to cleaning, but no dutchman inserts should be completed prior to cleaning of the work area to ensure accurate color matches.

3.2 PATCH REPAIR OF STONE MASONRY – MARBLE

A. All existing yet deteriorated patches shall be removed.

B. Holes and small losses measuring less than 2 inches square can be patched with composite patching compound.

C. The area to be repaired should be cut and dressed according to manufacturer's recommendations, providing adequate depth and squared edges; do not install repairs that will have a feathered edge.

D. Carefully clean out all voids and wash prior to patching.

E. Mix patching compound according to manufacturer's instructions to achieve correct color matching of patches to surrounding stone. Two or more colors can be combined in the body of a single patch to replicate the veining patterns in the marble.

F. Install patching compound into voids, tool patch, and allow to cure according to manufacturer's instructions.

3.3 DUTCHMAN REPAIR OF STONE MASONRY - MARBLE

A. Dutchman repairs shall be undertaken where existing loss and/or deterioration is greater than 2 inches deep. Remove defective portion of existing stone (backing stone). Carefully remove defective portion of stone by making vertical and horizontal saw cuts at face of backing stone and demolishing defective material to depth required for fitting partial replacement (dutchman).

1. Make edges of backing stone at cuts smooth and square to one another and to finished surface. Make back of removal area flat and parallel to stone face.
2. Do not overcut at corners and intersections. Hand trim to produce clean, sharp corners with no rounding and no damage to existing work to remain.
3. If existing stone that is to remain becomes damaged, remove damaged area and enlarge partial replacement as required.

B. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff fiber brush.

C. Cut and trim partial replacement (dutchman) to accurately fit where material was removed from backing stone. Fabricate to size required to produce joints between partial replacement and backing stone of no more than 1/16 inch in width, and joints between partial replacement and other stones that match existing joints between stones. Cut partial replacements so that, when it

is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stones unless otherwise indicated.

D. Pinning: Before applying adhesive, prepare for mechanical anchorage, if appropriate, consisting of 1/8 to 1/4 inch diameter, threaded stainless steel pins set into holes drilled at an angle that will ensure a durable repair, though the partial replacement and into backing stone. Center and space pins to provide required anchorage and at least 1 inch from any edge.

E. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4 inch diameter, threaded stainless steel pins set into 1/4 inch diameter holes drilled into backing stone and into, but not through, the partial replacement. Center and space pins to provide required anchorage and at least 1 inch from any edge.

F. Apply stone-to-stone adhesive to comply with manufacture's written instructions. Coat bonding surfaces of backing stone and dutchman, completely filling all crevices and voids. Protect surrounding stone from adhesive smears and drips.

G. Apply dutchman while adhesive is still tacky and hold securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of dutchman with face of backing stone.

H. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes with specified stone patching compound (see 3.2 Patch Repair of Stone Masonry- Marble).

I. The restored areas shall match all existing original contours, ornamental detail, and moldings, with particular attention paid to the texture of the repair.

J. The restored areas shall match the color, veining, and texture of the cleaned historic stone masonry (marble) as closely as possible.

K. All work shall conform to the approved sample.

3.4 CLEAN-UP

A. Upon completion of work, clean all surfaces of any debris, mortar droppings, construction materials, etc.

END OF SECTION 04 01 40.61

SECTION 040140.62-STONE REPAIR (WALL)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repairing soapstone and flagstone stone masonry wall caps.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1.3 DEFINITIONS

A. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of replacement stone units on the structure and their jointing.
2. Show partial replacement stone units (dutchmen).
3. Show provisions for expansion joints or other sealant joints.
4. Show replacement and repair anchors, including drilled-in pins.

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

1.6 INFORMATIONAL SUBMITTALS

A. Quality-control program.

1.7 QUALITY ASSURANCE

A. Stone Repair Specialist Qualifications: Engage an experienced stone repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in

only installing standard unit masonry or new stone masonry is insufficient experience for stone repair work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging stonework. Include provisions for supervising performance and preventing damage.

C. Mockups: Prepare mockups of stone repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.

1. Stone Repair: Prepare sample areas for each type of stone indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work.

PART 2 - PRODUCTS

2.1 STONE MATERIALS

A. Stone Matching Existing: Natural building stone of variety, color, texture, grain, veining, finish, size, and shape that match existing stone.
1. Soapstone caps
2. Bluestone base

3. For existing stone that exhibits a range of colors, texture, grain, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.
4. Quarry: Subject to compliance with requirements, provide soapstone from the original quarry Alberene Soapstone, Schuyler, Virginia

B. Cutting New Stone: Cut each new stone so that, when it is set in final position, the rift or natural bedding planes will match the rift orientation of existing stones.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Sand: ASTM C144.

1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

D. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in stone mortars.

1. Use formulation that is vapor and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than stone units being repaired, and develops high bond strength to all types of stone.

2. Formulate patching compound in colors, textures, and grain to match stone being patched.

E. Cementitious Crack Filler: Ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.

F. Stone-to-Stone Adhesive: Two-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 deg F (21 deg C), recommended in writing by adhesive manufacturer for type of stone repair indicated, and matching stone color.

2.3 ACCESSORY MATERIALS

A. Setting Buttons and Shims: Resilient plastic, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units, less the required depth of pointing materials unless removed before pointing.

B. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:

1. Previous effectiveness in performing the work involved.
2. Minimal possibility of damaging exposed surfaces.
3. Consistency of each application.
4. Uniformity of the resulting overall appearance.
5. Do not use products or tools that could leave residue on surfaces.

2.4 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:

1. Rebuilding (Setting) Mortar by Volume: 1 part portland cement, 1 part lime, and 6 parts sand.
2. Pigmented, Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors required.

PART 3 - EXECUTION

3.1 STONE REMOVAL AND REPLACEMENT

A. At locations indicated, remove stone that has deteriorated or is damaged beyond repair or is to be reused. Carefully remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.

B. Support and protect remaining stonework that surrounds removal area.

C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.

E. Remove in an undamaged condition as many whole stone units as possible.

1. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
2. Remove sealants by cutting close to stone with utility knife and cleaning with solvents.

F. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for stone replacement.

G. Replace removed damaged stone with other removed stone in good condition, where possible, matching existing stone, including direction of rift or natural bedding planes. Do not use broken units unless they can be cut to usable size.

H. Install replacement stone into bonding and coursing pattern of existing stone. If cutting is required, use a motor-driven saw designed to cut stone with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing stone.

1. Maintain joint width for replacement stone to match existing joints.
2. Use setting buttons or shims to set stone accurately spaced with uniform joints.

I. Set replacement stone with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting, and set units in full bed of mortar unless otherwise indicated. Replace existing anchors with new anchors of size and type indicated.

1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing stonework.
2. Rake out mortar used for laying stone before mortar sets according to Section 040140.62 "Stone Repointing." Point at same time as repointing of surrounding area.
3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.

J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.2 PARTIAL STONE REPLACEMENT

A. Remove defective portion of existing stone unit (backing stone). Carefully remove defective portion of stone by making vertical and horizontal saw cuts at face of backing stone and removing defective material to depth required for fitting partial replacement (dutchman).

1. Make edges of backing stone at cuts smooth and square to each other and to finished surface; essentially rectangular. Make back of removal area flat and parallel to stone face.
2. Do not overcut at corners and intersections. Hand trim to produce clean sharp corners with no rounding and no damage to existing work to remain.
3. If backing stone becomes damaged further, remove damaged area and enlarge partial replacement as required.

B. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.

C. Cut and trim partial replacement to accurately fit area where material was removed from backing stone. Fabricate to size required to produce joints between partial replacement and backing stone of no more than 1/16 inch (1.6 mm) in width, and joints between partial replacement and other stones that match existing joints between stones.

D. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, threaded stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into backing stone and into, but not through, the partial replacement.

E. Apply stone-to-stone adhesive according to adhesive manufacturer's written instructions. Coat bonding surfaces of backing stone and partial replacement, completely filling all crevices and voids.

F. Apply partial replacement while adhesive is still tacky and hold securely in place until adhesive has cured. Use temporary shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of backing stone.

3.3 STONE PLUG REPAIR

A. Remove cylindrical piece of damaged stone by core-drilling perpendicular to stone surface.

B. Prepare a replacement plug by core-drilling replacement stone. Use a drill sized to produce a core that will fit into hole drilled in damaged stone with only minimum gap necessary for adhesive.

C. Apply stone-to-stone adhesive according to adhesive manufacturer's written instructions. Coat bonding surfaces of existing stone and plug, completely filling all crevices and voids.

D. Apply plug while adhesive is still tacky and hold securely in place until adhesive has cured.

E. Clean adhesive residue from exposed surfaces.

3.4 STONE-FRAGMENT REPAIR

A. Carefully remove cracked or fallen stone fragment indicated to be repaired. Reuse only stone fragment that is in sound condition.

B. Remove soil, loose particles, mortar, and other debris or foreign material from fragment surfaces to be bonded and from parent stone where fragment had broken off, by cleaning with stiff-fiber brush.

C. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, threaded stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled at a 45-degree downward angle through face of fragment and into parent stone.

D. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, threaded stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into parent stone and into, but not through, the fragment.

E. Apply stone-to-stone adhesive according to adhesive manufacturer's written instructions. Coat bonding surfaces of fragment and parent stone, completely filling all crevices and voids.

F. Fit stone fragment onto parent stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of fragment with face of parent stone.

G. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in "Stone Patching" Article.

3.5 CRACK INJECTION

A. General: Comply with cementitious crack-filler manufacturer's written instructions.

B. Drill 1/4-inch- (6-mm-) diameter injection holes as follows:

1. Transverse Cracks Less Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 12 to 18 inches (300 to 500 mm) o.c.
2. Transverse Cracks More Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 18 to 36 inches (500 to 900 mm) o.c.
3. Delaminations: Drill holes at approximately 18 inches (500 mm) o.c. both vertically and horizontally.
4. Drill holes 2 inches (50 mm) deep.

C. Clean out drill holes and cracks with compressed air and water. Remove dirt and organic matter, loose material, sealants, and failed crack repair materials.

D. Place plastic injection ports in drilled holes and seal face of cracks between injection ports with clay or other nonstaining, removable plugging material. Leave openings at upper ends of cracks for air release.

E. Inject cementitious crack filler through ports sequentially, beginning at one end of area and working to opposite end; where possible, begin at lower end of injection area and work upward. Inject filler until it extrudes from adjacent ports. After port has been injected, plug with clay or other suitable material and begin injecting filler at adjacent port, repeating process until all ports have been injected.

F. Clean cementitious crack filler from face of stone before it sets by scrubbing with water.

G. After cementitious crack filler has set, remove injection ports, plugging material, and excess filler. Patch injection holes and surface of cracks as specified in "Stone Patching" Article.

3.6 STONE PATCHING

A. Remove deteriorated material and remove adjacent material that has begun to deteriorate. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch (6 mm) thick, but not less than recommended in writing by patching compound manufacturer.

B. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of stone unit.

C. Mix patching compound in individual batches to match each stone unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.

D. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.

E. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.

1. Simple Details: Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.

2. Carved Details: Build patch up 1/4 inch (6 mm) above surrounding stone, and carve surface to match adjoining stone after patching compound has hardened.

F. Keep each layer damp for 72 hours or until patching compound has set.

G. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

3.7 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low-pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION 040140.61

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Brick.
3. Mortar and grout materials.
4. Reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Accessories.
8. Mortar and grout mixes.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R Indicate elevations of reinforced walls.

C. Samples: For each type and color of exposed masonry unit.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product and for masonry units, include data on material properties and material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.5 QUALITY ASSURANCE

A. Sample Panel Mockups: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches (1219 mm) long by 36 inches (914 mm) <> high by full thickness.

1.6 FIELD 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. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. (6 m) vertically and horizontally of a walking surface.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C90, normal weight unless otherwise indicated.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216, Grade SW, Type FBX
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi (23.10 MPa).
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested in accordance with ASTM C67/C67M.
3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
4. Size (Actual Dimensions): 3-1/2 inches (89 mm) wide by 2-1/4 inches (57 mm) 3-1/2 inches (89 mm) high by 8 inches (203 mm) long.

C. Building (Common) Brick: ASTM C62, Grade SW.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi (23.10 MPa).
2. Size (Actual Dimensions): 3-1/2 inches (89 mm) wide by 2-1/4 inches (57 mm) high by 7-1/2 inches (190 mm) long.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, 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.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime, sand, and admixtures and complying with ASTM C1714/C1714M.

E. Aggregate for Mortar: ASTM C144.

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 (6.4 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

F. Aggregate for Grout: ASTM C404.

1.

G. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
1. Exterior Walls: Hot-dip galvanized carbon steel.
2. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
3. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
4. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (406 mm) o.c.
6. Provide in lengths of not less than 10 ft. (3 m).

C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

D. Masonry-Joint Reinforcement for Multiwythe Masonry:

1.
2. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches (102 mm) wide, plus [one side rod] [two side rods] at each wythe of masonry 4 inches (102 mm) wide or less.
3. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch (16-mm) cover on outside face.
4. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch (1.6 mm) and maximum vertical adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.[Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.]

E. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, [hot-dip galvanized carbon] [stainless] steel continuous wire.

2.6 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304.
3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
4. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
5. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (102 mm) wide.

1. Wire: Fabricate from 3/16-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: [Dovetail] [Channel] tabs for inserting into [dovetail] [channel] slots in concrete and attached to tie section; formed from [0.060-inch- (1.52-mm-) thick steel sheet, galvanized after fabrication] [0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication] [0.062-inch- (1.59-mm-) thick, stainless steel sheet] [0.109-inch- (2.78-mm-) thick, stainless steel sheet].

   a. [0.064-inch- (1.63-mm-)] [0.108-inch- (2.74-mm-)] thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.

2. Tie Section: Triangular-shaped wire tie made from [0.187-inch- (4.76-mm-)] [0.25-inch- (6.4-mm-)] diameter, [hot-dip galvanized steel] [stainless steel] wire.[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]
3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 13 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from [0.0635-inch- (1.61-mm-) thick steel sheet, galvanized after fabrication] [0.0785-inch- (1.99 mm-) thick steel sheet, galvanized after fabrication] [0.1084-inch- (2.75-mm-) thick steel sheet, galvanized after fabrication] [0.0625-inch- (1.59-mm-) thick, stainless steel sheet] [0.0781-inch- (1.98-mm-) thick, stainless steel sheet] [0.1094-inch- (2.78-mm-) thick, stainless steel sheet] with [dovetail] [channel] tabs for inserting into slots in concrete.

   a. [0.064-inch- (1.63-mm-)] [0.079-inch- (2.01-mm-)] [0.108-inch- (2.74-mm-)] thick galvanized sheet may be used at interior walls unless otherwise indicated.

2.7 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene,urethane,or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vents: Use one of the following unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch (6.4 to 10 mm) in diameter, in length required to produce 2-inch (51-mm) exposure on exterior and 18 inches (457 mm) in cavity. Use only for weeps.

2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3.2 mm) less than depth of outer wythe; in color selected from manufacturer's standard.

E. Proprietary Acidic Masonry 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 cleaner manufacturer and manufacturer of masonry units being cleaned.

2.8 MORTAR AND GROUT MIXES

A. General: 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.
3. For exterior masonry, use portland cement-lime mortar.
4. For reinforced masonry, use portland cement-lime mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type N.
3. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments do not exceed 10 percent of portland cement by weight.
2. Pigments do not exceed 5 percent of masonry cement by weight.
3. Mix to match Contracting Officer’s Representatives's sample.

E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (13 mm) or minus 1/4 inch (6.4 mm).

2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (13 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6.4 mm) in a story height or 1/2 inch (13 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (10 mm) or minus 1/4 inch (6.4 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3.2 mm).

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in Flemish bond; do not use units with less-than-nominal 4-inch (102-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Fill cores in hollow CMUs with grout 24 inches (610 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Lay structural clay tile as follows:

1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6.4- to 10-mm-) thick joints.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. (0.25 sq. m) of wall area spaced not to exceed 24 inches (610 mm)o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (914 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are indicated at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches (406 mm) o.c.
2. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.
3. Provide rigid metal anchors not more than 24 inches (610 mm)o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (152 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than [1/2 inch (13 mm)] [1 inch (25 mm)] [2 inches (51 mm)] wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (914 mm) o.c. horizontally.

3.8 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches (102 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (51 mm) on interior face.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products or open-head joints to form weep holes.
2. Space weep holes 24 inches (610 mm) o.c. unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

3.9 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1524 mm).

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with [Level 2] [Level 3] in TMS 402.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

H. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

3.11 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Contracting Officer's Representative's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with appropriate acidic masonry cleaner that shall be applied according to manufacturer's written instructions.

3.12 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (457 mm) of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 05 70 00 – Bronze Sculpture Conservation

1.1 SUMMARY

A. This section includes the conservation methods of outdoor bronze.

B. Related sections include the following:
   1. Division 1 – "01 11 00 Summary of Work" for description of work
   2. Division 1 – "01 35 91 Historical Preservation Treatment Procedures"
   3. Division 1 – "01 35 91.1 Sculpture Removal and Reinstallation"
   4. Division 1 – "01 40 00 Quality Requirements"
   5. Division 1 – "01 73 40 Execution"
   6. Division 4 – "04 01 10 Marble Plinth Conservation"
   7. Division 4 – "04 01 40.61 Stone Repair and Replacement"

C. The Contractor shall provide all labor, materials, equipment, and services required to clean, conserve, and coat the bronze sculpture.
   1. Clean, patinate, and coat all bronze elements as indicated on the contract drawings and using the specified methods. Work includes clean all surfaces of failed extent coating, soiling, and stains. Chemically re-patinate all surfaces to match approved sample, and coat with outdoor conservation grade waxes.

1.2 REFERENCES

A. Technical Reports:
   1. Appendix C "Robert Morris Statue Assessment & Cleaning Tests Report" by EverGreene Architectural Arts. Submitted to Mills + Schnoering Architects, LLC August 11, 2023.
   2. Appendix B "Robert Morris Status Nondestructive Testing Report" by Atkinson-Noland & Associates. Submitted in EverGreene Architectural Arts July 5, 2023

1.3 DEFINITIONS

A. Metal conservation refers to material treatments undertaken by qualified conservation practitioners to address visual and material deficiencies without harming historic fabric, using methods and procedures in compliance with the Cod of Ethics and Guidelines for Practice of the American Institute for Conservation (AIC).

B. Treatments executed as part of this contract shall be designed and executed in a manner respectful of the historic nature and character of the bronze.

1.4 QUALITY CONTROL

A. Work shall be performed by a firm specializing in metal sculpture conservation, and adhere to the specified treatment procedures and materials as outlined in this specification. The Contractor must have a minimum of five (5) years of experience and must demonstrate three (3) similar projects that were completed satisfactorily. Only competent skilled personnel will

perform the work and the Contractor shall submit references from three (3) similar projects to the Contracting Officer's Representative for each personnel working on the project.

B. Standards:
   1. U.S. Department of Interior, National Parks Service, “Secretary of the Interior’s Standards for the Treatment of Historic Properties” (latest edition).
   2. “Code of Ethics and Guidelines for Practice” of the American Institute for conservation (AIC).
   3. American Society for Testing of Materials (ASTM).
   4. Manufacturer’s printed instructions.

C. Source of Materials: Materials shall be obtained only from manufacturers who will, if requested, send a qualified technical representative to the work site, for the purpose of advising the Contractor of the procedures and precautions for the use of materials.

D. Cleaned Appearance Standard: cleaned surfaces are to have a uniform appearance as viewed from 10 feet away by the Contracting Officer's Representative. No streaking or secondary staining.

E. The Contractor shall replace all broken, lost, and damaged material resulting from conservation activities at no expense to the Owner.

1.5 SUBMITTALS

A. Work Plan: A work plan will be submitted to the Contracting Officer's Representative detailing all work to be performed on the bronze sculptural elements. All materials, methods, and equipment to be used will be described in detail.

B. Product Data: Submit manufacturer’s product data for all cleaning, patination, and coating materials. The manufacturer’s technical information including label analysis and instructions for handling, storage, and application shall be provided. The Contractor shall also provide the manufacturer’s safety data sheets (SDS) for each material used.

C. Conservation Treatment Report: A conservation treatment report shall be completed upon completion of work that details each step of the conservation treatment and illustrates all conditions and procedures performed.

1.6 DOCUMENTATION

A. Photographs
   1. Provide photographic documentation of the bronze sculpture before, during, and after conservation treatment. Photographs shall be in a color/digital, Jpeg 300 dpi minimum.

1.7 DELIVERY AND STORAGE

A. All materials shall be delivered to the work facility in factory sealed containers clearly labeled as to product, manufacturer, color, and other pertinent characteristics.

B. All materials for use in the work of this Section shall be stored in a dry location under cover and comply with recommended storage instructions from the manufacturers.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Materials shall be used only at the Manufacturer's recommended tolerances for temperature, and humidity, and weather.

B. Outdoor Work/Unconditioned Indoor Spaces:
   1. Conservation work may only be performed as long as the temperature remains above 40 degrees Fahrenheit and below 90-degree F. If in any given 24-hour period, the temperature drops or is expected to drop below 40 degrees Fahrenheit or rise above 90 degrees F, conservation work must stop. In the event that the temperature drops below 40 degrees Fahrenheit at any time, work will not recommence until a constant temperature of 40 degrees Fahrenheit or higher is projected for a minimum period of 72 hours.

2.1 MATERIALS AND PRODUCTS

A. This section outlines the products used in the cleaning, patination, repair, and waxing of the bronze sculpture.

B. This section assures quality of the work by setting standards of quality for materials.

C. Final material selection to be used in the work of this section, including bronze patination shall be based on approved work plan and test panels reviewed and approved by the Contracting Officer's Representative.

2.2 MATERIALS

A. Detergent: A nonionic detergent applied in an aqueous solution.

B. Patination Chemicals: Hot applied patination chemicals confirmed by the client.

C. Conservation Grade Hot Applied Wax

D. Cold Applied Paste Wax

2.3 MISCELLANEOUS MATERIALS

A. Water: Use only clean, distilled water. Free of oils, acids, alkalis, salts, and organic material.

B. Solvents:
   1. Denatured Alcohol
   2. Acetone
   3. Mineral Spirits

C. Abrasive Pads
   1. Green abrasive pads

2. Maroon abrasive pads
3. Or equal abrasive pads

3.1 EXECUTION

A. This section outlines the procedure for the treatment of the bronze sculpture.

3.2 DOCUMENTATION

A. Complete a conditions survey of historic elements prior to treatment, noting locations and extent of deterioration on measured drawings provided by the Contracting Officer's Representative.

B. Provide photographic documentation of sculpture, plinth, and step elements before, during, and after conservation treatment. Photographs shall be in color/digital, Jpeg 300 dpi minimum.

C. Upon completion of work, provide a written conservation treatment report describing conditions prior to treatment and materials and procedures used in treatments, illustrated with photographs depicting conditions before, during, and after treatment.

3.3 GENERAL

A. Work in this section shall be coordinated with other work at the site and project schedule.

B. Prior to wax application receive approval of the patina system from the Contracting Officer's Representative.

C. Follow all protection and precautionary measures noted by the manufactures in the product literature.

3.4 PROCEDURES

A. Protect all surrounding surfaces with the use of adequate protection from run-off, spills, and heat from torches. Use clean metal flashing and poly sheeting as needed to protect surrounding surfaces.

B. Remove extent wax coating on the bronze surface. Remove the wax using a steam power washer with clean water. Maintain a consistent distance from spray nozzle to bronze. Tenacious areas of persistent wax can be removed using solvents applied with cotton rags. Repeat this process until all wax and soiling has been removed from the surface.

C. Apply detergent in a clean aqueous solution with natural bristle brushes and agitate the surface until rinsing with the steam power washer. Repeat this process until soiling and surface level powdery corrosion products have been removed from the surface.

D. Tenacious corrosion products shall be removed by mechanical means with the use of bronze bristle brushes, scalpels, and abrasive pads. Once removed the bronze surfaces should be wiped down with denatured alcohol or rinsed with clean water, ensuring no corrosion products are left on the surface.

E. The surface finish shall be free of all salts, oils, greases, dirt, and foreign matter prior to patination.

F. The sculpture shall be chemically repatinated using hot patina methods. The patina should be consistently applied across the bronze using natural bristle brushes in a stippling application after the surface has been heated with propane torches. When the patina is fully developed it will be rinsed using distilled water and wiped with cotton rags. The fully developed patina shall match the selected mock-up as chosen by the Contracting Officer's Representative.

G. The bronze will be hot waxed using a conservation grade microcrystalline wax. The bronze will be heated using propane torches and the wax applied in a stippling motion across the entire area. Once cooled, the wax will be buffed using cactus bristle brushes to a soft luster.

H. A cold paste wax will be applied to the surface using lint free cloths. Once applied the wax will be buffed using cactus bristle brushes to a soft luster.

END OF SECTION 05 70 00

SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes waterproofing for 5th Street Foundation marker (Option 2):

1. Polyurethane waterproofing.
2. Protection course.
3. Molded-sheet drainage panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POLYURETHANE WATERPROOFING

A. PUMA Waterproofing: Two-component, polyurethane-methacrylate; ASTM C1305; with the following properties measured in accordance with standard test methods referenced:
   1. Tensile Strength: 900 psi (6.2 MPa) minimum; ASTM D638.
   2. Elongation at Break: 400 percent minimum; ASTM D638.
   3. Water Vapor Permeance: 0.003 perm (0.172 ng/Pa x s x sq. m), maximum, ASTM E96/E96M.

2.2 AUXILIARY MATERIALS

A. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.

B. Sheet Flashing: 50-mil- (1.3-mm-) minimum, nonstaining, uncured sheet neoprene.

   1. Adhesive: Manufacturer's recommended contact adhesive.

C. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

D. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; and as recommended by manufacturer for substrate and joint conditions.

   1. Backer Rod: Closed-cell polyethylene foam.

2.3 PROTECTION COURSE

A. Protection Course, Semirigid Sheets of Fiberglass or Mineral-Reinforced Asphaltic Core: ASTM D6506, pressure laminated between two asphalt-saturated fibrous liners and as follows:

   1. Thickness:
      a. 1/8 inch (3 mm), nominal, for vertical applications

   2. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21 mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft. (112 to 261 L/min. per m).

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

F. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.

G. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

H. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.

I. Install sheet flashing and bond to deck and wall substrates where required in accordance with waterproofing manufacturer's written instructions.

3.2 INSTALLATION OF WATERPROOFING

A. Apply waterproofing in accordance with manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.

B. Unreinforced Waterproofing Applications.

1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of 60 mils (1.5 mm).

C. Install protection course with butted joints over waterproofing before starting subsequent construction operations.

1. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.

2. Molded-sheet drainage panels may be used in place of a separate protection course for vertical applications when approved in writing by waterproofing manufacturer.

3.3 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, in accordance with manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install protection course before installing drainage panels.

3.4 PROTECTION

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 071416

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Expansion, isolation, and contraction joints within Portland cement concrete pavement.
2. Joints between Portland cement concrete and asphalt pavement.
3. Joints between brick and flagstone pavement
4. Joints between brick and concrete pavement
5. Joints at pavement edges adjacent to other materials and construction.
6. Cold-applied joint sealants.

B. Related Sections:

1. Division 32 Section "Exposed Aggregate Concrete Paving" for constructing joints in concrete pavement.

1.03 SUBMITTALS

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

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 3/8-inch- (9.5-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Pavement-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Qualification Data: For qualified Installer.

E. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

1. Contractor shall provide a letter on manufacturer’s letter head and signed by the manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

1. Contractor shall provide a letter on qualified testing agency letter head and signed by the qualified testing agency of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer is one who specializes in the installation of joint sealants. The installer shall have training, experience and be approved by the manufacturer to install joint sealants on materials and in joint types as those indicated for this project. The installer shall have a record of successful joint-sealant installations that result in continued in-service performance.

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

C. Preinstallation Conference: Conduct conference at Project site during mock-up installation and evaluation.

1.05 DELIVERY, STORAGE AND HANDLING

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

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

1.06 PROJECT CONDITIONS

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

1. Temperature: When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. Moisture: When joint substrates are wet.
3. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.
4. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS

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

B. Colors of Exposed Joint Sealants:

1. Joint Sealant Color 1 (JSC-1A): Standard Urethane Colors "Aluminum Stone" or color acceptable to the COR where sidewalk meets curb.
2. Joint Sealant Color 2 (JSC-1B): Standard Urethane Colors "Tan" or color acceptable to the COR where sidewalk meet sidewalk.
3. Sealant Color Verification: Physical samples for Color 1 and Color 2 products shall be provided for final acceptance of actual color.
4. Other Sealant Colors: Where other conditions require a joint sealant of a different color, Contractor shall provide sample of color to the Contracting Officer Representative.

2.02 COLD-APPLIED JOINT SEALANTS

A. Single- or Multi-Component, Pourable or Non-Sag, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type S or M, Grade P or NS, Class 12.5, for Use T_1.
1. Class 25 with Use T_1 is preferable; Class 12.5 is allowed only when necessary to attain Use T_1.
2. Grade P may be used if applied on slopes that do not exceed product limitations.

2.03 JOINT-SEALANT BACKER MATERIALS

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

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

2.04 PRIMERS

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

PART 3 - EXECUTION

3.01 EXAMINATION

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

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

3.02 PREPARATION

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

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

3.03 INSTALLATION OF JOINT SEALANTS

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

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

C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of joint-sealant backings.
   2. Do not stretch, twist, puncture, or tear joint-sealant backings.
   3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place joint sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Non-Sag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
   1. Remove excess joint sealant from surfaces adjacent to joints.

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

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

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

3.04 CLEANING

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

3.05 PROTECTION

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

3.06 PAVEMENT-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within cement concrete pavement (PJS-1).
   1. Joint Location:
      a. Expansion and isolation joints in cast-in-place concrete pavement.
      b. Contraction joints in cast-in-place concrete slabs.
      c. Joints at pavement edges adjacent to other materials and construction.
      d. Other joints as indicated.
   2. Urethane Joint Sealant for Concrete: As specified above in article “Cold-Applied Joint Sealants”.
   3. Joint-Sealant Color: As indicate above in article “Colors of Exposed Joint Sealant”.

B. Joint-Sealant Application: Joints between cement concrete pavement and other materials (PJS-2).
   1. Joint Location:
      a. Joints between concrete walks and asphalt pavement.
      b. Joints between concrete curbs and asphalt pavement.
      c. Joints between granite curbs and cobble pavement.
      d. Joints between brick pavers and flagstone pavement
      e. Other joints as indicated.
   2. Urethane Joint Sealant for Concrete: As specified above in article “Cold-Applied Joint Sealants”.
   3. Joint-Sealant Color: As specified above in article “Colors of Exposed Joint Sealant”.

END OF SECTION 07 92 00

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:
   a. Steel./Wrought Iron Fencing (Option 2)

1.2 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of coating system and in each color and gloss of topcoat indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated 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 coating system.

   a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
   b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Supplier of products known for high-performance architectural paints and industrial coatings.

B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: As selected by Architect from manufacturer's full range.

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 the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and 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.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel / Iron Substrates:

1. Pigmented Polyurethane over High-Build Epoxy System MPI EXT 5.1J:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.

b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.

c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

END OF SECTION 099600

SECTION 31 10 00 – SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Protection of trees, shrubs and other vegetation

2. Clearing and grubbing of site

3. Implementation of soil erosion and sediment control procedures

4. Demolition and removal of existing site features

5. Disposal of waste materials

1.2 DESCRIPTION

A. Design Requirements

1. The contractor shall clear and grub the site as required to perform the construction shown on the contract documents. Clearing and grubbing of the site shall be confined closely to the limits shown on the contract documents.

2. Site preparation operations required, but not limited to in the work, include:

a. Protection of existing trees, shrubs and vegetation, if any.

b. Removal of existing trees, shrubs and vegetation as indicated on the contract documents, if any.

c. Clearing and grubbing.

d. Transplanting and relocating of existing trees and shrubs as indicated on the contract documents, if any.

e. Temporary fencing.

f. Topsoil stripping.

g. Removal of above grade improvements and subsurface infrastructure.

h. Disconnecting and removing all existing utilities except those designated to remain.

i. Removal of debris.

j. Dust control.

1.3 SEQUENCE AND SCHEDULING

A. Coordinate site preparation operations with the following:

1. Work with other prime contractors.

2. Shut down and relocation of site utilities in field of operations.

3. Various stages of completion in the project schedule.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine conditions under which site preparation work is to be accomplished in coordination with the installer components specified in this Section. Notify affected Prime Contractors, the Contracting Officer Representative and the Project Designer in writing of any conditions detrimental to proper and timely accomplishment of the required work. Do not proceed with site preparation work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

1. When the installer confirms conditions as acceptable to ensure proper and timely installation and to ensure requirements for applicable warranty or guarantee can be satisfied, submit to the Project Designer written confirmation from the applicable installer. Failure to submit written confirmation and subsequent installation will be assumed to indicate conditions are acceptable to the installer.

B. Perform the following prior to starting site preparation work:

1. Inspect the entire project site including all objects that are designated to remain or to be removed.

2. Locate all underground infrastructure and utilities and determine requirement for their protection.

3. Preserve in operating condition all active utilities traversing the site and designated to remain.

4. Schedule site preparation work in consideration of adjacent public and private property owners.

5. Avoid interference with use of and passage to and from adjacent buildings and facilities.

3.2 PREPARATION

A. Protect existing objects designated to remain, both on and off the project site. In the event of damage, immediately make all repairs and replacements necessary for approval of the Contracting Officer Representative and the Project Designer.

B. Prevent spread of dust during performance of the work throughout the life of the project. Thoroughly moisten all site areas as required to prevent dust from being a nuisance to the Contracting Officer Representative, public, neighbors and performance of other work on the site.

C. Use all means necessary to minimize interference with roads, streets, walks, and other traveled areas. Do not close, obstruct, or cause to make impassable any traveled areas without first obtaining permission from the appropriate agencies.

D. Remove, relocate, store and protect from damage items designated to be savaged.

3.3 PROTECTION OF EXISTING TREES, SHRUBS AND VEGETATION

A. Install temporary fencing as required to protect existing trees, shrubs and other vegetation which are scheduled to remain from above ground damage including smothering of root systems. Do not store construction materials, debris or excavated materials within the drip line of trees. Restrict vehicular traffic, parking and pedestrian traffic from tree drip line areas to prevent excessive compaction of soil over root systems.

B. Trees, shrubs or vegetation scheduled to be saved that are damaged during construction work due to contractor negligence shall be placed under the care of a certified nurseryman or arborist. The Prime Contractor responsible for the damage to the plant material shall be liable for the cost of all required work. Trees, shrubs or vegetation that die as a result of contractor negligence shall be evaluated by a qualified nursery industry professional selected by the Contracting Officer Representative. The removal and replacement of the affected trees, shrubs or vegetation and the associated evaluation expenses shall be the responsibility of the contractor.

3.4 CLEARING AND GRUBBING

A. Remove trees, shrubs and other vegetation that interfere with the installation of new construction or grading work, except for those indicated to remain. Use only hand methods for grubbing inside the drip line of trees indicated to remain. Removal of plant material includes the excavation and off-site disposal of new and old stumps of trees, shrubs and other vegetation and their entire root mass.

B. Depressions caused by clearing operations shall be filled with satisfactory soil material unless further excavation or earthwork is required.

3.5 IMPLEMENTATION OF SOIL EROSION AND SEDIMENT CONTROL PROCEDURES

A. Install temporary and permanent measures to mitigate soil erosion and sediment control issues as directed by the Project Designer or governing agencies. Work may include the installation of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, sloped drains and other erosion control devices.

B. The temporary soil erosion and sediment control measures indicated on the Contract Documents shall be coordinated with the specified permanent erosion control features to the extent practical to assure economical, effective and continuous erosion control.

3.6 DEMOLITION AND REMOVAL OF EXISTING SITE FEATURES

A. Remove foundations, pavement, sidewalks, curbs, retaining walls and other site features noted for removal that are encountered as part of the work.

1. Remove asphalt concrete paving material to full depth and remove from site.

2. Gravel and stone fill under removed sidewalks may be reused if suitable for the particular new use and approved by the Project Designer.

3. Remove below grade structures such as retaining walls to a minimum depth of 4-ft. below new finished grade unless specifically noted otherwise within the Contract Documents.

4. Break up and completely remove miscellaneous concrete such as small foundations.

B. Leave cut edge neat and square where existing material is cut to adjoin new work.

3.7 DISPOSAL OF WASTE MATERIALS

A. Burning on the property of combustible cleared and grubbed material is not permitted.

B. Remove all combustible cleared and grubbed material, excess excavated subgrade material, broken stone, broken concrete, masonry materials, and debris from the property and legally dispose of it. Obtain all permits for off-site disposal and submit a copy of each permit to the Contracting Officer Representative.

END OF SECTION 31 10 00

SECTION 31 20 00 – EARTH MOVING

PART 1 – GENERAL

1.1 SUMMARY

A. This section specifies grading, excavating and backfilling for structures, pavements and utility facilities.

B. All work described and specified herein shall be performed in accordance with the requirements given in the Division 1 specifications

1.2 WORK INCLUDED

A. Overall work under this Contract shall include all labor, materials, equipment, supervision, coordination efforts, permitting costs, certificate costs, services, filing fees, testing costs, security, insurance and all other associated or related items specified herein that are necessary and are required to complete the Work. Work elements shall include:

1. Removal of existing pavements, curbs, abandoned pipes, utilities, walls, former foundations (as required), and other structures encountered which require removal for successful completion of the Work.
2. General excavation to levels established within the Contract Drawings and as described herein.
3. Local excavation for the walls, grade beams, piles and other foundation elements indicated on the Contract Drawings.
4. Excavation, fill placement, grading and compaction to required elevations for appurtenances and general site work as shown on the Contract Drawings.
5. Excavation, placement of planting and lawn soils, grading and compaction to required elevations for landscape work as shown on the Contract Drawings.
6. Excavation and trenching for work as shown or as required; backfilling same with approved fill; compaction, and rough grading.
7. Design, construct and monitor any temporary excavation support systems required to perform the Work described herein, and obtain any permits required by relevant agencies for construction of said temporary excavation support systems.
8. Removal of unsuitable subgrade soils, replacement with approved fill, and compaction as dictated by site conditions or as shown on the Contract Drawings.
9. Improvement of subgrade conditions via compaction, installation of geotextiles, or placement of approved fill as shown on the Contract Drawings.
10. Providing additional approved suitable material for filling and rough grading.
11. Legal off-site disposal of surplus excavated materials, unsuitable for use as fill or backfill.
12. Subgrade preparation at foundations, utilities, and paved areas.
13. Construction of stormwater management features.
14. Protection of adjacent structures, utilities, and pavements.
15. All other labor, equipment, and materials as may be reasonably inferred to be required to make the work under this Section complete.

16. Work in this section refers to the handling and placement and grading of clean fill on-site.

B. Definitions

1. Wherever the words “excavating”, “excavate”, “excavation”, “carried down”, “remove”, etc., are used, they shall be taken to include the removal of all existing work, including rubble, former foundation remnants (as required), rubbish, earth, as well as rock, boulders, concrete and all other materials and obstructions encountered; they shall also be taken to include all temporary excavation support, bracing, groundwater control, and all other operations and items needed for the proper execution of the Work. Excavation is considered unclassified.
2. Where the words “finished grades”, “finished grade lines”, or “future finished grades”, appear in these specifications, they shall be taken to mean the finished elevations as indicated on the Contract Drawings.
3. Rough grading consists of cutting or filling to the elevation herein established with a permissible tolerance of plus or minus one inch. This tolerance shall be so used within any area of 100 feet that it will not be necessary to remove excess or bring in additional fill to meet the required elevations.
4. Pre-excavation consists of excavation necessary to remove obstructions prior to installation of foundations, utilities, pavements, etc. Pre-excavation shall include all necessary backfilling and compaction to provide a suitable working surface for proposed construction as indicated in the Contract Documents.
5. Special Inspector of Record (SIR): A professional engineer or a certified technician supervised by a professional engineer who has been hired to provide testing and observation of all geotechnical items during construction.

1.3 RELATED SECTIONS AND DOCUMENTS

A. Drawings and general provisions of the Contract

B. Project Specifications:

1. Section 02 01 00 – Protection of Existing Utilities
2. Section 31 10 00 – Site Preparation
3. Section 31 23 33 – Trench and Backfill for Utilities
4. Section 31 25 00 – Soil Erosion and Sediment Control
5. Section 32 05 19 – Engineering Fabric
6. Section 33 41 00 – Site Storm Drainage System
7. Section 33 46 19 – Underdrains Project Documents

1.4 REFERENCE STANDARDS

A. The latest edition, as of the date of the executed construction contract, of referenced standards listed below applies to this contract.

1. International Building Code
2. District of Columbia Department of Transportation Standard Specifications for Highways and Structures, 2013:

a. 804 – Aggregates for Soils and Base Course Construction.

3. American Society for Testing and Materials (ASTM) standards, latest edition.

   a. ASTM C 33 Standard Specifications for Concrete Aggregates.
   b. ASTM D 75 Standard Practice for Sampling Aggregates.
   c. ASTM D 422 Standard Test Method for Particle Size Analysis of Soils (sieve only).
   d. ASTM D 1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
   e. ASTM D 2216 Test Method for Laboratory Determination of Water (Moisture) Content of Rock and Soil.
   f. ASTM D 2487 Test Method for Classification of Soils for Engineering Purposes.
   g. ASTM D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
   h. ASTM D 6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Method (Shallow Depths)
   i. ASTM STP 399 Vane Shear and Cone Penetration Resistance Testing of In-Situ Soils

4. ACI-318 latest edition – Building Code Requirements for Structural Concrete, latest edition
5. ACI-299R – Controlled Low Strength Materials, latest edition
6. Occupational Safety and Health Administration (OSHA)
7. Contractor shall provide at least one supervisory person who shall be present at all times during execution of the Work and who is thoroughly familiar with the type of Work being performed and its best methods for completion. This person shall have the authority to act on behalf of Contractor.
8. All work of this Section shall be subject to quality control tests and controlled inspection by the SIR, which shall be performed by a qualified engineer or a certified technician supervised by a professional engineer.
9. In case of conflict between regulations and specifications, the Contractor shall comply with the most stringent applicable codes, regulations or specifications.

1.5 PROJECT CONDITIONS

A. Prior to entering a bid, the Contractor for work of this Section shall visit the site and become familiar with all existing conditions. All nearby existing buildings and utilities shall be inspected by the Contractor prior to entering a bid.

B. If deemed necessary, the Contractor can perform additional subsurface investigation with the approval of the Contracting Officer Representative (COR) at the Contractor's sole expense. Contractors shall interpret for themselves the subsurface conditions of the site.

C. Existing Utilities: Do not interrupt utilities serving facilities permitted in writing by COR and then only after arranging to provide temporary utility services according to requirements indicated.

D. The site contains landscaped features, monuments, and possible former foundation elements. The Contractor shall excavate and remove remnant structures which conflict with proposed

construction indicated in the Contract Documents and associated RFIs, and backfill voids in conformance to the requirements of this Section.

1.6 SUBMITTALS

A. No work shall be performed until shop drawings, if required, have been reviewed and accepted by the COR.

B. The Contractor must provide the following submittals (in addition to submittals required under other Sections) to the COR for approval prior to purchase of materials:

1. Material Certificates: Submit materials certificate which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein and applicable regulatory requirements.
2. Submit receipts indicating imported backfill material used is a "certified clean fill" within 5 days after start of import in accordance with District of Columbia and US Federal requirements. Soil characterization analysis shall be obtained from the approved material facility for review prior to the transport of the fill material to the project site. Verification that the material is from a virgin quarry will be accepted.

    a. Characterization is required for re-use of concrete at the site as aggregate or blended with on-site soils. Tests shall confirm concrete meets local and District of Columbia requirements prior to use on-site.

3. Test Reports: Submit certified test reports of tests of each type of soil proposed for fill, backfill, and subbase for all tests required to demonstrate compliance with this specification. Test must be performed by an approved Independent Testing Agency. Provide a location map indicating the location of all proposed on site areas with the independent analysis.

    a. Test reports for all proposed fill materials (either from borrow sources or on-site) as follows:

        1) Particle size analysis in accordance with ASTM D 422 (sieve only).
        2) Soil classification in accordance with ASTM D 2487.
        3) Moisture content in accordance with ASTM D 2216.
        4) Modified Compaction Curve in accordance with ASTM D 1557.
        5) Atterberg Limits Testing in accordance with ASTM D 4318.

C. Samples: Include data for all samples (in addition to samples required under other Sections) indicating the exact location and methods of transportation and placement of all materials.

1. Submit a 12 inch by 12 inch sample of each geotextile filter fabric, geogrid, and drainage panel proposed for use as well as appropriate test data.

D. Shop Drawings: Submit detailed shop drawings and calculations to be reviewed. The submittals shall include but are not limited to following:

1. A comprehensive method statement which outlines all proposed procedures for completing the Work outlined in this Section, including consecutive steps and the approximate time

required for each step, and a labor and equipment usage schedule. The method statement will also address procedures for removal and demolition of existing remnant foundations and other obstructions.

2. Backfilling and compacting material, equipment and procedures.
3. Temporary support of excavation drawings and details to complete excavation work. Drawings and calculations shall be signed and sealed by a professional engineer licensed in the District of Columbia.

E. Catalog Cuts: Submit catalog cuts and manufacturer's literature for compaction equipment and all geotextile, drainage materials, and plastic warning tape.

F. Qualification Data: For qualified Testing agency.

G. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins. All photographs, memory cards, and videotapes must be submitted for review to the USSS prior to any cameras leaving the site. Review may take up to 3 days and the USSS holds the right to confiscate any images that may compromise security.

H. All required certifications and permits pertaining to the work of this Section.

1.7 QUALITY ASSURANCE

A. Contractor Qualifications

1. The Contractor performing the work of this Section shall be a qualified excavation contractor with at least 5 years of relevant field experience on projects of similar size, scope, and complexity.
2. Where conditions require temporary support of excavation (SOE), the Contractor shall retain a Professional Engineer to perform all necessary design calculations and shop drawings pertaining to SOE work. The Contractor shall be responsible for obtaining all permits required by the relevant agencies for the proposed support of excavation system.
3. The Contractor shall retain the services of a Land Surveyor to perform all survey monitoring during construction. The Contractor's surveyor shall have at least three years of professional experience and licensed in the District of Columbia.

B. Contractor shall provide at least one supervisory person who shall be present at all times during execution of the Work and who is thoroughly familiar with the type of Work being performed and its best methods for completion. This person shall have the authority to act on behalf of Contractor.

C. All work of this Section shall be subject to quality control tests and controlled inspection by the SIR.

D. The SIR shall execute field density test procedures which conform to one of the following tests:

1. ASTM D-1556 (Sand-Cone Method)
2. ASTM D-2167 (Rubber Balloon Method)
3. ASTM D-2937 (Drive Cylinder Method)

4. ASTM D-6938 (Nuclear Density Method)

E. SIR Test Reports:

1. Daily Inspection Reports shall be submitted daily. All reports shall include at least the following:

a. Date issued
b. Project title and number
c. Contract Number
d. Name of Inspector and testing laboratory
e. Date and time of inspection, sampling, or testing
f. Identification of materials, products, and/or work
g. Location in the project of the inspection, sampling, or testing; including plans as necessary to show location
h. Type of inspection, sampling, or testing
i. Date and results of associated laboratory tests
j. Results of inspection or testing
k. Elevation of testing
l. Conformance or non-conformance with acceptance criteria
m. Non-conformance: All non-conforming tests and/or inspections shall be brought to the Contractor or Contractor's designated representative for immediate action. The COR shall also be notified of all non-conformance items immediately. The Contractor shall be responsible for bringing all non-conforming tests or inspections within conformance before placing concrete, placing additional layers of fill or backfill or continuing with work that will not permit access to retesting or re-observing such non-compliant work.

F. Preconstruction Conference: Before commencing work of this Section, the Contractor shall meet with representatives of the governing authorities, Construction Manager, COR, Architect/Engineer, Landscape Architect, SIR, and other concerned entities, to discuss Earthwork procedures and responsibilities, including testing and inspection procedures and requirements. Notify participants at least three working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

G. It is the Contractor's responsibility to perform all work in accordance with these Specifications and all applicable Federal, and District of Columbia codes and standards. The Contractor shall cooperate with the SIR in performing all the work.

H. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 33740 for testing indicated.

1.8 CONTRACTOR RESPONSIBILITIES

A. The Contractor is responsible for meeting all requirements set forth in this Section.

B. The Contractor is responsible for coordinating his work with other trades on site.

C. The Contractor shall notify affected utility companies and the COR before starting work and comply with their requirements.

D. Location of Underground Facilities and Structures:

1. Locations shown for utility facilities are approximate.
2. The Contractor is responsible for contacting Pennsylvania One-Call, 1 (800) 242-1776, to have utilities located before beginning excavation. Submit written reports of findings on Coordinate PA.
3. The Contractor is responsible for verifying the accuracy and location of existing utilities, including exposing by hand excavation or soil vacuum extraction any utilities that may be in conflict with the construction.

E. Dust Control:

1. Use normal industry methods necessary to control dust on or near work. Where normal industry methods are not sufficient to control dirt and dust, use only methods approved by the Architect/Engineer and in accordance with District of Columbia and United States federal regulations.
2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the neighboring structures and performance of other work on the site.
3. Provide vehicle wheel cleaning to prevent tracking of soil, dirt, etc., onto public streets and in parking and access drive areas.

F. General Protection

1. The work shall be executed so that no damage or injury will occur to the existing public and adjoining or adjacent structures, streets, paving, sewers, gas, water, electric or any other utilities. Should any damage or injury caused by the Contractor, or anyone in Contractor's employ, or by the work under this Contract occur, the Contractor shall repair such damage and shall assume all responsibility for such injury.
2. The above shall also include the protection of all existing utilities (including sewers, water lines, electrical lines and telecommunication lines) to remain in use within and adjacent to the area affected by the work of this project.
3. Monuments, benchmarks and other reference features shall be protected. Should these be disturbed in any manner, the Contractor shall have them replaced.
4. The Contractor shall provide barricades and warning lights and barriers to prevent accidents, to avoid all necessary hazards, and to protect the public, the work and the property at all times.
5. The Contractor shall provide protection to sidewalks and pedestrians as required.
6. The Contractor shall provide erosion, sediment and dust controls.
7. The Contractor shall maintain the cleanliness of paved streets immediately adjacent to the site through regular sweeping and moistening as required to remove any excess mud, dirt, or rocks tracked from the site. Dump trucks hauling material from the site will be covered with a tarpaulin.

G. Protection of Excavations

1. Excavation sides and adjacent structures and foundations shall be protected by means of adequate bracing and shoring at all times. Excavation shall not proceed until adequate support for excavation sides is provided. The Contractor is solely responsible for the stability, safety and protection of excavation sides.
2. The Contractor shall furnish facilities and materials needed to prevent working subgrade from becoming frozen or unsuitable to receive the foundations.

3. The excavation shall not be carried to final grades during freezing weather without providing complete protection against freezing of the subgrades as specified hereinafter. The Contractor shall provide complete protection against freezing if freezing weather sets in after completion of the excavation to final subgrade. This protection shall include adequate heating and coverage of the area to maintain temperatures above freezing until foundations have been concreted and backfilled.
4. Excavations shall be kept dry during excavation and prior to placing concrete.
5. Where excavations have been brought to the bottom elevations called for on the Contract Drawings, and the bottom of these excavations become unsuitable in the opinion of the SIR or COR because of inadequate protection by the Contractor, these excavations shall be carried to lower depths sufficient to provide stable bearings. Such added excavation shall be considered as set forth in article "Errors in Depth" of this Section.

H. Errors in Depth

1. In the event that any part of the excavation be carried, through error, beyond the depth and the dimensions indicated on the drawings, called for in the specifications, or directed by the SIR or COR then the Contractor, at his own expense, shall furnish and install approved backfill materials with which to fill to the required level without additional cost to the Government.

I. Surveying and Monitoring

1. Before starting work, the Contractor's Professional Engineer and Land Surveyor shall check and verify governing dimensions and elevations, survey conditions of adjoining structures, and record any prior settlement or cracking of structures, and other improvements.
2. The Contractor shall be responsible for monitoring of excavation support systems, adjacent buildings, and other structures as specified herein. The Contractor shall be solely responsible for monitoring of existing buildings, structures, excavation support, etc.

J. Nuclear Density Gauge Storage Area

1. The Contractor shall provide an area on site for the safe and secure storage of a nuclear density gauge for the duration of the Work described in this Section.
2. The storage area shall be located inside a site trailer or other interior location (trailer closet, etc.) which can be securely locked and will be accessible only to the SIR responsible for the nuclear density gauge.
3. The storage area shall include an eyebolt or other accoutrement which is securely fastened to the floor and can allow the nuclear density gauge to be chained and locked down when not attended by the SIR.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials as recommended by the manufacturer to protect from damage.

B. Soil stockpiled for use as controlled fill shall be stored on site and shall be kept separate from other soils to prevent mixing.

PART 2 - PRODUCTS AND EQUIPMENT

2.1 GENERAL

A. The Contractor shall provide all materials and equipment needed to perform the specified work.

2.2 SOIL MATERIALS

A. Structural Fill: On-site or imported soil with a maximum particle size of 4 inches and not more than 60 percent retained on a ¾ inch sieve. Structural fill shall have a maximum fines content (passing the No. 200 sieve) of 35 percent. Soil shall have a liquid limit less than 35 and a plasticity index less than 10. A maximum particle size of 1.5 inches shall be maintained in the top 1 foot below subgrade or finished grade.

B Planting and Lawn Soil: Soil (Topsoil) used for establishment of plantings, beds, individual trees and shrubs, groundcovers and turf areas. Definition of Planting and Lawn soils is specified in Section 329100 Soil.

C. Drainage Fill: Narrowly-graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1 ½ inch sieve and 0 to 5 percent passing a No. 8 sieve.

D. Engineered Fill: Naturally or artificially well-graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with no particles greater than 3 inches, at least 90 percent passing a 1.5 inch sieve, and not more than 12 percent passing a No. 200 sieve. Engineered fill shall have a maximum liquid limit of 25 and maximum plasticity index of 10. A maximum particle size of 1.5 inches shall be maintained in the top 1 foot below subgrade or finished grade.

E. Non-Structural Fill: Shall have no materials greater than 4 inches in any dimension and contain less than 20 percent by weight materials finer than No. 200 mesh sieve. A maximum particle size of 1.5 inches shall be maintained in the top 1 foot below subgrade or finished grade.

F. Aggregate Subbase: Subbase materials below pavements shall consist of naturally or artificially well-graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 100 percent passing a 2 inch sieve, 85 to 95 percent passing a 1 inch sieve, 50 to 70 percent passing a 3/8 inch sieve, and not more than 8 percent passing a No. 200 sieve.

G. Fill for utility trenches shall meet the criteria given for structural fill and shall not contain sharp, angular pieces and pieces larger than 1.5 inches in any dimension within 2 feet of utility. Pipe bedding material shall match Contract Drawings and utility manufacturer's recommendations.

H. All fill materials shall be free from wood, debris, combustible materials, organics, and vegetable matter or any material subject to decay or disintegration.

I. The use of recycled aggregate is prohibited for use as drainage fill and within reinforced zones of retaining walls.

2.3 GEOTEXTILES AND GEOGRID MATERIALS

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

1. Survivability: Class 2, AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.1 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355

2.4 ACCESSORIES

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

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

PART 3 - EXECUTION

3.1 GENERAL SITE PREPARATION

A. The Contractor shall furnish all labor, equipment and materials required to prepare site and to excavate all materials of whatever type encountered to the lines and grades shown on the Contract Drawings and as specified.

B. The Contractor shall give 24 hours advance notice to the SIR of the impending completion of excavations so as to allow inspection of the exposed surface for foundations, slabs and pads and review the ground water conditions.

C. The Contractor is to obtain and pay for all necessary permits to perform the work from the appropriate authorities and agencies prior to start of such work. Obey all applicable District of Columbia and US Federal work safety rules and regulations.

D. Install all necessary protection equipment, structures such as fences, signs, scaffolding etc. prior to start of work.

E. Remove all existing structures, utilities, pavement in accordance with the Contract Documents.

F. Protect all utility lines which are not to be abandoned. The Contractor shall be responsible for any damage to utilities resulting from the Contractor's actions.

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

H. Protect plant material, lawns, and other features remaining as a portion of final landscaping to remain.

I. Protect sub-soil in areas of landscape from excess compaction, deleterious materials, liquids and waste.

J. Stockpile on-site materials anticipated for re-use. Care shall be taken to avoid blending with the deleterious materials. Stability of stockpiles is Contractor's responsibility.

1. Soil Materials, Planting/lawn soil, topsoil and subsoil must be stored in separate stockpiles.

K. Provide all necessary erosion and sediment control, in accordance with Contract Documents.

L The Contractor shall completely demolish and remove foundation walls and slabs, and shall backfill and compact all voids in accordance with the requirements of this Section.

M. Any abandoned structures or utilities encountered during excavation shall be removed and disposed of or abandoned-in-place by complete filling with grout or controlled density fill, are subject to review and approval by the COR and Engineer on a case-by-case basis. As a rule:

1. All abandoned utilities within the top 4 feet of the surface or at all depths within structural areas shall be completely removed and replaced with compacted fill.
2. All other abandoned utilities can be completely removed or filled with flowable fill meeting the provision of Controlled Low-Strength Materials (CLSM) defined in this specification.

N. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.2 SURFACE WATER AND GROUNDWATER CONTROL

A. Surface Water Control

1. The Contractor shall be responsible for controlling surface water on-site.
2. Excavations shall be protected from deleterious effects of surface water accumulation.
3. The Contractor shall grade accordingly to minimize run-off from entering and accumulating in excavations.

B. The Contractor's groundwater control system shall be capable of maintaining dry stable subgrade conditions.

3.3 EXCAVATION

A. General

1. All excavation shall extend to the depths of the form and size required for the installation of the work as indicated on the drawings. When excavations for foundation and site work have reached the required depths, the SIR shall make an inspection of the conditions.
2. Excavation shall be made to a depth that will allow installation of full depth of structural elements, and any sub-base materials as shown on Contract Drawings or specified, plus a one-inch tolerance. Excavation lines shall provide sufficient clearance for the proper execution of all concrete work including allowances for form work, shoring and inspection.
3. Excavation for lawn and plant installations shall provide sufficient clearance depth for the popper execution of landscape installations including soils and plant materials.
4. Materials that in the opinion of the SIR are not suitable for backfill, and any surplus earth and all rock shall be removed from the site and legally disposed.
5. Subgrades shall be level and free of loose soil, standing water and frost prior to acceptance for placement of concrete or fill. Hand-excavate to achieve final subgrade elevation as directed by the SIR or COR.
6. Subgrades in areas of landscape installations shall be free of standing water prior to acceptance for placement of planting/lawn soils. Notify Contracting Officer Representative in advance of placing soils in excavated area.

B. Excavation for Grade Beams and Foundations

1. Excavation shall be to required elevations for grade beams, footings, or other foundation elements.
2. Subgrades of foundations, and pavement areas shall be approved by the SIR before proceeding with installation of formwork, subbase, drainage layer, rebar or concrete placement.
3. Subgrades shall consist of material that meets the bearing capacity requirements given in the Contract Documents and is approved by the SIR. Subgrades resulting from excavation shall be free of unsuitable material (fill, loose rock pieces, organics, debris, etc.) as judged by the SIR.
4. Unauthorized Excavation: Excavations performed below the elevations shown or specified, shall be filled and compacted as hereinafter specified, at no additional cost.
5. Authorized Additional Excavation: Where the SIR determines that the bearing material encountered is unsuitable, remove the unsuitable bearing material. The removed material shall be replaced with structural fill, engineered fill, or concrete.

3.4 SUBGRADE PREPARATION

A. Proofrolling shall be performed for all subgrades within and outside the limits of the proposed development including all adjacent site work and pavements. Proofrolling shall be completed both: 1) prior to raising grades and 2) prior to placement of subbase/drainage course.

B. Proofrolling of subgrades shall conform to the following requirements:

1. All subgrades shall be proofrolled in the presence of the SIR.
2. Proofrolling shall be accomplished with a minimum of six overlapping cross-rolled coverages of a smooth drum roller having a static weight of at least 6 tons or as approved

by the SIR and COR. A vibratory trench roller having a static weight of at least 1.5 tons shall be used in confined areas as approved by the SIR and COR. Areas inaccessible to the heavy equipment shall be compacted using a vibratory plate or jumping jack compactor as directed by the SIR. The maximum travel speed of rollers should not exceed 1.5 mph.

3. Proofrolling/compaction shall not be performed on soils which are not within 3 percent of the optimum moisture content as determined by ASTM D1557.
4. Natural soil subgrades must be moisture-conditioned to be between 1 to 3 percent of the optimal water content prior to compaction/proofroll.
5. Fill, subbase, and/or drainage course, shall not be placed until the subgrade is approved by the SIR.
6. Soft Areas during Compaction: Areas deemed unsatisfactory due to "pumping or heaving" shall be undercut within the limits and extent ordered by the SIR. These areas shall be replaced with an approved fill, and compacted to the requirements of this Section or as directed by the SIR.

C. De-compact sub-grade in areas to receive landscape installation, including, trees, shrubs, groundcovers and herbaceous materials:

1. De-compact sub-grades as indicated for preparation of turf grass sod and plantings as specified.
2. Where de-compaction is not otherwise specified de-compact the sub-grade to a density of 85% or less.

3.5 FILL PLACEMENT, GRADING, AND COMPACTION

A. Filling and backfilling shall not be performed until related work has been inspected by the SIR.

B. Earthwork within the park shall be completed in accordance with local or National Park requirements. Earthwork in areas outside of the park shall be completed in accordance with local or District of Columbia Department of Transportation or requirements.

C. All subgrades shall be free of wood, organics, or other deleterious materials prior to placement of any fill.

D. Fill shall be placed such that there are no void spaces below floors, bottoms of pits, trenches, pipe haunches, pavements, etc.

E. Fill shall not be placed against concrete elements until the concrete has obtained its specified compressive strength, unless otherwise directed by the SIR. Where fill is required on both sides of a wall, said fill shall be brought up simultaneously and evenly on both sides.

F. Fill voids caused by the removal of boulders, remnant foundations, and/or below grade improvements, with lean concrete, CLSM, structural fill, or other material approved by the SIR.

G. The Contractor to supply and install all fill materials necessary to bring the ground surfaces to the required levels as shown on the Contract Drawings and as necessary to make the work complete.

H. All surplus materials shall be removed from site and legally disposed of. Should additional material be required for the placing of backfill, other than material obtained from the site, the Contractor shall obtain, deliver, and place accepted backfill material as required.

I. Fill Placement:

1. Begin placement of fill and backfill at the lowest section of the area. Spread material evenly by mechanical equipment or by manual means above the approved compacted subgrade in loose lifts not exceeding 12-inches for material compacted by heavy machinery (6 ton roller or larger) and 8-inches for material compacted by smaller equipment.
2. Build layers as horizontally as practical to prevent thickness of lift from exceeding that specified but provide with sufficient longitudinal and transverse slope to provide for runoff of surface water from every point.
3. Prior to placing embankment against slope steeper than one vertical to four horizontal, cut benches into existing slope. Height of bench not to exceed 2 feet unless otherwise approved by SIR.
4. Prior to compaction, adjust moisture content of fill material within required limits by sprinkling, aerating, harrowing, disking, draining, or other means. Maintain the moisture content of the material during compaction.
5. When backfilling against structures, place material approximately simultaneously on both sides of structures to equalize opposing horizontal pressures. The designer of record for a given structure shall be consulted to determine the maximum unsupported height of backfill that is allowed. Without guidance, a maximum unsupported height of 2 ft shall be allowed.

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

1. Under grass and planted areas, use non-structural or better soil material.
2. Under walks, utilities and pavements, use structural or engineered fill material.
3. Under steps and ramps, use structural or engineered fill.
4. Under footings and foundation over-excavations, use engineered fill. Use concrete to fill any undermining of previously-cast footings.

K. Compaction for landscaped areas:

1. Compact each lift to 88 percent of the maximum dry laboratory density as determined by ASTM D1557.

2. The degree of compaction shall be checked by the SIR and each successive lift shall not be placed or compacted until the previous lift is inspected and approved by the SIR. Compact all fill to elevations and limits shown on Contract Drawings.

L. Moisture Control: The moisture-density curve for the fill used shall be dictates based on the results of laboratory testing. If, in the opinion of the SIR, fill material becomes too wet for the required compaction, the fill shall be dried by a method approved by the SIR prior to commencing or continuing compaction operations. Likewise, if, in the opinion of the SIR, the fill material becomes too dry for the required compaction, the fill shall be moistened by a method approved by the SIR prior to commencing or continuing compaction operations.
1. All soils shall be placed and compacted within ±3 percent of optimum moisture content.

M. Compaction for footings, pavement, and utilities:

1. Compact each lift to 95 percent of the maximum dry laboratory density as determined by ASTM D1557.

2. The degree of compaction shall be checked by the SIR and each successive lift shall not be placed or compacted until the previous lift is inspected and approved by the SIR. Compact all fill to elevations and limits shown on Contract Drawings.

N. Frost: Do not place fill materials when either the fill materials or the previous lift (or subgrade) on which it is placed is frozen. In the event that any fill which has already been placed on the surface shall become frozen, it shall be scarified and recompacted, or removed, to the approval of the SIR before the next lift is placed. Remove or recompact any soft spots resulting from frost to the satisfaction of the Special Inspector before new fill is placed.

3.6 FIELD QUALITY CONTROL

A. State in each report whether or not the test specimens and results comply with all requirements of the Contract Documents and note any deviations.

B. The Contractor shall collect samples and forward them to the SIR for testing. A minimum of one laboratory test, including gradation and plasticity limits, shall be performed on each different type of material. Additional tests, including those for plasticity limits, shall be performed when material characteristics change, or when requested by the Contractor, the SIR, or the COR. The SIR shall submit the following laboratory test reports to the COR:

1. Gradation Analysis – ASTM D422
2. Atterberg Limits – ASTM D4318
3. Modified Moisture-Density Curve Determination – ASTM D1557

C. The SIR shall determine the conformance of materials to be used for fills.

D. Proofrolling and subgrade preparation shall be inspected by the SIR.

E. Backfilling and Compaction: Backfilling and compaction below foundations, building slabs, behind foundation walls, pavements, and any other backfilling and compaction work shall be inspected by the SIR. No fill shall be placed unless the previous lift is approved by the SIR.

1. In Place Densities; minimum 1 test per lift:
   a. One test per 2,500 square feet or fraction thereof of plazas, pavements, and structural areas.
   b. One test per 5,000 square feet for non-structural areas.
   c. One test per 100 linear feet of fence or roadways.

2. During backfill of trenches, each lift shall be tested. At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

3. For material excavated and to be reused as backfill or trench backfill on-site within 72 hours:

   a. Perform a one-point Proctor, or
   b. Use representative lower bound maximum dry density per ASTM D1557 as applicable, based on available test results in the immediate area.

4. Should these tests indicate that the density of any layer of backfill or fill material or portion thereof is below the required density, the particular layer, or portion thereof, shall be replaced or reworked until the required density has been obtained – and then re-compacted and re-tested at no additional cost to COR.

F. The Contractor shall cooperate with the SIR in the performance of the required tests and inspections.

3.7 MAINTENANCE

A. Protect newly graded areas from erosion and traffic. Keep work area free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Where completed or compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to any further construction.

D. Where settling is measurable or observable at excavated areas during general project warrantee period, remove surface (pavement, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

E. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

F. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

G. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.8 CLEAN-UP

A. All excess material including earth, rock, and fill shall be removed from site and legally disposed.

B. All lumber, forms and metal work shall be removed immediately after completion of local areas. The Contractor shall be responsible for removal of all debris produced by work to this section from the site.

C. Sidewalk and streets adjoining the property shall be broom cleaned and free of debris, rubbish, trash and obstructions of any kind caused by the work of this Section.

END OF SECTION 31 20 00

SECTION 31 23 33 – TRENCHING AND BACKFILL FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work shall consist of the following:

1. Excavating trenches for the installation of utilities. Trench excavation shall consist of the removal of all pavement, earth, boulders, brick, stone, and concrete masonry, small structures, rock, and other materials encountered as required for the construction utility lines, structures, laterals, and appurtenances as shown on the contract drawings. Disposal of material from trench excavations shall comply with the procedures and criteria as stated in this section and in coordination with the Contracting Officer Representative's Archaeologist.
2. The contractor is responsible for all methods of support of excavation.
3. All excavation shall be coordinated with the Contracting Officer Representative's Archaeologist.
4. Backfilling trench with bedding material as specified and finish filling trenches with suitable material to proposed subgrade.
5. Compacting subgrade, bedding, and backfill materials in an acceptable manner.
6. Compliance with all environmental health and safety regulations.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Contract Drawings and Specifications

B. PennDOT Publication 408 Construction Specifications (current edition)

1.3 QUALITY ASSURANCE

A. Provide at least one supervisory person who shall be present at all times during execution of the work and who is thoroughly familiar with the type of work being performed and its best methods for completion. This person shall have authority to act with regard to the scope of this specification section.

B. Comply with any provisions of all applicable federal, state and local requirements, codes, regulations and standards.

C. Contracting Officer Representative may engage a Geotechnical Engineer to perform construction observation and testing of backfilling operations as specified in the project specifications and as stated herein, including COR's Geotechnical Engineer density testing and visual observation. This observation shall not provide relief from the responsibility to complete the work in accordance with the plans and specifications. COR's Geotechnical Engineer would be solely responsible for determining what is geotechnically unsuitable material. If COR

engages an Environmental Engineer of Record, they will be responsible for determining what is environmentally unsuitable material.

D. All costs related to re-testing due to failures shall be provided at no additional expense to the COR. Provide free access to the site for Geotechnical Engineer and COR's Engineer's activities.

1.4 SUBMITTALS

A. Contact all utility companies and identify any requirements that may impact work of this section. Submit written confirmation of the status of all utility construction to COR no later than two weeks prior to mobilization of equipment and material to the site.

B. At least two weeks prior to mobilization of equipment and material to the site, submit to COR and COR's Geotechnical Engineer a schedule detailing the sequence and time of completion of all phases of work under this section.

C. At least two weeks prior to mobilization of equipment and material to the site, submit to COR and COR's Geotechnical Engineer its proposed excavation means and methods, and equipment to be utilized for such work. Include proposed method of temporary excavation support to be utilized to facilitate proposed utility excavation and installation, and backfilling at the site in accordance with the drawings and technical specifications.

D. At least two weeks in advance of imported fill delivery to the site for proposed use, submit either the following laboratory test data or a 10-pound soil sample to COR's Geotechnical Engineer for each type of imported soil/gravel material to be used as compacted fill.

1. Moisture and Density Relationship: ASTM D1557
2. Mechanical Analysis: AASHTO T-88

E. Submit the name and details of the source for the proposed material, and any necessary environmental certificates. Any change in source or soil type throughout the job requires the COR's approval. Submit certification of environmental compliance for each type of proposed off-site fill material in accordance with the requirements set forth by the COR's Environmental Engineer of Record.

F. At least two weeks prior to mobilization of equipment and materials to the site, submit to COR evidence substantiating qualifications as required herein.

G. Health and Safety Measures: a Health and Safety Plan (HASP) and field monitoring program shall be submitted to COR for review at least two weeks prior to mobilization of equipment or materials to the site.

H. Shop drawings or details pertaining to Site Utilities are not required unless use of materials, methods, equipment, or procedures contrary to the Construction Drawings of these specifications are proposed. No work shall be performed until shop drawings, if required, have been accepted by the COR and Engineer.

1.5 ENVIRONMENTAL CONSIDERATIONS

A. Install and maintain erosion control measures in the sequence shown on the plans or as directed by local authorities to protect adjacent properties and water resources from erosion and sediment damage.

B. All excavation, handling, hauling, on-site storage, field monitoring and disposal of soil and other materials, performed at the site shall be in accordance with any environmental requirements established for the site.

C. Perform all work of this section in accordance with the most recently adopted and applicable general industry (29 CFR 1910) and construction (29 CFR 1926) standards of the Federal Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, as well as any other federal, state, or local applicable statutes or regulations.

1.6 PROTECTION OF ADJACENT STRUCTURES AND PROPERTY

A. Prior to commencement of any work, consult the records for existing structures and utilities and note all conditions and limitations, which might affect the work required under this section. Notify utility locator service for area where project is located prior to earthwork. Immediately report to the COR and respective utility owners any damage to utilities, permanent or temporary structures, and trees, slopes, and vegetated areas designated to remain undisturbed, because of earthwork procedures/operation.

B. All benchmarks and monuments shall be protected during construction. If disturbed or destroyed, replace in original position by a Professional Land Surveyor licensed in the State of Pennsylvania at no additional expense to the COR.

C. Take whatever measures are necessary to prevent damage to buildings, structures, utilities, sidewalks, pavement and other facilities in the vicinity resulting from construction. Repair all such damage at no additional cost to the COR and to the satisfaction of the COR.

D. Provide and install temporary excavation support, shoring, bracing, underpinning, fencing and such other protection as required to insure against any damage to existing roadways, pavement, other structures and utilities when excavation work occurs adjacent to or below it. Shoring and bracing shall be installed in accordance with requirements of COR's Geotechnical Engineer and in accordance with Federal OSHA requirements as well as the requirements of all federal, state and local authorities having jurisdiction.

E. Provide barricades, warning lights, and barriers to prevent accidents, to avoid all necessary hazards and protect the public, the work, and the property at all times, including Saturdays, Sundays and Holidays. Minimize interference of vehicular and pedestrian traffic with adjoining roads, streets, walks, and other adjacent occupied or used facilities during all operations. Protect fences, structures, sidewalks, paving, curbs, etc. to remain from equipment and vehicular traffic.

F. Dust and Dirt Control:

1. Use normal industry methods necessary to control dust on or near work. Where normal industry methods are not sufficient to control dirt and dust, use only methods approved by the COR and in accordance with federal, state and local regulations.

2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors and performance of other Work on the Site.
3. Provide vehicle wheel cleaning to prevent tracking of soil, dirt, etc., onto public streets and in parking and access drive areas.

G. Provide adequate safety measures at the site as relate to earthwork operations.

H. Provide for the stability of stockpiles and the areas where stockpiles are placed. Stockpile materials in a manner so as not to compromise the stability or cause loss of support to existing structures, surfaces and embankments.

1.7 PROJECT RECORD DOCUMENTS

A. Accurately record and promptly inform COR and COR's Geotechnical Engineer of Record of actual locations of all subsurface utilities, structures and obstructions encountered.

B. Accurately record any as-built variation from the construction plans and specifications. Provide as-built drawings within 30 days of project completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bedding Material:

1. Clean washed 3/4-inch crushed stone.
2. AASHTO No. 67 processed sand and gravel free from debris, clay lumps, organic, or other deleterious material, and complying with the following gradation requirements:

U. S. Sieve Size	Percent Passing (by weight)
1 Inch	100
3/4 Inch	90-100
3/8 Inch	20-55
No. 4	0-10

3. Alternate bedding material shall be subject to review and approval by COR's Engineer.

B. On-site fill for backfilling of utility excavations shall meet the requirements for on-site fill as identified by the Construction Documents.

C. Off-site imported fill for backfilling of utility excavations shall meet the requirements for on-site fill as identified by the Construction Documents.

D. Topsoil shall be used as fill only in landscaping areas.

E. Graded stone coarse aggregate (AASHTO/PennDOT 2A) meeting gradation requirements of the State of Pennsylvania Department of Transportation Specifications, Publication 408, latest edition (Section 703.2 Coarse Aggregate).

F. Clean, washed 3/4-inch crushed stone.

G. Filter/drainage fabric meeting AASHTO M288-15 Class 3 for Elongation greater than 50%.

2.2 EQUIPMENT

A. Excavation is to be performed using capable, well-maintained equipment and methods acceptable to the COR and the Contract Document requirements and schedule.

B. Compactors

1. Minimum 2.5-ton total-weight walk-behind vibratory roller
2. Minimum 5-ton static drum weight vibratory roller

C. Smaller compaction equipment may be used where access or maneuverability is limited. However, the loose lift thickness of the fill must be reduced commensurate to the type and size of the compactor. The final lift thickness shall be determined by the on-site geotechnical engineer.

PART 3 - EXECUTION

3.1 GENERAL

A. Set all lines, elevations, and grades for utility and drainage system work and maintain for the duration of work. Provide careful maintenance of benchmarks, property corners, monuments, or other reference points. If marker needs to be removed, it shall be referenced by licensed land surveyor and replaced, as necessary, by same at no cost to the COR.

B. Protect and maintain in operating condition existing utilities encountered during utility installation. Repair any damage to surface or subsurface improvements shown on drawings.

C. Verify location, size, elevation and other pertinent data required to make connections between existing utilities and drainage systems, and proposed construction indicated on drawings. Coordinate all building utility connection locations and elevations with site-civil, structural, and architectural plans. Comply with all local codes and regulations.

D. Over-excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas shall be stabilized by using acceptable backfill materials and additional bedding material placed and compacted and be evaluated by a third-party soil inspector.

3.2 EXCAVATION

A. Contact local utility companies before excavation begins. Dig trenches at proper width and depth for laying pipe, conduit or cable and in accordance with utility company requirements. Cut trench banks for safety and remove stones as necessary to avoid point-bearing.

B. All trench excavation side walls shall be sloped, shored, sheeted, braced or otherwise supported by means of sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by Local ordinances. Temporary excavation support is the sole responsibility of the Contractor and shall be designed based on applicable regulations.

C. Trench width requirements below the top of the pipe shall not be less than 12 inches nor more than two feet wider than outside surface of any pipe or conduit that is to be installed. All other trench width requirements for pipe, conduit or cable shall be the minimum practical width that will allow for proper compaction of trench backfill and satisfy safety and utility company regulations.

D. Accurately grade trench bottom to an elevation six inches below the pipe, as per bedding details in construction drawings. Provide uniform bearing and support for each section of pipe on bedding material at every point along the entire length, except where necessary to excavate for bell holes, pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer or wider than needed to make the joint connection properly.

E. During excavation, stockpile excavated material suitable for backfilling in an orderly manner far enough from the trench to avoid overloading, slides, or cave-ins.

F. Excavated material shall be evaluated by a third-party soil inspector for geotechnical and environmental suitability as backfill.

G. Any abandoned structures, utilities or debris discovered during excavation shall be removed and disposed of, abandoned in place by complete filling with grout or controlled density fill, or capped subject to review and approval by COR and COR's Archaeologist on a case-by-case basis.

H. Utility alignments have been designed to avoid expected obstructions wherever possible. If unanticipated significant obstructions are encountered during utility installation work immediately notify COR and Engineer.

I. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

J. Utility installation shall meet the following minimum pipe installation depths, or applicable codes and ordinances, measured from finished grade or the paved surface.

1. Water Mains: 48 inches to top of pipe barrel or six inches below the frost line (established by the local building official or local utility company), whichever is deeper.
2. Sanitary Sewer: Elevations and grades as indicated on drawings.
3. Storm Sewer: Elevations and grades as shown on drawings.

4. Gas Mains and Services: 30 inches minimum to top of pipe, or as required by the local utility company, whichever is deeper.

3.3 PIPE BEDDING

A. Accurately cut trenches for pipe or conduit to designated line and grade six inches below the bottom of the pipe or as otherwise indicated on the drawings, to width as specified previously. Compact trench bottoms to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D1557, Modified Proctor Test.

B. Over-excavate unstable soil from trench bottom to provide a suitable base for continuous and uniform bedding. The maximum depth of over-excavation shall be two feet below proposed utility subgrade elevation.

C. Place bedding material and compact in eight-inch loose lifts to obtain at least 95 percent of the material's Modified Proctor maximum dry density. Accurately shape bedding material to conform to lower portion of pipe barrel. After pipe installation, place and compact bedding material around the pipe as specified above in maximum eight-inch loose lifts to the spring line of the pipe.

3.4 BACKFILLING

A. After pipe or conduit has been installed, bedded and tested as necessary, backfill trench to finish grade in 12-inch thick loose lifts using fill, compacting each lift as specified above.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces. Should these conditions exist, the areas shall be removed, replaced and re-compacted.

C. For cases where groundwater is encountered within a utility excavation, backfilling shall be done using 3/4-inch clean crushed stone to a level six inches above the encountered groundwater level and then using approved compacted fill.

3.5 COMPACTION

A. All off-site materials used for backfill shall be tested by a third-party soil inspector.

B. Exercise proper caution when compacting immediately over top of pipes or conduits.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Compaction of backfill shall be performed in accordance with the requirements of the Construction Documents.

END OF SECTION 31 23 33

SECTION 31 25 00 – SOIL EROSION AND SEDIMENT CONTOL

PART 1 - GENERAL

1.1 SUMMARY

A. Work shall consist of the construction, placement or erection of soil erosion and sediment control measures as specified herein and as indicated on the Contract Drawings.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Contract Drawings and Specifications

1.3 REFERENCE STANDARDS

A. The Pennsylvania Department of Environmental Protection's (PADEP) Erosion and Sediment Pollution Control Program Manual, dated March 2012.

B. Any applicable City of Philadelphia standards and specifications.

1.4 QUALITY ASSURANCE

A. Implement soil erosion controls in a timely manner.

B. Carefully adhere to the construction sequence that is shown on the construction drawings.

C. Follow the Soil Erosion and Sediment Control Notes that are shown on the construction drawings and which are dictated by the Philadelphia Water Department and PADEP.

D. Make frequent inspection of temporary soil erosion controls and maintain them in working order until permanent soil erosion controls are established.

E. Install all soil erosion and sediment control measures in accordance with the requirements indicated on the Contract Drawings, permit and specifications. All work shall be performed in accordance with the requirements of the "Commonwealth of Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual," latest revision.

F. Maintain all soil erosion and sediment control measures during the Contract.

G. Keep all streets clear of dirt and sediment and shall be responsible for any cleaning of the streets necessary during the course of the project.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties and water resources from soil erosion and sediment damage throughout construction.

B. Discharge from dewatering operations shall not be directed to surface waters.

C. Comply with all requirements as directed by the municipality, conservation district, or PADEP for the duration of construction until all permanent stabilization is achieved.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary mulches – Straw, wood cellulose, fiber mats, and other materials as approved by the Project Designer or the Contracting Officer Representative's designated representative for erosion control issues.

B. Tree protection fencing as specified on Construction Drawings. Root protection system: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve and manufacture's standard non-woven, pervious geotextile fabric of polypropylene, nylon, or polyester fibers.

C. Erosion control blankets: Short term double net blanket shall be machine-produced mat of 100% agricultural straw with a functional longevity of 12 months and meet Type 2.D specification requirements established by the Erosion Control Technology Council and Federal Highway Administration.

D. Compost filter sock: Biodegradable product. Install in locations shown and as detailed on the Construction Drawings.

E. Inlet protection as specified on the Construction Drawings.

F. Construction entrance as specified on the Construction Drawings.

G. Anchoring Staples: Cold drawn, 14 gauge or wider wire formed in a U-shape from a minimum 12 inches long wire.

H. Sediment filter bags to be installed as the Contractor deems necessary.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review site conditions and sediment control plans. Examine conditions under which temporary erosion and sediment control measures are to be constructed with the materials and components specified in the Contract Documents. Notify affected parties, including the Contracting Officer

Representative's and Engineer, in writing in the case of erosion control issues or any conditions detrimental to the proper and timely installation of the work.

1. Confirms conditions as being acceptable to ensure proper and timely installation of the work and to ensure requirements of applicable environmental standards can be satisfied, then submit written confirmation to the Contracting Officer Representative's Engineer. Failure to submit written confirmation and subsequent installation will be assumed to indicate conditions are acceptable to the installer.

2. Schedule a pre-construction meeting with the Philadelphia Water Department.

B. Review the soil erosion and sediment control plans as they apply to current conditions. Any proposed deviation from the plans must be submitted to Contracting Officer Representative's Engineer in writing 72 hours prior to commencing that work.

C. Notify the Philadelphia Water Department and the PADEP at least 72 hours prior to the start of construction of any soil erosion and sediment control measures.

D. All soil erosion and sediment control measures shall be maintained until all work under this Contract is completed.

3.2 SOIL EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place soil erosion control systems in accordance with the staging and features shown on the sediment control plans prior to any earthwork construction and immediately following the construction of any storm drainage devices.

B. Limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations by following construction phasing in the sediment control plans.

C. Incorporate all permanent soil erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical. Equip catch basins with inlet protection immediately upon construction.

D. Install tree protection fencing where indicated on the drawing to protect remaining trees and vegetation from construction damage. Refer to landscape specifications. Maintain tree protection fence throughout the life of the construction project and remove when construction is complete. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions.

E. Root protection system to be installed where existing trees are adjacent to construction roadways, locations to be approved in field by landscape architect. Do not permit vehicular traffic within the building construction access area or the tree protection zone during installation of the fencing. In the root protection area, remove any woody shrubs or trees scheduled to be removed. Mow the area short before installation of filter fabric and stone. Care must be taken not to damage any tree roots that are growing on the soil surface. Install pressure treated timbers immediately adjacent to protective fencing as indicated on the drawing. Secure to fence posts and to each timber as necessary to ensure a structurally sound timber retaining wall. Place filter fabric vertically along inside face of wood retaining wall and along the soil surface between the

retaining wall and the sheeting/shoring for the building excavation. Place crushed stone to the depth indicated above the filter fabric between the fence and the building excavation. Place crushed stone in such a manner that the equipment used to place the stone remains on the crushed stone and does not drive within the root protection zone until completion of the protection system.

F. The temporary soil erosion control systems shall be maintained all times during the life of the contract. Respond to any maintenance or additional work ordered by Contracting Officer Representative's Engineer, Municipality, or Philadelphia Water Department within a 24-hour period.

G. Slopes that erode easily shall be temporary seeded as the work progresses with quick-growing grass grains of wheat, rye or oats unless otherwise specified.

H. All soil erosion control measures shall be maintained until all permanent improvements to the site are complete unless otherwise directed by Contracting Officer Representative's Engineer.

I. Upon completion of all earth disturbance activities and the successful implementation of permanent stabilization measures, obtain the Conservation-District-issued statement of compliance.

3.3 SOIL EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Clean storm ponding areas, catch basins, drywells, and other drainage areas of contaminants, sediment, rubbish, construction debris and other deleterious materials prior to final acceptance of the work.

END OF SECTION 31 25 00

SECTION 316330 – HELICAL PILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes helical piles, including furnishing of all designs, materials, tools, equipment, labor and supervision, and installation techniques.

1.2 SCOPE OF WORK

A. The work consists of designing, furnishing, installing, post-loading and testing helical piles, and any ancillary materials according to the plans provided and these specifications. The contractor shall provide all labor, tools, equipment and materials necessary to accomplish the work.

1.3 DEFINITIONS

A. Bearing Stratum: Any soil layer which provides a significant portion of the axial resistance of an installed helical pile through bearing on one or more of the pile's helices.

B. Coupling Bolt: High strength, structural steel fasteners used to connect helical pile segments together. Connections transfer axial and torsional forces.

C. Extension Section: Helical pile component installed between the lead section and the structure connection. May be plain or with helix plates.

D. Helical Foundation: A combination of helical pile and the ground in which it is embedded, which together resist loads applied to the pile.

E. Helical Pile: Consists of one or more helix plates attached to a central shaft and connector means for attachment to a structure. May also include surface coating or other corrosion protection means. Installed by screwing into the soil with down pressure ("crowd"), and thereafter resists tensile loads through bearing of the helical plates on the soil in which they are embedded.

F. Helix Plate: Generally round steel plate formed into a helical spiral and welded to a steel shaft. When rotated in the ground, the helical shape provides thrust along its longitudinal axis thus aiding in pile installation. After installation, the plate transfers axial load to soil through bearing.

G. Installation Torque: The resistance generated by a helical pile when installed into soil. The installation resistance is a function of the soil type, and size and shape of the various components of the helical pile.

H. Lead Section: The first helical foundation component installed into the soil, consisting of one or more helical plates welded to a steel shaft.

I. Reveal: The distance from ground surface to the end of the last installed extension of a helical pile, measured along the pile's longitudinal axis.

J. Torque Strength Rating: The maximum torque energy that can be applied to the helical pile foundation during installation in soil.

1.4 PERFORMANCE REQUIREMENTS

A. Comprehensive engineering design of helical foundations to support loads indicated.

1. All components shall be selected to provide a minimum factor of safety against ultimate mechanical failure of 3.
2. Critical Buckling Load: Where helical piles are installed into low strength soil, the critical buckling load shall be determined.
3. The helical pile attachment shall distribute the design load (DL) to the concrete foundation such that the concrete bearing stress does not exceed those in the ACI Building Code and the stresses in the steel plates/welds does not exceed AISC allowable stresses for steel members.
4. The overall length and installed torque of a helical pile shall be specified such that the required in-soil capacity is developed by end-bearing on the helix plate(s) in a very dense sand stratum at approximately 8 to 10 feet depth.

1.5 SUBMITTALS

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

B. Working Drawings: Signed and sealed by a professional engineer registered in the Commonwealth of Pennsylvania who was responsible for their preparation. Drawings shall include:

1. Helical pile number, location and pattern by assigned identification number
2. Helical pile design load (see drawing set)
3. Type and size of central steel shaft
4. Helix configuration (number and diameter of helix plates)
5. Minimum effective installation torque
6. Maximum allowable installation torque for piles
7. Minimum overall length
8. Inclination of helical pile
9. Cut-off elevation
10. Helical pile attachment to structure relative to grade beam, column pad, pile cap, etc.
11. Indications for corrosion protection

C. Design Calculations for Helical Piles: Signed and sealed by the professional engineer preparing the design registered in the Commonwealth of Pennsylvania

D. Welding certificates

E. The Contractor shall provide copies of helical pile installation records within 24 hours after each installation is completed. Formal copies shall be submitted on a weekly basis. These installation records shall include, but are not limited to, the following information:

1. Name of project and Contractor
2. Name of Contractor's supervisor during installation
3. Date and time of installation

4. Name and model of installation equipment
5. Type of torque indicator used
6. Location of helical pile by assigned identification number
7. Actual helical pile type and configuration – including lead section (number and size of helix plates), number and type of extension sections
8. Helical pile installation duration and observations
9. Total length of installed helical pile
10. Cut-off elevation
11. Inclination of helical pile
12. Installation torque at one-foot intervals for the final 10 feet
13. Calculated ultimate capacities based on actual torsional resistance.
14. Comments pertaining to interruptions, obstructions, or other relevant information

F. Plans for production testing for the helical piles prior to beginning load tests to determine the load versus displacement response of the helical pile and provide an estimation of ultimate capacity.

G. Calibration reports: For each torque indicator or torque motor, and all load test equipment to be used on the project. The calibration tests shall have been performed within forty-five (45) working days of the date submitted. Helical pile installation and testing shall not proceed until the Owner has received the calibration reports. These calibration reports shall include, but are not limited to, the following information:

1. Name of project and Contractor
2. Name of testing agency
3. Identification (serial number) of device calibrated
4. Description of calibrated testing equipment
5. Date of calibration
6. Calibration data

H. Test Reports: Copies of field test reports within 24 hours after completion of the load tests. Formal copies shall be submitted within a reasonable amount of time following test completion. These test reports shall include, but are not limited to, the following information:

1. Name of project and Contractor
2. Name of Contractor's supervisor during installation
3. Name of third party test agency, if required
4. Date, time, and duration of test
5. Location of helical pile by assigned identification number
6. Type of test (i.e. tension or compression)
7. Description of calibrated testing equipment and test set-up
8. Actual helical pile type and configuration – including lead section, number and type of extension sections
9. Steps and duration of each load increment
10. Cumulative pile-head movement at each load step
11. Comments pertaining to test procedure, equipment adjustments, or other relevant information
12. Prepared by third party test agency representative or registered geotechnical engineer employed by the **Contractor** engaged Special Inspector.

I. Closeout Submittal: To include:

1. Project Warranty: Refer to Conditions of the Contract for project warranty provisions
2. Warranty Period: 30 years commencing on date of Substantial Completion

3. Manufacturer's Warranty: Submit, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the Owner may have under Contract Document.

J. Contractor Qualifications: A list of at least three completed projects within the past three years with comparable ground conditions.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in performing design and construction of helical piles.

1. Authorized by the helical pile manufactures for installation of their helical piles.
2. Trained and certified by the helical pile manufacturer in the proper methods of design and installation of helical piles.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

C. Comply with applicable provisions of the following specifications and documents:

1. ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations
2. Guide to Drafting a Specification for High Capacity Drilled and Grouted Micropiles for Structural Support, 1st Edition, Copyright 2001 by the Deep Foundation Institute (DFI)

D. Helical pile components shall be manufactured by a facility whose quality systems comply with ISO (International Organization of Standards) 9001 requirements.

1.7 ALLOWABLE TOLERANCES

1. Centerline of helical piles shall not be more than 3 inches from indicated plan location.
2. Helical pile plumbness shall be within 2° of design alignment.
3. Top elevation of helical pile shall be within +1 inch to –2 inches of the design vertical elevation.

1.8 GROUND CONDITIONS

A. The Geotechnical Report, including logs of soil borings as shown on the boring location plan, shall be considered to be representative of the in-situ subsurface conditions likely to be encountered on the project site. Said Geotechnical Report shall be the used as the basis for helical pile design using generally accepted engineering judgment and methods.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

PART 2 - PRODUCTS

2.1 Central Steel Shaft: consisting of lead sections, helical extensions, and plain extensions, shall be square, round or a combination of the two.

A. Structural Steel Tube or Pipe: ASTM A53, A252, ASTM A500, or ASTM A618.

1. 0.300” minimum wall thickness.

B. Plate and Bar: ASTM A36, or A572, or A1018, or A656

1. Helix bearing plate shall be formed on matching metal dies to true helical shape and uniform pitch.
2. Pile cap shall be a welded assembly designed to fit the pile and transfer the applied load

C. Bolts, Nuts and Washers: SAE J429 Grade 8, ASTM A320 Grade L7, ASTM A325 or ASTM A193 Grade B7

D. Couplings: Either formed as an integral part of the plain and helical extension material as hot forge expanded sockets, or as internal sleeve wrought steel connectors. The steel connectors can be either tubing or solid steel bar with holes for connecting shaft sections together. q

2.2 GALVANIZING

A. Hot-Dip Galvanized Finish: Helical piles, extensions, underpinning brackets and appurtenance shall be hot-dipped galvanized steel in accordance with ASTM A 123/A 123M.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Prior to commencing helical pile installation, the Contractor shall inspect the work of all other trades and verify that all said work is completed to the point where helical piles may commence without restriction.

B. The Contractor shall verify that all helical piles may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc.

1. In the event of a discrepancy, the Contractor shall notify the Owner.

3.2 INSTALLATION EQUIPMENT

A. Rotary type, hydraulic power-driven torque motor with clockwise and counter-clockwise rotation capabilities. The torque motor shall be capable of continuous adjustment to revolutions per minute (RPM’s) during installation. Percussion drilling equipment shall not be permitted. The torque motor shall have torque capacity 15% greater than the torsional strength rating of the central steel shaft to be installed.

B. Equipment shall be capable of applying adequate down pressure (crowd) and torque simultaneously to suit project soil conditions and load requirements. The equipment shall be capable of continuous position adjustment to maintain proper helical pile alignment.

3.3 INSTALLATION TOOLING

A. Shall consist of drive tools supplied by the helical pile manufacturer and used in accordance with the manufacturers written installation instructions.

B. A torque indicator shall be used during helical pile installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling.

1. Shall be capable of providing continuous measurement of applied torque throughout the installation.
2. Shall be capable of torque measurements in increments of at least 500 ft-lb
3. Shall be calibrated prior to pre-production testing or start of work. Torque indicators which are an integral part of the installation equipment, shall be calibrated on-site. Torque indicators which are mounted in-line with the installation tooling, shall be calibrated either on-site or at an appropriately equipped test facility. Indicators that measure torque as a function of hydraulic pressure shall be calibrated at normal operating temperatures.
4. Shall be re-calibrated, if in the opinion of the Owner and/or Contractor reasonable doubt exists as to the accuracy of the torque measurements

3.4 STEEL REINFORCEMENT

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

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

3.5 INSTALLATION PROCEDURES

A. The helical pile installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.

B. The lead section shall be positioned at the location as shown on the working drawings. Battered helical piles can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle shall be established. The helical pile sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 20 RPMs. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the working drawings. Connect sections together using coupling bolt(s) and nut torqued to 40 ft-lb.

C. Sufficient down pressure shall be applied to uniformly advance the helical pile sections approximately 3 inches per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths.

D. Void area around upper portion of piles shall be backfilled in accordance with the geotechnical report or filled with lean concrete.

3.6 TERMINATION CRITERIA

A. The torque, as measured during the installation, shall not exceed the torsional strength rating of the central steel shaft.

B. The minimum installation torque and minimum overall length criteria as shown on the working drawings shall be satisfied prior to terminating the helical pile installation.

C. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:

1. Terminate the installation at the depth obtained subject to the review and acceptance of the Owner, or:
2. Remove the existing helical pile and install a new one with fewer and/or smaller diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new helical pile shall be terminated at least (3) three feet beyond the terminating depth of the original helical pile.

D. If the minimum installation torque as shown on the working drawings is not achieved at the minimum overall length, and there is no maximum length constraint, the Contractor shall have the following options:

1. Install the helical pile deeper using additional extension sections, or:
2. Remove the existing helical pile and install a new one with additional and/or larger diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new helical pile shall be terminated at least (3) three feet beyond the terminating depth of the original helical pile.
3. De-rate the load capacity of the helical pile and install additional helical pile(s). The de-rated capacity and additional helical pile location shall be subject to the review and acceptance of the Owner.

E. If the helical pile is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the helical pile re-installed. If the obstruction can't be removed, the helical pile shall be installed at an adjacent location, subject to review and acceptance of the Owner.

F. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to proper positioning of the last plain extension section relative to the final elevation, the Contractor may remove the last plain extension and replace it with a shorter length extension. If it is not feasible to remove the last plain extension, the Contractor may cut said extension shaft to the correct elevation. The Contractor shall not reverse (back-out) the helical pile to facilitate extension removal.

G. The average torque for the last three feet of penetration shall be used as the basis of comparison with the minimum installation torque as shown on the working drawings. The average torque shall be defined as the average of the last three readings recorded at one-foot intervals..

3.7 HELICAL PILE LOAD TESTS

A. LOAD TEST EQUIPMENT

1. The load test equipment shall be capable of increasing or decreasing the applied load incrementally. The incremental control shall allow for small adjustments, which may be necessary to maintain the applied load for a sustained, hold period.
2. The reaction system shall be designed so as to have sufficient strength and capacity to distribute the test loads to the ground. It should also be designed to minimize its movement under load and to prevent applying an eccentric load to the pile head. Test loads are normally higher than the design loads on the structure. The direction of the applied load shall be collinear with the helical pile at all times.
3. Dial gauge(s) shall be used to measure helical pile movement. The dial gauge shall have an accuracy of at least +/-0.001-in. and a minimum travel sufficient to measure all helical pile movements without requiring resetting the gauge. The dial gauge shall be positioned so its stem is parallel with the axis of the helical pile. The stem may rest on a smooth plate located at the pile head. Said plate shall be positioned perpendicular to the axis of the helical pile. The dial gauge shall be supported by a reference apparatus to provide an independent fixed reference point. Said reference apparatus shall be independent of the reaction system and shall not be affected by any movement of the reaction system.
4. The load test equipment shall be re-calibrated, if in the opinion of the Owner and/or Contractor reasonable doubt exists as to the accuracy of the load or deflection measurements.

3.8 PRODUCTION HELICAL PILE TESTING

A. Perform proof tests on a minimum of 10% of the total production helical piles. The helical piles to be tested will be selected by the Owner. Contractor's option to perform tension tests in lieu of compression tests up to 1.00 x DL for helical piles with sufficient structural tension capacity.

B. The test sequence shall be as shown in Table 1 to the extent practical.

Table 1: Steps for Production Load Testing

LOAD STEP	HOLD TIME	LOAD STEP	HOLD TIME
AL	0 Min.	1.00 DL	5 Min.
0.20 DL	2.5 Min.	0.60 DL	1 Min.
0.40 DL	2.5 Min.	0.40 DL	1 Min.
0.60 DL	2.5 Min.	0.20 DL	1 Min.
0.80 DL	2.5 Min.	AL	5 Min.

AL = Alignment Load; DL = Design Load

C. The Helical Pile shall sustain the compression and tension design capacities (1.0 x DL) with no more than 1/2 in. total vertical movement of the pile-head as measured relative to the top of the helical pile prior to the start of testing.

D. If a production helical pile that is tested fails to meet the acceptance criteria, the Contractor shall be directed to proof test another helical pile in the vicinity. For failed helical piles and further construction of other foundations, the Contractor shall modify the design, the construction procedure, or both. These modifications include, but are not limited to, installing replacement helical piles, modifying the installation methods and equipment, increasing the minimum effective installation torque, changing the helix configuration, or changing the helical pile material (i.e., central steel shaft). Modifications that require changes to the structure shall have

prior review and acceptance by the Owner. Any modifications of design or construction procedures shall be at the Contractor's expense.

3.9 FIELD QUALITY CONTROL

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

END OF SECTION 316330

SECTION 32 05 19 – ENGINEERING FABRIC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Geotextile Fabric for around underdrain

1.2 DEFINITIONS

A. UV: Ultraviolet

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, provide manufacturer's standard data sheets describing components including materials, dimensions, relationship to adjacent construction, and attachments

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store in direct sunlight.

B. Protect product from soil and damage.

C. Handle products according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 GEOTEXTILE FILTER FABRIC

A. Description: Filter fabric for use around stone for underdrains shall consist of needled non-woven polypropylene fibers and meet the material properties of this specification.

B. Material properties:
   1. Grab tensile strength (ASTM-D4632): ≥ 120 lbs
   2. Mullen burst strength (ASTM-D3786): ≥ 225 psi
   3. Flow rate (ASTM-D4491): ≥ 135 gal/min/ft^2
   4. UV resistance after 500 hours (ASTM-D4355): ≥ 70%
   5. Heat-set or heat-calendared fabrics are not permitted.

PART 3 - EXECUTION

3.1 GEOTEXTILE FABRIC INSTALLATION:

A. Cut fabric to proper dimensions prior to placement and in accordance with manufacturer's recommendations. Fabric width shall be adequate to conform to trench perimeter with minimum six-inch overlap at top of trench.

B. Place fabric over trench to length needed. Anchor edges of fabric with heavy objects to prevent fabric from falling into trench. Do not damage fabric.

C. Where overlaps are required between rolls, allow minimum three-foot overlap from upstream to downstream roll.

D. Consult manufacturer requirements for additional details.

END OF SECTION 32 05 19

SECTION 32 13 13 – INTEGRAL EXPOSED AGGREGATE CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving Including the Following:
   1. Walks.

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete" for general applications of concrete.
   2. Section 079200 "Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.2 DEFINITIONS

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

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

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

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

      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.

   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete paving Subcontractor.
      e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color/material selection.

C. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

1. Exposed Aggregate: 3-lb Sample of each mix.

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Certificates: Signed by manufacturers certifying that each of the following materials used in the project complies with requirements:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Applied finish materials.
5. Bonding agent or epoxy adhesive.
6. Joint fillers.

C. Field quality-control reports.

D. Pavement Joint Layout Plan: Plan to show joint locations and typical dimensions for review and approval by the Contracting Officer.

1.6 SHOP DRAWINGS

A. Reinforcement Shop Drawing: Submit shop drawings, minimum of 2 copies or electronically in PDF format for fabrication, bending, and placement of concrete reinforcement.
1. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (latest edition), showing bar schedules, stirrup spacing, diagrams of bent bars, placing plans elevations showing arrangement of concrete reinforcement.
2. Reproduction of the Contract Drawings are not acceptable for use as shop drawings.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Experienced installer who has completed pavement work similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

C. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

D. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Aggregate Samples and Test Panels: Submit aggregate samples and construction of test panels for selection of exposed aggregate materials and finish.
1. Aggregate Samples: The Contractor shall submit four (4) three (3 lbs.) pound bags of the aggregate for initial selection of aggregate for use.
   a. Aggregate shall be angular crushed quarry stone No. 8 in size (3/8 to 5/8" dia.)
   b. Aggregate shall be from a regional quarry source (within 500 miles of the project location.).
   c. Aggregate shall range in color from grey and black to beige
2. Color Admixture: The Contractor shall submit the manufacturer's standard dolor chart for initial selection of color admixture to be used with the test panels.

3. Test Panel Mixtures: Up to two (2) color aggregates and two (2) color admixtures, one no color admixture may be selected for use in constructing up to five (5) test panels for initial selection of desired finish and color. Combinations will be determined by the Contracting Officer.

F. Test Panels: Contractor shall construct not less than five (5) test panels of selected aggregates and colors for review and selection of the preferred exposed aggregate concrete paving mock-up panel.
1. Test samples shall:
   a. Be constructed as 5 foot x 5 foot square panels
   b. The five sample panels for the prescribed aggregate and color mixes, will incorporate concrete color admixture. The test panels will be used to test for the color and exposed aggregate finished appearance, color and finishing techniques for exposing the integral aggregate. Prescribed mixes will be determined at the time of test panel construction with the Contracting Officer's Representative.
   c. One of the five (5) panels will be selected for a final mock-up.

G. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
1. Build a 5 foot wide by 8 foot in length mock-up on site. At a location as determined by the Contracting Officer's Representative.
2. Notify the Contracting Officer's Representative seven days in advance of dates and times when mockups will be constructed.
3. Obtain approval from Contracting Officer's Representative before starting mockup construction.

4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Contracting Officer's Representative.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.
   1. Before submitting design mixes, review concrete pavement mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with concrete pavement to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixes.
      c. Ready-mix concrete producer.
      d. Concrete subcontractor.

1.9 FIELD CONDITIONS

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

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

   1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:

   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

D. Coordination and Scheduling: Coordinate with other trades and arrange scheduling to avoid damage to other work including grading, site utilities and piping, asphalt paving, landscaping and irrigation systems.

E. Field Measurements: Verify dimensions and existing conditions shown on the drawings by taking field measurements prior to start of work. Report discrepancies to the Contracting Officer for clarification and make minor adjustments in layout as required by field conditions and as approved by the Contracting Officer's Representative, at no additional cost to the Government.

F. Environmental Requirements: Perform work only under suitable weather conditions. Comply with the environmental requirements of PennDOT Standard Specifications Section 1000 for concrete placement.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.
   a. Faceted form work will not be accepted.

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

2.3 STEEL REINFORCEMENTS

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) epoxy coated steel bars;. Cut bars true to length with ends square and free of burrs.

B. Reinforcing Bars: ASTM A615, Grade 60, deformed , epoxy coated

C. Welded Wire Fabric (WWF) ASTM, welded steel wire fabric, epoxy coated

2.4 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I.
2. Fly Ash: ASTM C 618, Class C
3. Slag Cement: ASTM C 989/C 989M, Grade 100.
4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IP, portland-pozzolan cement.
5. Cement Concrete: meeting PennDOT Class C Concrete.

B. Normal-Weight Aggregates: Provide aggregates from a single source.

1. Aggregate size and color shall be same as specified for exposed aggregate.

C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
1. Exposed Aggregate shall be stone type #8 washed stone sourced from (identify NYS local quarry/supplier for project)
2. Top Cast 50%: Acid etch 1/8" to 3/8" into top of concrete
3. As approved in the mock up.

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

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Chemical admixtures shall meet the following, or PennDOT Standard Specification Section 711:

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

F. Water: Potable and complying with ASTM C 94/C 94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.

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

C. Water: Potable.

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

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

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

C. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

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

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
3. Do not use the Project field quality-control testing agency as the independent testing agency.

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

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
2. Air Content: 6 percent plus or minus 1-1/2 percent for 1-inch (25-mm) nominal maximum aggregate size.
3. Air Content: 6 percent plus or minus 1-1/2 percent for 3/4-inch (19-mm) nominal maximum aggregate size.

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

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

1. Use high-range, water-reducing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 3500 psi
2. Maximum W/C Ratio at Point of Placement: 0.45
3. Slump Limit: 2 to 4 inches.

G. Concrete Sidewalk Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 3500 psi
2. Maximum W/C Ratio at Point of Placement: 0.45
3. Slump Limit: 2 to 4 inches.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
2. Project-Site Mixing: There will be no Project-Site Mixing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Subgrade shall be tested by Geotechnical Engineer and pass required tests prior to concrete pavement placement.

B. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

C. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph (5 km/h).
2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of ½ inch according to requirements in Section 312000 "Earth Moving."

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

3.2 PREPARATION

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

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

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

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 20 feet maximum unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

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

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) min. wide joints into

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

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing. Do not add water to concrete surface during finishing operations.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

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

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Walks: Minimum 4” thick, with expansion joints at intervals of 20 feet maximum and saw cut contraction joints at intervals equal to width of walks or maximum 5-foot intervals. Tool edges to rounded profile and finish as noted herein or shown on the drawings. Pitch walks ¼” per foot for drainage unless otherwise indicated.

3.6 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions. Surface retarded shall be applied in a way to avoid contamination onto surrounding areas. Alternative methods of application may be presented for approval.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
5. Top Cast 50%: Acid etch 1/8” to 3/8” into top of concrete.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

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

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period. Power spray for applying curing compound shall only be used if the work can be performed without contamination onto surrounding areas.

3.8 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:

1. Elevation: 1/4 inch (19 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-feet- (3-m-) long; unleveled straightedge not to exceed 1/4 inch (13 mm).
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
6. Vertical Alignment of Dowels: 1/4 inch (6 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.9 FIELD QUALITY CONTROL

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

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m)or fraction thereof of each concrete mixture placed each day.

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

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to Contracting Officer's Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by CO but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by COR.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.10 REPAIR AND PROTECTION

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

B. Drill test cores, where directed by COR, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1313

SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick pavers set on sand and concrete base
2. Brick pavers set on concrete with mortar joints
3. Brick pavers stair treads and risers
4. Brick pavers set on sand and aggregate base

B. Related Requirements:
1. Section 321313 "Concrete Paving" for concrete base under unit pavers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For materials other than water and aggregates.
2. For the following:

a. Pavers.
b. Mortar and grout materials
c. Sand for setting and joint fill.

B. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C136.

C. Samples for Initial Selection: For each type of unit paver indicated and the following.

1. Brick pavers.
2. Joint materials involving color selection.
a. Mortar
b. Joint sand

D. Samples for Verification: For full-size units of each type of unit paver indicated. Include Samples of the following:

1. Joint materials.
a. Mortar
b. Joint sand

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

C. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified unit paving installer. Installer's field supervisor must have Concrete Paver Installer Certification from the Interlocking Concrete Pavement Institute (ICPI) with both of the following designations:
   1. Commercial Paver Technician Designation.

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

C. Shop Drawings: Include drawing of brick paving pattern for walks, Steps and landings.

D. Preconstruction Compatibility and Adhesion Testing: Submit to latex-additive manufacturer, for testing indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.

   1. Use manufacturer's standard test methods to determine whether mortar and grout materials are required to obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.
   2. Submit a sufficient number of pavers and other materials involved in installation to allow comprehensive testing.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain mortar and grout manufacturer's written instructions for corrective measures, including the use of alternative materials to obtain optimum bond and prevent staining.

E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

   1. Construct a mock-up of brick paving on concrete with sand and mortar joints of the following.
      a. Construct a mock-up for each brick pattern
      b. Mock-up size to be not less than 5 foot square for herringbone pattern
         1) Mock-up to include border band of brick set mortar joint

c. Mock-up size to be not less than 5 foot square for basket weave pattern
   1) Mockup to include border band of brick with mortar joint.
d. Mock-up size to be not less than 4 foot by 6 foot for modified basket weave pattern
e. Mock-up size to be not less than 4 foot square herringbone pattern with mortar joints

2. Construct a mock-up of brick paving on sand with mortar joints
3. Notify the COR seven days in advance of dates and times when mockup will be constructed.
4. Obtain COR's approval of mock-ups before starting unit paver installation
5. Approved mockups may Not become part of the completed Work and shall be removed from the construction site following substantial completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquids in tightly closed containers protected from freezing.

1.7 FIELD CONDITIONS

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

B. Weather Limitations for Bituminous Setting Bed:

1. Install bituminous setting bed only when ambient temperature is above 40 deg F (4 deg C) and when base is dry.
2. Apply asphalt adhesive only when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (2 deg C) for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.

a. When ambient temperature exceeds 100 deg F (38 deg C), or when wind velocity exceeds 8 mph (13 km/h) and ambient temperature exceeds 90 deg F (32 deg C), set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products for each one of the following:

1. Brick Pavers
2. Latex-Portland Cement Mortars, Grouts Polymeric Sand

2.2 COLORS AND TEXTURES

A. Colors and Textures: Match existing site pavers as follows
1. Review and select the most representative of the historic brick pavers in the area to be matched
2. Provide a range of color samples that match or match as closely to the historic brick's
   a. Size
   b. Color
   c. Texture/finish

2.3 BRICK PAVERS

A. Brick Pavers, Heavy Vehicular Paving Brick: ASTM C1272, Type F, Application PX for sand set pavers and Type R, Application PX for stair treads and risers. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.

1. Thickness: Match historic/existing brick pavers for each area and pattern to be reconstructed
2. Face Size: Match historic/existing brick pavers for each area and pattern to be reconstructed
3. Color: Match historic/existing brick pavers for each area and pattern to be reconstructed [

B. Efflorescence: Brick to be rated "not effloresced" when tested according to ASTM C67.

2.4 ACCESSORIES

A. Compressible Foam Filler: Preformed strips complying with ASTM D1056, Grade 2A1.

2.5 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Base: Sound, crushed stone or gravel complying base material] requirements in Section 312000 "Earth Moving" for base course.

B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C33/C33M for fine aggregate.

C. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.

   1. Provide sand of color needed to produce required joint color.

D. Polymeric Joint Sand: fine-grained sand combined with silicon and various additives so that it becomes a binding agent when installed with water.

   1. Provide sand of color needed to produce required joint color.

2.6 PORTLAND CEMENT MORTAR SETTING-BED MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II.

B. Hydrated Lime: ASTM C207, Type S.

C. Sand: ASTM C144.

D. Latex Additive: acrylic resin water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.

E. Water: Potable.

2.7 MORTAR MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimal performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

B. Cement-Paste Bond Coat: Mix bond coat to a consistency similar to that of thick cream and consisting of either neat cement and water or cement, sand, and water.

   1. For latex-modified portland cement setting-bed mortar, substitute latex admixture for part or all of water per directions of latex-additive manufacturer.

C. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C270, Proportion Specification.

D. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

C. Proof-roll prepared subgrade according to requirements in Section 312000 "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for unit pavers.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: Match historic paving patterns
   1. See drawing plans and details for joint and pattern information.

E. Tolerances:
   1. Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

F. Expansion and Control Joints:

1. Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints where joints are expressed through the brick paving.
2. Install joint filler before setting pavers. Sealant materials and installation are specified in Section 079200 "Joint Sealants."
3. Provide fiber board joint filler continuous through concrete substate slab

    a. Maintain joint filler below brick surface where expansion joints are not expressed through the brick surface where sand is used for setting and joint fill.

4. Where pavers embedded in concrete are indicated as edge restraints for pavers set in aggregate setting bed, install pavers embedded in concrete and allow concrete to cure before placing aggregate setting bed and remainder of pavers. Hold top of concrete below aggregate setting bed.

G. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.

1. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

3.4 AGGREGATE SETTING-BED APPLICATIONS

A. Compact soil subgrade uniformly to at least 95 percent of ASTM D698, ASTM D1557 laboratory density.

B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Contracting Officer's Representative, and replace with compacted backfill or fill as directed.

C. Place aggregate subbase and base, compact by tamping with plate vibrator, and screed to depth indicated.

D. Place aggregate base, compact to 100 percent of ASTM D1557 maximum laboratory density, and screed to depth indicated.

E. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant, and density is loose and uniform until pavers are set and compacted.

F. Treat leveling course with herbicide to inhibit growth of grass and weeds.

G. Set pavers with a minimum joint width of 1/16 inch (1.5 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines.

H. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on

face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches (900 mm) of uncompacted pavers adjacent to temporary edges.
2. Before ending each day's work, compact installed concrete pavers except for 36-inch (900-mm) width of uncompacted pavers adjacent to temporary edges (laying faces).
3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches (90 mm) of laying face.
4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

I. Spread dry sand / polymeric and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

J. Do not allow traffic on installed pavers until sand has been vibrated into joints.

K. Repeat joint-filling process 30 days later.

3.5 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat. Limit area of bond coat to avoid its drying out before placing setting bed.

C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

D. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

E. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

F. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- (1.5-mm-) thick bond coat to mortar bed or to back of each paver with a flat trowel.

G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

H. Spaced Joint Widths:
   1. Match historic joint width for each paved area were work abuts existing conditions
   2. Match joint widths as approved by the COR on the reviewed mockup for each paving type and pattern.
   3. Provide nominal joint width with variations not exceeding plus or minus 3/16 inch (4.5 mm).

I. Grouted Joints: Grout paver joints complying with ANSI A108.10.

J. Grout joints as soon as possible after initial set of setting bed.

   1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
   2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
   3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
   4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

K. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.6 REPAIRING, POINTING, AND CLEANING

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

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

END OF SECTION 321400

SECTION 32 14 05 - STONE PAVING (FLAGSTONE)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes
   1. Flagstone stone paving.
   2. Flagstone curbing.

1.3 SUBMITTALS

A. Submit manufacturer's product data (specifications and installation instructions) for type of stone, grout and latex additive materials, and colored mortar. Submit product data in a separate submittal package for each type of stone paving.

B. Preconstruction Material Test:
   1. Flagstone density
   2. Mortar adhesion strength and compatibility

C. Shop Drawings: Provide cutting and setting shop drawings for all cut stone indicating pertinent dimensioning, layout, jointing, mechanical anchoring, construction details, and method of installation. Number pieces on the setting drawings to correspond to a permanently marked identification number on the back of each stone.

D. Submit to the Contracting Officer's Representative three full size sample sets, each sample being not less than 12" x 12" in size, of each stone type, color range, and finish required and associated mortar in color specified. Contracting Officer's Representative review and acceptance of samples shall be reviewed for color and texture only. Compliance with all other requirements, is the exclusive responsibility of the Contractor. Include the full range of exposed color and texture proposed for the work. Sample review and acceptance shall precede sample installation as hereinafter specified.

   1. Sample sets shall indicate high, middle, and low range of color.
   2. Each range sample of each set shall be finished as specified.
   3. All samples shall be permanently labeled.
   4. Include samples for both flagstone paving and flagstone edging

E. Submit samples of colored mortars and joint sealants to be used in association with the stone paving.

1.4 QUALITY ASSURANCE

A. Installation:

1. Installer Qualifications: Engage an experienced Installer who has successfully completed in excess of five stone paver installations similar in material design, and extent to that indicated for Project. Provide completed project examples and project references for the proposed paver installer.

B. Sample Panel, Mock- up:

1. Before starting stone pavement work, provide a sample panels as required to fully illustrate all paving materials, bond methods, and joint tooling indicated for the project work. Provide the range of color, texture, and workmanship proposed for the work. Correct and rebuild sample panels until the Contracting Officer's Representative acceptance of the work. Retain panel during construction as a standard for completed stone masonry work.

   a. Provide a sample panel for each type of stone paving.
   b. Provide a sample panel for each pattern of stone paving.
   c. Sample panel to include:
      (1) Stone set on a concrete base and mortar bedding
      (2) Mortar Joints
      (3) Expansion Joint

   d. Sample panels to be minimum 8’-0” long x 3’-6” wide (two flagstone rows). Locate sample panel as directed by Contracting Officer’s Representative.

B. Single-Source Responsibility: Provide each type of stone from only one quarry to ensure consistent color range and textures.

C. Flagstone to meet or exceed 2500 psi density

D. Do not change source or brands of mortar materials during the course of the work.

E. Do not install stone that has saw marks, drill marks, chips, cracks, or discoloration.

F. Preconstruction Compatibility and Adhesion Testing for Flagstone: Submit samples of paving materials contacting or affecting mortar and grout containing latex additives to manufacturer of latex additives for compatibility and adhesion testing as indicated below.

1. Use test methods standard with manufacturer to determine if mortar and grout materials will obtain optimum adhesion with, and will be non-staining to, installed pavers and other materials constituting the paving installation.
2. Submit sufficient number of stone pavers and other materials involved in installation to allow comprehensive testing.
3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
4. Investigate materials failing compatibility or adhesion tests and obtain mortar and grout manufacturer's written recommendations for the use of materials to obtain optimum bond and prevent stag.
5. Submit results of testing to Contracting Officer’s Representative.

1.5 REFERENCES

A. ASTM C97 - Test Methods for Absorption and Bulk Specific Gravity of Natural Building Stone.

B. ASTM C99 - Test Method for Modulus of Rupture of Natural Building Stone.

C. ASTM C127 - Test Method for Specific Gravity and Absorption of Coarse Aggregate

D. ASTM C170 - Test Method for Compressive Strength of Natural Building Stone.

E. ASTM C321 - Test Method for Bond Strength of Chemical-Resistant Mortars.

F. ASTM C615 - Test Method for Physical and Chemical Properties

1.6 STANDARDS

A. American Concrete Institute (ACI).

B. American Society for Testing and Materials, (ASTM).

1.7 DELIVERY AND STORAGE

A. Delivery:

1. Schedule operations to avoid unnecessary rehandling.

B. Storage:

1. Deliver, store, and handle stone materials in accordance with stone fabricators' recommendations. Use non-staining materials for blocking and packing. Stack cut stone materials off the ground on non-staining skids. Protect from damage, ground water, soiling or contamination from earth and other materials.

C. Mortar Materials and Grout:

1. Deliver cement, lime, and admixture materials in manufacturer's unopened and undamaged containers with labels intact and legible. Store materials off the ground, under cover, and protect from weather damage, temperature, moisture and deterioration. Store in a dry location or in waterproof container. Protect liquid components from freezing.

1.8 PROJECT CONDITIONS

A. Establish and maintain required levels and grade elevations. Review installation procedures and coordinate work with other affected by the stone paving work.

B. Hot Weather: Protect stone pavers when temperature and humidity conditions produce excessive evaporation of setting beds and grout. Protect installed paving with windbreaks or artificial shade

to prevent excessive moisture evaporation and use cooled materials as required. Do not apply mortar substrates with temperatures of (38 deg C) and above.

C. Weather Limitations: Protect stone paver work against freezing when atmospheric temperature is (40 degrees Fahrenheit and falling). Heat materials and provide temporary protection of completed portions of stone paver work. Comply with International Masonry AU-Weather Council's "Guide Specification for Cold-Weather Masonry Construction, 'Section 04200, Article 3. Protect partially completed paving against weather damage when work is not in progress.

D. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade, compacted fill, or setting beds. Remove and replace stone paver work damaged by frost or freezing.

E. Provide temporary barricades and warning lights as required for protection of project work and public safety.

F. Protect adjacent work from damage, soiling, and staining during paving operations.

G. Do not install stone paving until utility work, curbing, walls, or similar work is complete.

PART 2 – PRODUCTS

2.1 FLAGSTONE PAVING

A. ASTM C616 and as follows: .

1. Color: Blue/Grey Range to match existing / historic flagstone paving.
2. Width: Custom cut and as indicated.
3. Length: Custom cut and as indicated.
4. Thickness: As indicated on the drawings.
5. Finish: Natural cleft finish to match historic stone finish
6. Strength: Stone to meet 2500 psi compressive strength

B. Construction Tolerances for Stone Paving:

1. Variation from plumb lines and surfaces shall not exceed 1/8" in twenty (20) feet. For external corners, expansion joints, and other conspicuous lines, variations shall not exceed 1/4" in forty (40) feet.
2. Variation from level, from grades shown, and other conspicuous lines, shall not exceed 1/8" in a twenty (20) feet by twenty (20) feet in an area.
3. Variation of plan lines shall not exceed 1/8" in twenty (20) feet.
4. Variation in cross-sectional dimensions, for paving curb edge shall not exceed plus or minus 1/8".
5. Tolerances: Do not exceed 1/16" unit-to-unit offset from flush (lippage), for finished surface of paving.

1.1 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

B. Mortar-Bed Bond Coat: Mix neat cement and latex additive, water to a creamy consistency.

C. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.

D. Latex-Modified, Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and liquid latex for bond coat to comply with written instructions of liquid-latex manufacturer.

E. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture.

1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.

F. Packaged Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

1. Colored Mortar Pigments for Grout: Natural and synthetic iron and chromium oxides, compounded for use in mortar and grout mixes. Use only pigments that have proved, through testing and experience, to be satisfactory for use in portland cement grout.

2.3 STONE SETTING-BED MATERIALS

G. Concrete base for mortar set stone, see Cast-in-Place Concrete Section No. 03 3000

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit pavers. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from concrete substrates that could impair bond of mortar, including curing and sealing compounds, form oil and laitance.

3.3 INSTALLATION, GENERAL

A. Do not use stone pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.

B. Cut stone pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Core drill pavers are cut radially to fit around circular profiles. Use full units without cutting where possible. Hammer cutting is not acceptable.

C. Joint Pattern: Lay unit pavers in joint pattern shown, and as approved on stone paving mock-up panel(s)

D. Do not permit traffic of any type over set paving until beds and grouting are completely cured.

3.5 STONE PAVING ON CONCRETE BASE

A. General:

1. Verify dimensions at the site, do work necessary to adjust stone to field conditions.

B. Installation:

3. Setting Stone:

a. Latex-Portland Cement Mortar Setting Bed:

(1) Clean concrete base free of all dirt, debris, etc.
(2) Prepare and install setting bed in accordance with latex additive manufacturer's recommendations to section and grades indicated.

b. Setting Flagstone:

(1) Do not use stone units with chips, cracks, voids, stains, or other visible defects.
(2) Clean cut stone work before setting by thoroughly scrubbing with fiber bristle brushes and clean water. Drench stone with clean water just prior to setting.
(3) Apply Latex - admixture bond coat to setting bed in accordance with manufacturer's recommended rate of application.
(4) Distribute natural color range of stone evenly.
(5) Reset stone as requested by the Contracting Officer’s Representative where deficiencies occur.

c. Expansion Joints:

(1) Provide and install as recommended by applicable installation standards.
(2) See contract drawings for expansion joint details and locations.
(3) Install expansion joints on modules of not less than 30 foot apart unless otherwise approved by Contracting Officer's Representative.

d. Finishing:

(1) Once stones are set at a proper grade and pitch, grout with mortar joint material specified.
(2) Clean face of stone and grouting.

3.7 PROTECTION AND RESTORATION

A. Protect completed stonework from damage. Cover and protect the completed work areas in a manner approved by installer.

1. Restore damaged stonework as directed by the Contracting Officer's Representative

a. Restoration approval required by the Contracting Officer's Representative.

B. Contractor shall install pavers per manufacturers' recommendations. Discrepancies between this specification and manufacturers' recommendation, if any, shall be resolved in advance of installation and agreed to by the Contracting Officer's Representative.

3.8 REPAIR, POINTING, CLEANING AND PROTECTION

A. Remove and replace stone pavers which are loose, broken, stained, or otherwise damaged. Provide new matching units, install as specified. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

B. Pointing: During tooling of grouted joints, enlarge voids or holes and fill completely with mortar or grout. Point-up joints at sealant- type joints to provide a neat uniform appearance, properly prepared for application of sealant.

C. Clean stonework not less than 6 days after completion of work, using clean water and stiff-bristle brushes. Do not use wire brushes, acid type cleaning agents or other cleaning compounds with caustic or harsh fillers. Do not use cleaning agents that harm plant material. Remove excess grout from exposed stone surfaces, wash, and scrub clean.

D. Cleaning agents and methods shall be acceptable to the Contracting Officer's Representative.

E. Provide final protection and maintain conditions which ensures stone paver work being without damage or deterioration at time of Final Acceptance. Final Acceptance – The work (or specified part thereof) has progressed to the point where, in the opinion of Contracting Officer as evidenced by Contracting Officer's definitive certificate of Final Acceptance, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the work refer to Final Acceptance thereof.

F. Upon completion of work, remove from site all excess materials, debris, tools, and equipment. Repair damage resulting from stonework operations.

END OF SECTION 02 51 60

SECTION 32 14 13 – PERVIOUS CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pervious Concrete Walks.

B. Related Sections:
   1. Division 32 Section "Exposed Aggregate Concrete Paving" for walk pavements.
   2. Division 07 Section " Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
   3. Division 31 Section Earth Moving for sub base and drainage base requirements.

1.3 DEFINITIONS

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

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

1.4 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

   1. Aggregate: 10-lb (4.5-kg).

D. Other Action Submittals:

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Pervious Concrete Pavement certified contractor, ready-mix concrete manufacturer and testing agency.

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

1. Cementitious materials.
2. Fiber reinforcement.
3. Admixtures.
4. Curing compounds.
5. Bonding agent or epoxy adhesive.
6. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Pervious Paving Installer Qualifications: Pervious Concrete Contractor should be “Certified Pervious Concrete Craftsmen” and shall be able to demonstrate at least three years of competent work with pervious concrete. The contractor must be able to submit a list of at least three jobs completed within the last three to five years. The jobs must be within the same climatic region as this construction project. The oldest jobs installed during that period must still be demonstrating durability.
1. Contractor to submit location and owner or client reference for each of the three requested work examples
2. Any applicable test results from such previous jobs shall be furnished to the C.O.R if requested.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed pervious concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

2. Pervious Concrete Ready-Mix Concrete Manufacture: shall be able to provide proof of experience with pervious concrete pavement design mix and delivery. Provide not less than three project examples.
   a. Three project examples submittals shall include: job date, location and contractor or construction company contact information

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

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

E. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

F. Mockups: Cast mockups of full-size sections of pervious concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
   1. Build a 5 foot wide by 8 foot in length mock-up on site. At a location as determined by the Contracting Officer.
   2. Notify the Contracting Officer's Representative seven days in advance of dates and times when mockups will be constructed.
   3. Obtain approval from Contracting Officer's Representative before starting mockup construction.
   4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
   5. Mockup shall not be part of the finished pavement.

G. Demolish and remove approved mockups from the site when directed by Contracting Officer's Representative.

H. Preinstallation Conference: Conduct conference at the Project site.

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

      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.
      c. Mockup panel location.

   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

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

1.7 FIELD CONDITIONS

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

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.

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

2.2 CONCRETE MATERIALS

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

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

a. Fly Ash: ASTM C 618, Class C.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

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

1. Maximum Coarse-Aggregate Size: 3/8 to No. 8 and 3/8 to No. 67.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Pore Space: Void Content range 20% to 25%, not less than 18%

D. Water: Potable and complying with ASTM C 494/C 494M.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

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

2.3 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Monofilament Fibers:
1) Euclid Chemical Company (The), an RPM company; Fiberstrand 100, Fiberstrand 150.
2) Grace, W. R. & Co. - Conn.; Grace MicroFiber.
3) Metalcrete Industries; Polystrand 1000.

2.4 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film.

B. Water: Potable.

2.5 RELATED MATERIALS

A. Joint Fillers: See Joint Sealant Section 07 9200
1. ASTM D 1751.

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

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

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

1. Compressive Strength (28 Days): 4000 psi (27.5 MPa)
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45 .

3. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm).

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

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

   1. Use water-reducing admixture in concrete as required for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

   1. Fly Ash or Pozzolan: 25 percent.
   2. Ground Granulated Blast-Furnace Slag: 50 percent.
   3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m).

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

   1. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below pervious concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Division 31 Section "Earth Moving."

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

3.2 PREPARATION

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

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, riser strips and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

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

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.

3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 20 feet (6.10 m) unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

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

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.
1. Review locations of tooled edging with C.O.R. in advance of pervious concrete placement.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Install riser strips for use in initial screed.

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

H. Screed paving surface with a straightedge and strike off, remove riser strips and compact pervious pavement to required density and specified percent open pore space.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

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

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

L. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3.8 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 1/4 inch (6 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/2 inch (13 mm).
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
6. Vertical Alignment of Dowels: 1/4 inch (6 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.9 FIELD QUALITY CONTROL

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

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each **100 cu. yd. (76 cu. m)** or fraction thereof of each concrete mixture placed each day.

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

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to Contracting Officer's Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Contracting Officer's Representative but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Contracting Officer's Representative.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.10 REPAIRS AND PROTECTION

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

B. Drill test cores, where directed by C.O.R., when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1413

SECTION 32 84 00 – IRRIGATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Delegated Design, system performance requirements.
2. Pipe and fittings, valves, sprinkler heads and accessories for the modification and repair of the irrigation system.
3. Control system modifications related to the repair of the irrigation system.

1.2 REFERENCES

A. ANSI B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings

B. ASTM B32 - Solder Metal.

C. ASTM B42 - Seamless Copper Pipe, Standard Sizes.

D. ASTM B88 - Seamless Copper Water Tube.

E. ASTM D1784 - Poly (Vinyl Chloride) (PVC) Compounds.

F. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 80.

G. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.

H. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).

I. ASTM D2464 - Threaded Poly (Vinyl Chloride) (PVC) Plastic Fittings, Schedule 80.

J. ASTM D2466 - Threaded Poly (Vinyl Chloride) (PVC) Plastic Fittings, Schedule 80.

K. ASTM D2564 - Solvent Cement for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

L. ASTM D2774 - Underground Installation of Thermoplastic Pressure Piping.

M. ASTM D2855 - Making Solvent Cement Joints with Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

N. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

O. NSF 14 - Plastic Piping Components and related Materials.

P. PPI TN8/8 - Making Treaded Joints with Thermoplastic Pipe and Fittings.

1.3 SYSTEM DESCRIPTION

A. Automatic (operable in semi-automatic, and manual modes), underground, turf and tree area, plant bed, irrigation system with flooded suction variable frequency drive (VFD) booster pump assembly.

B. System design anticipates 50 to 60 PSI Municipal water source pressure to inlet of backflow preventer. Verify available City Static Pressure prior to commencing work. Report to COR variation of more than 5 PSI.

C. Controller Power: 120 Vac from 15 Amp dedicated circuit breaker.

D. Low Voltage (24vac) control signal to field-located Remote Control Valves (RCV).

E. Controllers installed in NEMA 4X enclosures.

F. Quick-coupling Valves (QCV).

1.4 PERFORMANCE REQUIREMENTS

A. Irrigation system in the areas of landscape improvements shall connect to the existing irrigation supply lines.

1. The irrigation system zones control shall be automatic operation with controller and automatic control valves.

2. Irrigation system to provide 'head to head' coverage

3. Irrigation system shall fit the landscape conditions as completed as part of the contract work, bed edges, trees, plantings, groundcover, and turf areas shall covered by the irrigation system as appropriate for each planting type, as illustrated on the contract drawings.

4. Provide and install new irrigation system components. Re-use of removed or pre-used system components will NOT be acceptable.

5. The existing irrigation system in other zones of the landscape that are not affected by site improvements must be maintained as operational during the period of removal and reinstallation of the irrigation system of this work, unless otherwise approved in writing by the COR.

a. Protect and maintain existing irrigation supply lines, heads, value boxes, etc.

b. Provide operational valves where new irrigation pipe is connected to existing irrigation piping to remain.

B. Irrigation System Delegated Design and Layout: Design 100 percent coverage irrigation system including comprehensive engineering analysis by a qualified engineer. The Contractor shall work from plans and operational criteria herein to provide the final Irrigation System Design for full coverage of

the areas indicated as the project area, including analysis by a qualified professional irrigation contractor, using performance requirements and design criteria indicated.

1. System shall be compatible with the existing system and controls.
2. System shall be designed to work with existing service water pressure. Operation of system pressure shall take into account operation of the irrigation overall irrigation system existing and that are not part of the current project.
3. System Design shall be reviewed and accepted by COR. Contractor to make adjustments as directed.

1.5 ACTION SUBMITTALS

A. Product Data: Provide Catalog Cuts and Data Sheets for the following equipment and materials:
   1. Flow Sensors and Digital read-outs.
   2. Sprinkler Heads, all types and sizes.
   3. Remote Control Valves (RCV).
   4. Quick-coupling Valves (QCV).
   5. Manual Valves, all types and sizes.
   6. Valve Boxes and Splice Boxes, all types and sizes.
   7. Ductile Iron (DI) Fittings and restraint system.
   8. PVC Pipe and Fittings.
   9. Low Voltage Control Wire.
   10. Below-ground Electrical Splice Materials and Methods for fully waterproof connections.
   11. PVC Conduit and Fittings.
   12. Valve Tags and Valve Tag Schedule - interior valves.
   13. Submittals at project close-out:
      a. Refer to Section 01 77 00.
      b. Record Drawings: Record actual locations of all concealed components of system giving dimensions from two permanent monuments and depth of bury.

B. Shop Drawings: Provide layout and details of proposed irrigation system to address the areas of project work in a comprehensive drawing, showing new and existing irrigation system components to remain. Drawing shall include and not be limited to:
   1. Overall layout and design
   2. System details and installation
   3. Valves, sprinkler heads, piping, components, etc.
   4. Operational controls, electrical and wiring diagrams

C. Installers Qualifying Data:

   1. Provide list of previous successful project work. Include contact information for each project.
      a. Provide Installer must be able to be on site within one hour with experienced staff to address any urgent issue(s).
      b. Installer must be certified to work on approved irrigation systems.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 20 years' experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable codes for electrical and piping requirements.

B. Controllers and controller enclosure: UL Listed.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide new materials conforming to applicable standard(s).

B. All parts must be fully compatible with existing system components and flow rates.

C. Provide most recent model of manufacturers' products unless "or equal" appears, in which case Contractor may submit substitution for consideration.

2.2 SYSTEM EQUIPMENT

A. All parts must be fully compatible with existing system components and flow rates.

B. Components:
   1. Sprinkler Heads:
      a. Match existing system heads or equivalent.
   2. RCVs: Automatic Control Valves
      a. Match existing system heads or equivalent.
   3. Manual Valves: Use
      a. Match existing system heads or equivalent.
   4. Valve and Splice Boxes:
      a. Jumbo Boxes
      b. 12" circle valve boxes
      c. Or equivalent.
   5. Boiler drain valves
   6. Back flow preventer

C. Other Materials
   1. SCH 80 PVC pipe
   2. SCH 80 PVC fittings
   3. Quick Connectors
   4. Solder wire connections
   5. Wire nuts
   6. Waterproof gel caps for wire connections
   7. Swing joints

8. Funny Pipe
9. Supplemental sprinkler heads/emitters
   a. Match existing system components or equivalent.

PART 3 EXECUTION

3.1 GENERAL

A. Install equipment and materials in accordance with Manufacturers' recommendations unless otherwise indicated/directed.

B Contact local services for locating below grade utilities and services prior to excavation operations.

C. Make field measurements for Work noting relationship of irrigation Work to existing and new work of other trades. Coordinate with other trades (landscaping, paving, electrical, and other site trades). Make field adjustments for variations in trees, pavements, critical tree root-zone areas, and interference with new and existing utilities as approved by the COR.

D. Stake routing of mainlines and wiring, lateral piping, sprinkler heads, and valve boxes. Review intended routing and locations with COR. Re-routing may be required due to proximity to existing utilities, critical tree root zone areas, and other features.

E. All electrical connections and splice materials shall be soldered and placed in waterproof jackets as approved by the COR.

F. Conduct installation so as to protect new and existing landscaping, site electric, drainage systems, paving, structures, walls, footings and foundations, waterproofing, and other work, and utilities, from damage. Report damage to work of other trade(s) to COR immediately. Make or arrange repairs to satisfaction of COR.

3.2 EXCAVATION, BACKFILL, AND PIPE INSTALLATION

A. Comply with Section 31 20 00 Earth Work.

B. Stake locations of pedestrian and vehicular pavement crossings and review with COR. Unless otherwise agreed or directed, accomplish pavement crossings by Horizontal Direct Drilling (HDD) method. Engage qualified sub-contractor to perform HDD work. Install sleeving, with solvent-weld joints, at 30" cover from pavement to top of sleeve. For mainline crossings, either oversize sleeves or provide separate 4" sleeve for control wires.

C. For installation of piping and wiring, excavate with minimum-width trencher chain, or bucket, if to be installed in common trench with Domestic Water piping. Depths of bury as follows: Mainlines: 30"; Laterals: 24", unless directed otherwise in critical root zone areas and to avoid existing utilities. Excavate to a depth of within 1" of pipe invert, provided a suitable base, i.e., no sharp edges or rocks over 1" in diameter, is available. If not, excavate to 1" below invert and provide sand base or clean select fill from trenching spoils on which to lay pipe. Where common trench is shared by more than one pipe, ensure minimum 12" soil separates pipes. Pipes shall at no time be backfilled in contact with one another.

D. Install detectable underground warning tape on pipes prior to backfill for future locating purposes.

E. Critical root zone areas: Following staking review, re-routing, shallower depth-of-bury or "air-spade" trenching may be required.

F. Cut plastic pipe square and true with hand saw or pipe-cutting tool. Remove burrs at cut ends.

1. Gasketed joints: Make in accordance with manufacturer's recommendations relating to lubrication and insertion of gaskets and male ends. Ensure gaskets are properly seated and have not "rolled" during installation.

   a. Form and pour concrete thrust-blocking in accordance with ASAE recommendations where needed or indicated. See Details on Drawings. It is the intention of the Documents to rely primarily on the joint restraint system and to provide minimal concrete thrust blocking. Confer with DI Fitting manufacturer's representative relating to installation of joint restraints.

2. Solvent-weld joints: Make in accordance with manufacturer's recommendations relating to preparation, temperature, humidity, and cure-time. Make certain not to apply an excess of primer or solvent, and wipe excess solvent from each made connection. Allow connections to set as recommended before assembly is moved or pressure is applied to system.

G. Ensure no stress to piping bells and fitting shoulders at interface with trench bottom. Keep open ends of piping covered or capped to inhibit entry of dirt and debris.

H. Valve wiring: Install in PVC conduit. Lay in same trench, and at same invert, as mainline.

3.3 VALVE INSTALLATION

A. Automatic valves: Set in valve boxes with adjusting handle and solenoid vertical-up. Provide line-size isolation ball valve at inlet of each zone valve or cluster of zone valves. Wiring shall be of sufficient length to permit solenoid to be brought to surface. Coil extra wire neatly in valve box. Provide filter fabric and 4" washed gravel under each valve box. Bring gravel up to pipe invert. Do not cover components with gravel. Use D.I. side-outlet service tee so as to maintain 30" depth-of-bury for laterals. NOTE: each valve is to have a separate power wire "home run" to Controller. "Linking" of valves, if indicated, shall be done at Controller. Bring SPARE wires into each valve box as they pass through, twist together, cinch, and tag "SPARE". Conduit shall terminate within valve boxes. Install Valve Tag with chain attached to each valve. Install matching Valve Tag permanently fixed by screws to the top of the lid for the corresponding valve box.

B. Manual drain valves: Install at low points of system. Connect discharge piping to existing inlets or drain piping.

C. Quick-Coupling Valves: Install on prefabricated three-ell SCH-80 swing joint in 10" diameter valve box set to finish grade.

3.4 SPRINKLER INSTALLATION

A. Turf heads: Set to finish grade at coordinates indicated. Maintain 4” clearance from side of sprinkler cap to nearest hardscape. Reset sprinklers to finish grade during warranty period if necessary. See flushing requirements below.

B. Heads in mulch areas: Set cap 1” above grade. i.e., within mulch area. Maintain 4” clearance from side of sprinkler cap to nearest hardscape or locate within first row of plant material, up to 12” from nearest hardscape. Reset sprinklers to finish grade during warranty period if necessary. See flushing requirements below.

C. Rigid risers above grade not permitted unless specifically directed.

D. Sprinkler system shall provide head-to-head coverage.

E. Irrigation system layout measurements shall be field confirmed as shown on plan drawing. Where irrigation system deviates from plan, as-built drawings shall be provided.

3.5 START-UP AND ADJUST OPERATIONS

A. Leak Test: Flush, cap, and test mainlines for leaks: Test Pressure: 150 PSI; Time: 2 hrs. Repair leaks and re-test until satisfactory results obtained. Provide pump and necessary equipment to accomplish testing. Mainlines may be tested in sections at Contractor option. Laterals: Test at operating pressure. Backfilling may be done prior to testing at Contractor option, and in any event, trenches are to be backfilled at end of each workday unless otherwise directed by COR.

B. Flushing: After piping, valves and sprinkler bodies are in place and connected, but prior to installation of sprinkler internals, flush piping under full head of water until discharge runs clear and clean. Install internals and proceed to adjust system.

C. Adjustment: Adjust sprinkler heads for optimum performance and to prevent over-spray onto walks, pavement, and structures. Adjustments may include changes in nozzle sizes, and/or degrees of arc, and/or distance of throw. Overthrow onto walks and buildings is not permissible. Set/adjust sprinkler heads perpendicular to finish grade unless shown or directed otherwise.

D. Coverage Test: Perform coverage test in presence of COR. Coordinate coverage test/walk-through with COR. COR will determine if water coverage is complete and adequate. Re-adjust heads or head locations as necessary to or directed to achieve proper coverage.

3.6 CLEAN UP

A. Following completion of installation work, remove leftover materials and equipment from site and dispose of in safe and legal manner. Re-tamp work areas, replace sod and mulch, and broom-clean and hose-off pavements.

B. Leave site in at least as neat and clean condition as when irrigation installation was begun.

END OF SECTION 33 28 11

SECTION 32 91 15 – SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing subgrades for placement of planting/lawn soil
2. Excavating for planting of trees, shrubs and turf.
3. Testing and approvals for planting/lawn soil
4. Placing, spreading and compaction of planting/lawn soil

1.2 DEFINITIONS

A. Planting/Lawn Soil: Satisfactory Sandy Clay Loam soil for use as fill or backfill mixed on-site with natural soil and soils amendments or imported from off-site and amended to match soil specification herein.

B. Backfill: Approved sand, soil or gravel material used to fill an excavation. See Section 31 20 00 – Earth Moving.

C. Humus for Soil Amendment as required: Composted Pine Bark fines, material shall range in size from 0.1 mm – 15 mm, have a dark brown to black color and be free of wood particles for organic humus matter composted to meet specified soil composition. To be added as required to achieve specified % using fully composted pine bark that is weed free to match approved sample.

D. Excavation: Removal of materials to accommodate specified soil fill above subgrade elevations and to grades, lines and dimensions indicated. See Section 02300 – Earth Moving.

E. Fill: Planting/lawn soil materials used to fill utility trenches and other excavations to final grades.

F. Final Grade: Finished surface elevation to match grading plan(s) and spot elevation(s) or surrounding undisturbed grades.

G. Grubbing: Removal of surface turf and vegetation to shallow subgrade to receive planting/lawn soil for fine grading operations.

H. pH Modification Materials for Soil Amendment: To increase pH if below desired range apply Standard Dolomitic Liming Material, minimum 36% magnesium carbonate passing 100% through a standard No. 20 sieve and retaining 25% passing a No. 100 sieve. To decrease pH if it is above desired range Iron Sulfate or Aluminum Sulfate. Amend soils as required for pH adjustment. Retest for target of 6.0 to 7.0 pH range by area as determined, amending until target pH range is achieved.

I. Sand for Soil Amendment as required based on test results:

1. Very Coarse Sand: Sharp sand with particle size from 1.0 mm to 2.0 mm particle size and neutral pH to match approved sample.
2. Coarse Sand: Sharp sand with particle size from .5 mm to 1.0 mm particle size and neutral pH to match approved sample.
3. Medium Sand: Sharp sand with particle size from .25 mm to .5 mm particle size and neutral pH to match approved sample.
4. Fine Washed Sand: Sand with particle size from .10 to .25 mm particle size and neutral pH to match approved sample.

J. Small Gravel for Soil Amendments as required based on test results: Sharp gravel with particle size from 2 mm to 12.5 mm (1/2 inch) particle size and neutral pH to match approved sample for soil amendment as required to meet percolation specification.

K. Subgrade: Surface of elevation after completing excavation backfill that may be specified, top surface on which planting/lawn soil is placed. Level reached after excavation to specified depth, or removal to undisturbed subsoil as a prepared and approved surface to place planting/lawn soil.

L. Subsoil: Soil removed below topsoil to the required depth of excavation and stockpiled as directed by Government's Representative or disposed of offsite. See Section 31 20 00 Earth Moving.

M. Topsoil: Soil removed from surface to an average depth of 4 inches from the construction site and stockpiled with erosion control as directed by Government's Representative. See Section 31 20 00 Earth Moving.

N. Utility Trench: Excavation for the installation of on-site underground pipes, drains, conduits, ducts, and cables that is to receive planting/lawn soil above approved backfill to subgrade level. See Section 31200 Earth Moving.

1.3 SUBMITTALS

A. Product Data for the following:

1. Complete Physical Planting/Lawn Soil Test results for stockpiled topsoil and subsoil, and for proposed planting/lawn soil prior to amendments.
2. Test results with particle sizes to include:

   a. Sand, all sizes
   b. Small Gravel
   c. Standard Dolomitic Liming material to increase pH
   d. Iron Sulfate or Aluminum Sulfate to lower pH
   e. Composted Pine Bark for Humus

B. Samples: Planting/lawn soil to be provided as samples in the following samples sizes. All samples to be accompanied by test results. All soil and amendment testing costs to be paid by Contractor.

1. One (1) five (5) gallon (1155 cubic inches) sample of each soil proposed as planting/lawn soil to be sent to the soil testing lab for complete physical analysis.

2. Three (3) samples to be one (1) gallon (231 cubic inches) in separate packages for distribution with testing results as follows:

    a. Sent to project Contracting Officer's Representative for review and approval.
    b. Retained on site for comparison to bulk materials provided
    c. Retained in original packaging as reference sample to transfer to client at close of project.

C. Material Test Reports: From a qualified soil testing agency indicating and interpreting test results for soil testing of samples of proposed soils materials to be installed as planting/lawn soil and representative samples of stockpiled topsoil and subsoil. Detailed soil tests are to include complete physical analysis to include:

1. Nutrients, N, P, K Mg, Ca
2. Soluble salts
3. Sodium
4. Percent organic materials:

    a. pH
    b. CEC-cation exchange capacity
    c. Soil texture - % sand, silt, clay and classification
    d. Particle sizes
    e. Sand fractions – sand classifications
    f. Bulk Density
    g. Infiltration/percolation rate

5. Proctor test for compaction characteristics according to Standard Compaction Effort ASTM D 698-91 for stockpiled soil and each planting/lawn soil material.
6. Solvita ™ Compost Maturity test for composted materials. Composition for organic compost to determine presence and parts per million concentration of any pollutants.
7. The submittal process for all soil types, and soil amendment components and amended soils shall begin a minimum of eight weeks prior to the scheduled date of soil installation work. The contractor shall make best efforts to conclude the soil testing and approval process four weeks prior to the scheduled date of soil installation.

D. Construction Means and Methods: Written method, machinery and sequence for placing of planting/lawn soils in area as indicated on the layout, grading and planting plans. Submit for review and approval. Modify until approved.

E. Soils Testing Laboratory: Information regarding the testing agency qualifications for testing of soils. Information to be reviewed for ability to perform types and testing of soils as outlined in these specifications.

1.4 QUALITY ASSURANCE

A. Soil and Soil Amendments Testing Agency Qualifications: An independent testing agency qualified according to the ASTM E 329 testing required, to conduct soil amendment materials testing, to include ASTM-D698-91 Proctor test as documented according to ASTM D 3740 and ASTM E 548.

1. The testing agency shall be experienced in the soil testing protocols and specialize in the testing of turf and landscape soil. The testing agency shall be approved by the Contracting Officer.
2. Testing methods shall comply with the USDA standard format for testing results computation in English measure units.
3. Testing of planting/lawn soil shall be performed by the following or equal testing agency approved in advance by the Contracting Officer:

CLC Labs 325 Venture Drive Westerville, Ohio 43081 614 888 1663	or	Hummel & Co., Inc 35 King Street Trumansburg, NY 14886 607 387 5694

B. Pre-Soil Placement Conference: Conduct conference at Project site to review Construction Means and Methods plan with Contracting Officer and Government and adjust based on direction received.

1.5 PROJECT CONDITIONS

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

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

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

1. Do not proceed with work on adjoining property until directed by Contracting Officer's Representative.

C. Utility Locator Service: Notify "*Miss Utility"* for area where Project is located before beginning earth moving operations.

D. Do not commence soil placement operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section 31 10 00 Site Clearing, are in place.

E. Do not commence soil placement operations until plant-protection measures specified in Division 01 Section 01 56 39 Temporary Tree and Plant Protection are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.

6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

Planting/Lawn soil: Planting/lawn soil will be Sandy Clay Loam natural topsoil with amendments, topsoil that meets the specifications, or an amended natural sandy clay loam with granular materials and composted pine fines, and pH adjustment additions homogeneously mixed to meet the specifications. Planting/lawn soil is to be free from subsoil, refuse, roots larger than one inch in diameter, stiff or clumped clay, stones larger than 1 inch, noxious seeds, sticks, brush, litter, and other deleterious substances. Planting/lawn soil is to be suitable for the germination of seeds and the support of turf and plant growth.

1. Planting/lawn soil shall have the following characteristics:

   a. Nutrients, N, P, K Mg, and Ca: at normal ranges for lawns and planting specified.
   b. Soluble salts: less than 4 mmho/cm
   c. PH: adjusted to be between 6.0 and 7.0
   d. CEC-cation exchange capacity: above 8
   e. Soil texture - % Particle sizes with total gravel, sand, silt and clay classifications as follows for sandy loam soil with the following approximate mineral soil distribution:
      - 60% Overall sand and gravel in the approximate percentages of particle sizes to include 5-10% Gravel, 55-60% Coarse to medium sand, 10-15% Fine sand, 5-10% Very fine sand
      - 10% Silt
      - 20% Clay
   f. Bulk Density: between 1.3 and 1.45 mg/m^3 with sample compacted to 80% of maximum dry density.
   g. Infiltration/percolation rate: 2 inches per hour or greater with sample compacted to 80% of maximum dry density.
   h. Target pH 6.0 to 7.0.
   i. Percent organic materials: to reach 10% to 12% humus by volume
   j. Soil Salinity, by electrical conductivity measurement, not to exceed 3 millionhms per centimeter at 25 degrees, C as determined by the saturated soil test method described in USDA Circular No. 982.
   k. Soil Fertility: “High” in natural nutrients based on the coordinated ratings in pounds per acre as established by the National Soil and Fertilizer Research Committee.

2.2 SOIL AMENDMENTS

A. Blend of sands and gravels or selected sizes based on test results of on-site soils and off-site soils proposed for use as planting/lawn soil.

B. Humus added in composted pine bark fines material shall size 0.1 mm – 15, have a dark brown to black color and be free of wood particles.

C. PH modifying materials to decrease or increase pH.

D. Screened Compost: ”James River Blends Organic Compost” as available through Environmental Solutions, Inc., 2423B Grenoble Road, Richmond, VA, 23294, (804) 672-7570, "Com-PRO Agricultural Compost" as available through Maryland Environmental Services, 2020 Industrial Drive, Annapolis, MD 21401 (301/261-8596) completely composted and free from all extraneous materials such as glass, paper, plastics, etc.

E. Screened Leaf Mold: As available from Maryland Environmental Services, 2020 Industrial Drive, Annapolis, MD 21401 (301/261-8596) or as acceptable to the COR, completely composted and free from all extraneous materials such as glass, paper, plastics, etc.

F. Imported Topsoil for use in mixing Lawn/Planting Soil: Natural friable, fertile loam, possessing characteristics of the best soils of the vicinity, containing at least 2% organic matter, which produces a heavy growth of crops, grass and other vegetation. Reasonably free from subsoil, clay lumps, stones, stumps, roots, or similar objects larger than 1/2" in diameter, brush, weeds, Bermuda grass, litter, toxic substances, or other material harmful to plant growth or hindering grading, planting, or maintenance operations.

G. Upon the approval of the soil amendments, blend soil amendments in ratios as directed in sample of planting/lawn soil. Resulting mix of soil and amendments should yield planting/lawn soil. Clearly identify sample batches of mixed soil by the ratio of each component in the mix. Submit 1 gallon sample for review and approval.

H. Upon approval of the amended soil the planting/lawn soil required for the Work shall be prepared and homogeneously blended at the planting/lawn soil mixing location utilizing soil blending equipment sufficient to prepare material that is consistent in its component ratio, well blended and screened of clods, sticks and other debris. Any material required to adjust soil nutrient or pH levels shall be added to the soil at the time of final soil mixing.

I. Planting/lawn soil or soil amendments shall not be harvested, disturbed, transported, mixed or installed when the soil moisture content is such that the soil is not friable. Soils are considered friable when they are dry enough to easily crumble when dug, but not so dry that clods cannot be easily broken, and not so wet that soil leaves mud on the hand when squeezed

2.3 EQUIPMENT

A. All equipment utilized to install or grade soil/fill shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6-inch-long teeth to scarify any soil that becomes compacted.

B. Soil Ripping Equipment: Shall be a tract-type tractor equipped with a rear, multi-blade ripper attachment.

C. Ripper Grader: Shall be large, curved static rear shanks, depth is controlled by the tractor arm. Caterpillar D series or similar, with not less than 3 ripper bars spaced at 24 inches to 30 inches apart.

D. Soil Tilling Equipment: Shall be a tract-type tractor equipped with a rear, multi-blade tilling attachment.

E. Machine Tillage Equipment shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. Equipment shall have buckets equipped with 6-inch-long teeth to scarify any soil that becomes compacted.

F. Rock Picker: Shall be balloon tire, with arm attachment for use with tract-type tractor. Equipment shall be calibrated to remove stones and debris 6 inches and larger in any direction.

PART 3 - EXECUTION

3.1 PREPARATION

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

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

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

3.2 STORAGE OF SOIL MATERIALS

A. Stockpile and store topsoil, planting/lawn soil, in contained areas. Obtain materials directly in advance of need with sufficient time for inspection and testing and amendment of bulk materials to conform to specifications. Place, grade, and shape stockpiles to drain surface water. See Section 31 20 00 Earth Moving.

B. Protect all soil stockpiles, soil amendments and finished planting/lawn soils from damage, erosion and separation of mixes by water. Cover all stockpiles with non-woven filter cloth. Do not cover soils with plastic. See Earth Moving for stockpiling instructions.

3.3 EXCAVATION, GENERAL

A. Excavation for Lawn and Planting Work: Excavate to prepare subgrade as required to receive planting/lawn soils. Excavation includes removal of materials to specified depth for each soil area. Excavate to specified dimension below final elevation of grade to receive lawn or to final grade for tree planting and shrub planting bed.

1. Earth excavation includes removal of foreign materials, rock, debris, other objects that would obstruct installation of planting/lawn soils in areas as designated for sod and groundcover and other items indicated to be removed; together with soil, boulders, and other materials.

2. Tree and shrub excavations to conform to profiles, minimum depths and measurements in areas as shown the drawings and indicated final grades.

   a. For tree planting in lawn and bed areas not less than 30 inches.
   b. For tree planting in tree pits at sidewalks, not less than 30 inches.

c. For shrub beds, not less than 24 inches for indicated bed area.
d. For bare root trees planted in non-disturbed planting areas, to depth of root flare, but not less than 24 inches.
e. For groundcover and herbaceous plantings not less than 18 inches.

3.4 PLANTING/LAWN SOIL SUBGRADE PREPARATION AND SOIL FILL

A. Subgrade is to be prepared and approved in advance of placement of soils.

B. Notify Contracting Officer' Representative when subgrade is prepared for planting/lawn soil installation.

C. If Contracting Officer' Representative determines that unsatisfactory subgrade conditions, soil or other materials are present, continue removal and replace with approved fill material or planting/lawn soil as directed.

D. Place planting/lawn soil in accordance with these specifications, details of contract drawings for areas of lawn, tree and shrub, planting and to establish final grades, and not limited to the following:

1. Areas within tree protection: After removal of all temporary bark mulch. Rake to scarify. Remove vegetation. Topdress with planting/lawn soil at an average of 1-inch depth. Fill surface depressions to create smooth continuous surface grade with positive drainage pattern.
2. Areas below former structures or pavements and contaminated by construction activity: Excavate to required depths to reach undisturbed subgrade. Fill excavations with planting/lawn soils and compact to 85% relative density.
3. For all fill areas fine grade by raking smooth for continuous grades without irregularities.
4. Central Green lawn panel and formalized planting at either perimeter
5. Parking area isle tree, and tree and planting
6. Tree planting in lawn areas
7. Shrub planting beds
8. See also Division 32 Section 32 93 00 PLANTS and Section 32 92 00 TURF AND GRASSES.

E. Do not place planting/lawn soils or imported soils when planting within the flagged wetlands areas unless otherwise directed by the Government's Representative:

3.5 SOIL MOISTURE CONTROL

A. Uniformly moisten planting/lawn soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place soil material if soil is excessively wet/muddy, frozen, or contains frost or ice.
2. Grading, compacting and handling of all subgrade and planting/lawn soil material shall occur only at times when the soil is friable. Soils are considered friable when they are dry enough to easily crumble when dug, but not so dry that clods cannot be easily broken, and not so wet that soil leaves mud on the hand when squeezed. Suspend operations

during and after any rain until such time as the subgrade or planting/lawn soil material dries sufficiently to become friable.

3.6 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place Planting/Lawn soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by hand-operated tampers.

B. Place Planting/Lawn soil materials evenly in turf or planting area to required elevations, and uniformly along the full length of each structure.

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

1. For turf and planting beds, compact each layer of initial and final backfill soil material at 85 percent. Avoid excessive, irregular settling.
2. Compaction testing to be undertaken at regular intervals during placement and compaction operations and as acceptable to the COR.

3.7 GRADING

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

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. See Specification Sections 32 92 00 Plants and 32 93 00 Lawns.

B. FINAL GRADING

1. Prior to fine grading, planting and seeding operations, examine site to confirm that existing conditions are satisfactory for the work to proceed.
   a. Confirm that the rough final grade is at the proper elevation and compacted as required. Finish grade elevations shall sloped at no less than 2 percent gradient for positive surface drainage. Make any required adjustments prior to proceeding with fine grading and planting, seeding operations.
2. If unsatisfactory conditions are encountered, notify the COR immediately to determine corrective action before proceeding.
3. Do not proceed with fine grading operations if soils are wet or frozen.
4. Grade the finish surface to meet the grades shown on the drawings, allowing the finished grades to remain one (1) inch higher than the grades on the grading plan to anticipate settlement over the first year.
5. Utilize equipment approved by the COR such as small garden tractors with rakes or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction.
   a. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.

6. Provide for positive drainage from all areas toward the existing inlets and drainage swale. Adjust grades as directed to reflect field conditions and elevations. Notify the COR for direction on how to take corrective measures to ensure positive drainage.
7. Provide smooth, rounded transitions between slopes of different gradients and direction.
8. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in seeded areas shall be a 1-inch deviation from the plane in 1 feet.]
9. Following review and acceptance by the COR of finish grades, proceed with planting and seeding operations.

3.8 PROTECTION

A. Protecting Graded Areas: Protect newly installed planting/lawn soil from physical disgorging, freezing, erosion and contamination from other site materials or use of site by other trades. Keep free of trash and debris.

B. Repair and reestablish planting/lawn soils in pockets to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Remove and replace material to depth as directed by Contracting Officer' Representative and reshape and secure.

C. Where settling or dislodgment occurs before project correction period elapses, remove finished surfacing, backfill with additional planting/lawn soil material, compact, and reconstruct surfacing.

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

3.9 SOIL MOISTURE CONTROL

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

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

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Government's property.

B. Disposal: Transport surplus satisfactory soil to designated Government storage area off site. Stockpile or spread soil as directed by Government's Representative. Remove waste material,

including unsatisfactory soil, trash, and debris, and legally dispose of it off Government's property.

END OF SECTION 32 91 15

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hydroseeding of turf areas
2. Sodding
3. Turf renovation, repair areas

1.2 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. Manufactured 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. See Specification Section 32 9100 Soil for planting/topsoil requirements.

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.

1.3 ACTION SUBMITTALS

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

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
2. Hydro-Seeding Mix: include product label, materials composition and manufacturer's application instructions specific to this project.

1.4 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass. Include identification of source and name and telephone number of supplier.
2. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.
3. Turfgrass Grower/ Nursery, source information and location for sod production.

B. Qualification Data: For qualified landscape Installer.

C. Product Certificates: For fertilizers, from manufacturer.

D. Material Test Reports: For lawn planting soil as indicted in specification Section 32 1000 Soils

E. Maintenance Instructions: Recommended procedures to be established by Government for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

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: Ten (10) years' experience in turf 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. Personnel Certifications: Installer's field supervisor assigned to the Work shall have certification in all of the following categories from the Professional Landcare Network:

a. Certified Landscape Technician - Exterior, with installation and maintenance of irrigation specialty area(s), designated CLT-Exterior.
b. Certified Turfgrass Professional, designated CTP.

5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
6. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications:

1. See Section 32 91 00 Soils as part of these project documents for lawn planting soil.

C. Soil Analysis:

1. See Section 32 91 00 Soils as part of these project documents for lawn planting soil.

D. Preinstallation Conference: Conduct conference at Project site or other location as determined by the Contracting Officer.

1.6 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. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

A. Planting Restrictions: Coordinate planting periods with phased construction sequencing and site availability. Begin initial maintenance periods to provide required maintenance from date of planting installation.

1. Make arrangements to have sod finished upon completion construction operations for phased work.

a. Arrangements may include obtaining and holding sod for installation during off season periods for sod installation and maintenance, including winter and mid to late summer.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1. Work within project scheduled sod installation dates for providing, installing and maintaining sod materials.

1.8 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Sodded Turf: 60 days from date of planting completion.

2. Seeded Turf: 90 days from date of planting completion

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

A. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Sod:

1. Machine cut at uniform soil thickness of 3/4"(+-1/4") excluding top growth and thatch. Cut individual pieces at least 12" wide and of length such that each piece is at least 1/2 sq. yd. Maximum allowable deviation from standard width is 5%.
2. Broken pieces and torn or uneven ends will not be accepted. Each piece of sod must be strong enough to support its own weight and retain its size and shape when suspended vertically from a firm grasp on the upper 10% of the piece.
3. Each load of "Certified Sod" or Certified Turf" shall be accompanied by, in the same vehicle, an official certification label and that label must be attached to a dated invoice, bill of lading or labeling information document.

C. Certified Turfgrass Sod:

1. Sod to be a tall fescue blend of 90% tall fescue and 10% Kentucky Bluegrass.
2. A certified tag must accompany sod for NPS approval. The sod is not to be netted. Only non-netted sod will be accepted.
3. Obtain prior approval of grower/source from Contracting Officer’s Representative.

2.2 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; 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. Sun and Partial Shade: Proportioned by weight as follows:
   a. 10 percent Kentucky bluegrass (Poa pratensis).
   b. 80 percent Tall fescue (Festuca variety).
   c. 10 percent perennial ryegrass (Lolium perenne).

2. National Park Services will review and modify seed mix selection for final approval:

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, Mix of 10-10-10-grade FS)-F-241, containing 10% nitrogen, 10% phosphoric acid and 10% potash, uniform in composition, dry and free flowing material suitable for application by a common fertilizer distributer or other as accepted by COR.

2.5 PLANTING SOILS

A. Planting Soil:
   1. See Section 32 10 00 Soils as part of these project documents for lawn planting soil.

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 MULCH FOR HYDROSEEDING

A. Fiber Mulch: Bio 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. f

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
   3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Contracting Officer's Representative and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches (150 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 Government's property.

1. Spread Lawn soil to a depth of 6 inches (150 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

    a. Loosen sub grade to 6 inches (150mm) in advance of placing lawn/planting soil. Remove stones or debris 1 inch dia. and larger and dispose of off site.
    b. Spread approximately 2 inches (50 mm) thickness of lawn/planting soil over loosened subgrade. Mix thoroughly into top 4 inches (100 mm) of subgrade. Spread remainder of planting soil.
    c. Place lawn/planting soil to the finish grade anticipate settlement for seeding operations
    d. Anticipate finish elevation of lawn/planting soil to allow for soil thickness of sod.
        1) Allow for sod to be ½ below adjacent pavements

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least 8 inches (200 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches (150 mm) of soil. Till soil to a homogeneous mixture of fine texture.
3. Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, trash, and other extraneous matter.

4. Legally dispose of waste material, including grass, vegetation, and turf, off Government's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Contracting Officer's Representative acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.5 HYDROSEEDING FOR TURF LAWN

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch at manufacturer's recommended mixture ratio.
2. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply slurry from two opposite directions to ensure even coverage within celled pavement structures. Apply first slurry coat at a rate so that mulch component is deposited at not less than 1000-lb/acre (10.4-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply second slurry cover coat of fiber mulch (hydromulching from the opposite direction) at a rate of 500 lb/acre (5.2 kg/92.9 sq. m.

3.6 TURF RENOVATION

A. Renovate existing turf where indicated, and as needed to blend new grading with existing grades on site.

B. Renovate existing 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. Remove turf in a module that corresponds to turfgrass sod replacement sections. Replace sufficient area that will achieve a successful and non-apparent turf recovery area. Seeding of areas damaged or unsatisfactory turf is not acceptable.
3. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. 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.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Government'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 fertilizers 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.

J. hydroseed or sod as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.7 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and re-plant with turfgrass sod, bare or eroded areas to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow turf grass to a height of 1-1/2 to 2 inches (38 to 50 mm).

D. Turf Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Contracting Officer's Representative:

1. Satisfactory Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
2. Satisfactory seeded areas shall have not less than 85% coverage of specified turf seed species.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

1. Contractor shall overseed using satisfactory methods to scarify/slice/or otherwise prepare areas to be overseed.
2. Overseeding methods to be approved by the Contracting Officer's Representative.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Government's operations and others in proximity to the Work. Notify Government before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants, trees, shrubs, groundcovers.
2. Tree stabilization.

1.2 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 diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Container and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil. SEE soil specifications Section 32 9100 SOIL.

I. 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.

J. 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.

K. Planting Area: Areas to be planted.

L. 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. SEE soils specification section 32 9100 SOIL.

M. 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.

N. 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.

O. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

P. 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.

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

R. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
3. Plant Photographs: Include color photographs in digital format (high resolution), of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than twenty (20) plants are required, include a minimum of six (6) 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. Trees, Shrubs and Herbaceous material : Three samples of each variety and size delivered to the site for review. Maintain approved samples on-site as a standard for comparison.
2. Organic Mulch: 1-quart 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.
3. Root Barrier: Width of panel by 12 inches (300 mm).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of Governments' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
1. Certification from Nursery sources on plant materials for genus species and varieties as specified.
2. Manufacturer's certified analysis of standard products.
3. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation 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. Personnel Certifications: Installer's field supervisor shall have certification in one of all of the following categories from the Professional Landcare Network:

   a. Certified Landscape Technician - Exterior, with installation & maintenance irrigation specialty area(s), designated CLT-Exterior.
   b. Certified Landscape Technician - Interior, designated CLT-Interior.
   c. Certified Ornamental Landscape Professional, designated COLP.

5. Pesticide Applicator: State licensed, commercial.

B. Landscape Nursery/Suppliers: Qualifications

1. Professional Membership: suppliers shall be a member in good standing with the American Nurseryman Association.
2. Experience: 15 years' experience in production of certified nursery stock.
3. General information on nursery location(s), facilities, principals and staff
4.

C. Soil-Testing Laboratory Qualifications: See Specifications Section 32 9100 Soils

D. Soil Analysis: See Section 32 9100 Soils

E. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1. Selection of plants purchased under allowances will be made by Contracting Officer's Representative, and/or their designee, who will tag plants at their place of growth before they are prepared for transplanting.

F. 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.

G. Plant Material Observation: Contracting Officer's Representative may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Contracting Officer retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects 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 Contracting Officer's Representative of sources of planting materials in accordance with Quality Assurance measures herein.

2. Secure approval of plant material sources in advance of delivery to site. Material from non-approved sources will be rejected.

H. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.

F. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with soil, organic mulch, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Government unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify the Contracting Officer's Representative no fewer than two (2) days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Contracting Officer's Representative's written permission.

C. Planting Restrictions: Coordinate planting periods with construction operations and maintenance periods to provide required maintenance from date of Substantial Completion.

1. Planting operations are to be coordinated with overall project phasing and sequencing. There are eight (8) on-site project phases anticipated for this project. Project phases are subject to modification.

2. Planting is permissible ONLY in the period between:

   a. March 1st through June 30th
   b. September 15th through November 30th

3. Construction zone completed within a period when planting is not permissible shall have planting areas mulched and or sodded until the appropriate time.

4. Plant material and installation operations are to be undertaken and completed prior to the close out of each project work phase when they fall into the permissible planting period.

   a. Materials and/or installation operations un-able to be supplied or completed by the scheduled phased operation close out date are to be identified and approved by the Contracting Officer.

5. Plant materials are to be secured and made available for installation prior to each project phased completion date.

   a. Availability based on seasonal conditions, nursery supply restrictions and species with fall hazard dig periods are to be anticipated and materials made available for installation during the scheduled phased construction period.
   b. Plant material substitutions will not be allowed.
   c. Approval for material not provided and installed within the phased construction date and installed at a later date shall be approved in writing by the Contracting Officer and shall remain under the Contractor's warranty period as specified.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. 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.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

   1. Failures include, but are not limited to, the following:

      a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Government, or incidents that are beyond Contractor's control.
      b. Structural failures including plantings falling or blowing over.
      c. Faulty performance of tree stabilization

2. Warranty Periods from Date of Substantial Completion

   a. Trees, Shrubs, Vines, and Herbaceous Plants: Eighteen (18) months.
   b. Ground Covers, Biennials, Perennials, and Other Plants: Eighteen (18) 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 10 percent dead or in an unhealthy condition at the end of warranty period.
   c. Provide/extended warranty for period equal to original warranty period, for replaced plant material from the date of replacement.

1.9 MAINTENANCE SERVICE

A. Initial 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: Twelve (12) months from date of planting completion.

B. Initial 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: Six months from date of planting completion

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. Plant material is to be of the highest quality nursery stock.
   2. 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.
   3. 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 Contracting Officer, 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 each 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.

E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

1. Materials, including trees that are not matched in form and size will be rejected.

F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch (19-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

E. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

2.5 PLANTING SOILS

A. Planting Soil: See Specification Section 32 91 00 Soils for Planting Soil for use in planting the following:

1. Deciduous Trees
2. Evergreen Needle Trees
3. Broadleaf Evergreen Trees
4. Shrubs
5. Groundcovers
6. Herbaceous Materials

2.6 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Organic natural bark mulch:

   a. Shredded pine bark

2. Size Range: 2 inches (50mm) maximum, 1/2 inch (13 mm) minimum.
3. Color: Natural.

2.7 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.

2.8 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Guy Cables: 8 gage or heavier double stranded guy wire
2. Tree Stakes: To be selected and applied at the digression of the COR.
3. Arbor Ties: To be selected and applied at the digression of the COR.
4. Tree trunk guards: 1-inch black rubber guard.

2.9 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA C2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic;

including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.

B. 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.

C. Burlap: Non-synthetic, biodegradable.

D. 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.

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 Contracting Officer and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Contracting Officer's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Contracting Officer. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. 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.

F. 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.

3.3 PLANTING AREA ESTABLISHMENT

A. Shrub Planting Bed: Prepared Beds to a 24 inch depth minimum. Loosen subgrade of planting areas to a minimum depth of 6 inches (150 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 Government's property.

1. Spread planting soil to a depth of 4 inches (100 mm) but and mix into the top 4 inches (100 mm) of loosened sub soil.
2. Spread the remaining planting soil to a depth of 24 inches (600 mm) 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.

B. Ground Cover/Herbaceous Planting Bed: Prepare ground cover planting beds to a 18 inch depth. Loosen subgrade of planting areas 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 Government's property.

1. Spread planting soil to a depth of 4 inches (100 mm) and mix into the top 4 inches (100 mm) of loosened sub soil
2. Spread the remaining planting soil to a depth of 16 inches (450 mm) 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.

C. 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.

D. Before planting, obtain Contracting Officer's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES

A. Planting Pits and Trenches: Excavate square planting pits with vertical sides. 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. Tamp center area lightly to stabilize soil and prevent settlement.

1. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock. But Not Less than 5 foot square.

2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
3. If area under the tree was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
4. Maintain supervision of excavations during working hours.
5. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Subsoil and topsoil removed from excavations may not be used as planting soil.

1. See Specification Section: 32 91 00 Soils for planting soil specifications.

C. Obstructions: Notify Contracting Officer 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.

2. Obtain approval of Contracting Officer in writing before drilling and filling with drainage material.

D. Drainage: Notify Contracting Officer 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 EXCAVATION FOR SHRUBS

A. Planting Pits and Trenches: Excavate square planting pits with vertical sides. 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.

1. Comply with sections 3.3 A and B for planting bed preparation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
3. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
5. 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.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected after working hours.

B. Subsoil and topsoil removed from excavations may not be used as planting soil.

1. See Specification Section: 32 91 00 Soils for planting soil specifications.

C. Obstructions: Notify Contracting Officer if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Contracting Officer 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.

3.6 TREE AND SHRUB PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grades.

1. Use planting soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets IN THEIR ENTIRETY from root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. 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.

E. Set and support bare-root stock in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grade.

1. Use planting soil for backfill.

2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.
3. 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 soil-covered roots about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole or touching the roots.
4. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. 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.

3.7 TREE STABILIZATION

A. Staking and Guying: Stake and guy trees more than 10 feet in height and more than 2 inches in caliper unless otherwise indicated. Securely attach no fewer than two guys to stakes 30 inches long, driven to grade.

1. Secure approval in advance from COR for tree staking

3.8 GROUND COVER PLANTING

A. Fine grade areas for planting of ground cover materials.

B. Set out and space ground cover 9 inches (225 mm) apart in even rows with triangular spacing

C. Use planting soil for backfill.

D. For potted materials, loosen roots that are pot bound in a manner that will minimally disturb the roots but facilitate their growth outward into the planting soil.

E. 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.

F. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

G. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

H. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING AREA MULCHING

A. 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 minimum 24-inch (600-mm) radius around trunks or stems. Do not place mulch within 3 inches (75 mm) of trunks or stems.

2. Organic Mulch in Planting Areas: Apply 2-inch (50-mm) thickness of organic mulch 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 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 past 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.

3.11 PESTICIDE APPLICATION

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 Government's operations and others in proximity to the Work. Notify Government 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.

3.12 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.13 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Government's property.

END OF SECTION 32 93 00

SECTION 33 41 00 – SITE STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Drains.

1.2 DEFINITIONS

A. HDPE: High Density Polyethylene

B. PVC: Polyvinyl chloride plastic

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, provide manufacturer's standard data sheets describing components including materials, dimensions, relationship to adjacent construction, and attachments

B. Shop Drawings:

1. Yard drains. Include plans, elevations, sections, details, frames, covers, and grates.

C. Product Certificates: For each type of pipe and fitting, from manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic yard drains, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle products according to manufacturer's written instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Contracting Officer Representative or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Contracting Officer Representative no fewer than seven days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Contracting Officer Representative's written permission.

PART 2 - PRODUCTS

2.1 PLASTIC PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings DN75 to DN250 (NPS 3 to NPS 10): AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings DN300 to DN1500 (NPS 12 to NPS 60): AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

C. PVC Profile Sewer Piping:

1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

D. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, [**T-1**] [**T-2**] wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.2 CLEANOUTS

A. Plastic Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.3 ENGINEERED SURFACE DRAINAGE PRODUCTS (YARD DRAINS)

A. General:

1. PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications. The grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer.

B. Materials:

The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermoforming process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The ram material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.

The grates and frames furnished for all surface drainage inlets shall be ductile iron for structure sizes 8”, 10”, 12”, 15”, 18” 24”, 30” and 36” and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for drain basins shall be capable of supporting various wheel loads. Ductile iron used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05. Grates and covers shall be provided painted black, except where noted otherwise on the drawings.

C. Installation:

The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material the requirement of class 1, class 2, or class 3 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be well placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height. For load rated installations, a concrete slab shall be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations such as migration of fines, groundwater, and soft foundations refer to ASTM D2321 guidelines.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. Install gravity-flow, non-pressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping 6 inches and larger with restrained joints at tee fittings and at changes in direction.
3. Install piping with 3 feet minimum cover or as indicated on drawings.
4. Install PE corrugated sewer piping according to ASTM D 2321.

3.2 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure drainage piping according to the following:

1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
2. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
3. Join dissimilar pipe materials with non-pressure-type flexible couplings.

3.3 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.4 CONNECTIONS

A. Connect force-main piping to building's storm drainage force mains specified in building specifications. Terminate piping where indicated.

B. Make connections to existing piping and structures.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6-inch of concrete with 28-day compressive strength of 3500 psi.
2. Make branch connections from side into existing piping, 4 inch to 20 inch piping. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6-inch of concrete with 28-day compressive strength of 3500 psi.
3. Make branch connections from side into existing piping, 21 inches or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6-inch of

concrete for minimum length of 300 mm to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain a minimum 28-day compressive strength of 3500 psi unless otherwise indicated.
b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.

a. Unshielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

3.5 FIELD QUALITY CONTROL

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

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

   a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
   b. Option: Test plastic piping according to ASTM F 1417.
   c. Option: Test concrete piping according to ASTM C 924/C 924M.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.6 CLEANING

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

END OF SECTION 33 41 00

SECTION 33 46 19 – UNDERDRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Subsurface underdrain (or “finger drain”) pipes wrapped in stone and geotextile.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, provide manufacturer’s standard data sheets describing components including materials, dimensions, relationship to adjacent construction, and attachments.
   1. Underdrain / Finger Drain Pipe
   2. Fittings

1.3 DELIVERY, STORAGE, AND HANDLING

A. Do not store products in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle products according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 UNDERDRAIN / FINGER DRAIN PIPE

A. Shall be 4-inch diameter perforated HDPE pipe. Perforations shall be slot-type perforations with maximum length of 0.875 inches and maximum width of 0.120 inches to provide a minimum inlet area of 1.0 in^2/ft. Perforations shall be oriented in a 3-slot pattern at 120-degree spacing along the pipe circumference.

2.2 STONE:

A. Shall be 3/4-inch clean stone (AASHTO #57)

2.3 GEOTEXTILE FABRIC

A. Shall be non-woven fabric in accordance with Drawings and Engineering Fabric Specification.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Pipe installation shall follow Site Storm Drainage System Specification.

B. Existing native subsoil at bottom of underdrain trench shall not be over-compacted.

C. Engineering filter fabric shall be placed at the bottom of trench and in accordance with specifications.

D. 4-inch stone bedding shall be provided for underdrains.

E. Place pipe and backfill with stone up to 4 inches above top of pipe.

F. Wrap stone completely with engineering filter fabric.

G. Backfill with topsoil and seed to grades on Drawings.

END OF SECTION 33 46 19