

**ACADIA NATIONAL PARK
Hancock County, Maine**

HARDEN FARM EMPLOYEE HOUSING

ACAD PMIS NO. 309000

PROJECT SPECIFICATIONS



NATIONAL PARK SERVICE
ACADIA NATIONAL PARK

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**DIVISION 01 - GENERAL
REQUIREMENTS**

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Work covered by the Contract Documents.
 2. Contractor use of premises.
 3. Public use of site.
 4. Work Restrictions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Location: Acadia National Park Harden Farm Employee Housing site on Harden Farm Road off Kebo Street in Bar Harbor on Mount Desert Island in Hancock County, Maine.
- B. The ACAD 309000 Harden Farm Employee housing project expands the existing employee housing at the Harden Farm site to address increasing employee housing needs at Acadia National Park. Two buildings containing existing employee housing units exist at the site and will remain. The project generally includes constructing a loop driveway, parking areas, and utility infrastructure for an ultimate buildout of 8 total new housing buildings in addition to re-servicing the two existing housing buildings located within the complex. The project will be phased, with the initial work (as described within these Construction Documents) including the construction of the infrastructure for the overall complex and constructing up to four of the housing buildings, specifically two 6-plex flat buildings with 6 one-bedroom apartments in the base bid (Phase 1A), and two 8-bedroom dorm buildings as part of an additive alternate (Phase 1B). The locations for the remaining, future four housing buildings are depicted in the Construction Drawings for planning purposes only; construction of these remaining four housing buildings is not part of this contract. They may be constructed in the future under a separate contract if funding becomes available. Certain site improvements such as utility service stubs, as shown as in the Construction Drawings, are included in this contract in anticipation of these four future buildings.
- C. A separate Acadia National Park project will bring municipal sewer service to the site. A new sewer pump station will be installed as part of that project at the intersection of Kebo Street and the north site drive (Harden Farm Road). That separate project will also remove the existing septic system for the existing two employee housing buildings. That separate project will also include bringing three-phase electrical service to the sewer pump station and the site.
- D. Coordination for municipal water service to the project is ongoing. If NPS determines that adequate municipal water service is not available, water service to the project will be addressed in a separate project.
- E. Refer to specification Section 01 27 00 Definition of Contract Line Items for a general description of the Work included in the Base Bid, Bid Option 1, and Bid Option 2.

1.3 CONTRACTOR USE OF SITE

- A. General: Contractor's use of the site for construction operations during the construction period will be limited by the Government's right to perform work or to retain other contractors on portions of Project. The Contractor shall coordinate his/her work with other contractors working within the project area. The Contractor shall allow other contractors hired by the Government access and use of the project area insofar as this access does not directly impede the Contractor's immediate plan of operations.
- B. Storage of Materials: Confine storage of materials to staging area locations mutually acceptable to the Contractor and the Contracting Officer. Contractor shall not store any equipment or materials within 15 ft of the edge of any active travel lane, unless it is behind temporary concrete barrier that was installed as part of the approved maintenance of traffic plan.
- C. 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 that are to remain.
 - 3. Do not remove, injure, or destroy trees or other plants outside of the designate clearing areas without prior approval. Consult with Contracting Officer 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.
- D. Maintain access to the existing housing buildings during construction at all times when the buildings are occupied, unless approved by the Contracting Officer. Do not use these areas for parking or storage of materials unless approved by the Contracting Officer.
- E. Construction Camp: Establishment of a camp within the park will not be permitted.
- F. Hauling Restrictions: Comply with all legal load restrictions in the hauling of materials. Load restrictions on park roads are identical to the 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.

1.4 PUBLIC USE OF SITE

- A. Contractor shall at all times conduct his operations to ensure the least inconvenience to the public.
- CONDUCT OF OPERATIONS
- A. At all times the contractor shall conduct his operations in conformance with the rules and regulations promulgated by the Secretary of the Interior for the National Park Service, and applicable park rules and regulations prescribed by the Park Superintendent.

- B. Work on Saturdays, Sundays, Federal holidays or at night may not be performed without prior consent from the Contracting Officer. Submit requests 72 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 6 p.m., Monday through Friday, except when otherwise indicated.
 - 1. Weekend and NPS Holiday Hours: No work shall be performed on the weekends and NPS holidays without prior approval.
 - 2. Early Morning Hours: No work shall be performed before 7 a.m. unless approved by the Contracting Officer.
- 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 48 hours in advance of any proposed utility interruptions.
 - 2. Do not proceed with any utility interruptions without Contracting Officer's written permission.
 - 3. Disruptions to facilities outside the project limits shall be prevented by investigation of existing utilities and protection during construction. Contractor shall be responsible for all costs associated with remedy of accidental disruptions to facilities outside the project limits.

1.7 SPECIAL CONSTRUCTION REQUIREMENTS

- A. Existing employee housing units at the Harden Farm project site will remain in service during construction. Contractor shall maintain access to the units while they are occupied. Interruptions to utility services necessary to complete the work shall be approved by the Contracting Officer 48 hours prior to shut down, and shall not exceed 4 hours without provision of temporary or bypass service.
- B. Construction Camp: Establishment of a camp within the Park will not be permitted.

- C. All construction signing, fencing, erosion control measures, and traffic control measures shall be in place before starting construction.
- D. A 48 hour notice is required for any changes in the approved work schedule.
- E. Do not pave or stripe when and if conditions are not suitable for paving and striping work.
- F. A 48 hour notice is required for all paving operations.
- G. Equipment when not in use shall be shut off to minimize noise and air-pollution.
- H. Areas of the Park damaged by the movement of the Contractor's vehicles and equipment, or other construction operations, shall be restored as approved by the Contracting Officer, at no additional expense to the Government.
- I. For endangered species protection, cutting/clearing trees at the project site shall not be performed between April 15 and October 31.
- J. The Contractor shall achieve Substantial Completion within 365 days, and Final Completion within 455 days, of contract award for the Base Bid. The warranty period for the work included in the Base Bid shall begin upon final acceptance by the Contracting Officer.
- K. The Contractor shall achieve Substantial Completion within 365 days, and Final Completion within 455 days, of contract award for either Bid Option if one is awarded. The warranty period for the work included in an awarded Bid Option shall begin upon final acceptance by the Contracting Officer.

1.8 SOILS INVESTIGATION REPORT

- A. The boring logs for the geotechnical investigation that was conducted for this project are included in these specifications in Appendix B.

1.9 SALVAGE OF NATIVE STONE AND EXCAVATED MATERIAL

- A. Any blasted ledge, native stones and all other excavated material suitable for reuse shall remain property of the Park. Separate stones from other excavated material. Transport all salvage materials that will not be reused in the project to the Park storage area at Liscomb Pit, Liscomb Pit Road off Route 233 near Eagle Lake. Place in storage piles as directed by Contracting Officer.

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. The work of this section consists of administrative and procedural requirements for contract modifications.

1.2 DEFINITIONS AND ALLOWANCES

- A. Home Office Overhead: Those 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 the preparation of modifications will not be allowed. The 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, 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: These are 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 the 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: This is the hourly rate paid directly to the worker
 - b. Labor Burden: Employer payments of all applicable burdens, this includes insurance and taxes that 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) FUTA– Cap Rate and percentage to be proportionally allocated over one year.
 - 5) 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 the contractor from claims resulting from bodily injury or property damage to a third party. Include this 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 that the contractor will pay the labor and material costs they have incurred. Banks and Insurance companies charge a premium for each individual project based on a sliding scale which relates to the size of the project. Include this as a separate line item in modification proposals and provide current company bonding rates upon request.
- H. Builder's Risk Insurance: This covers the contractor's loss due to fire, high winds, or other natural forces. This is 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. Your proposal must be received in the format and within the time frame specified in the Request for Proposal letter. Costs or delays resulting from failure of contractor to submit within the time frame specified will not be compensable.
- 2. The proposal must 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 that 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 Gov't provided form.

3. Requests for extensions of contract time as a result of this change must be justified with a Time Impact Analysis (TIA). Refer to Division 01 Specification, "Construction Schedule", for time impact analysis requirements. TIA and associated costs must 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 the 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 upon request.
5. Contractor must review and approve all subcontractor/supplier pricing in detail for proper format, scope, production rates, and pricing prior to submission to the 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 the cost of labor by itemizing each craft involved, indicating worker hourly rate (base rate + labor burden + fringe benefits) for each and itemizing the hours required for each craft that will be directly engaged in modification work. Any work proposed that will require overtime work or premium pay shall be itemized separately. All 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, 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. The labor cost for foremen shall only be costs for related work required for the modification.

C. Materials:

1. The estimated cost for materials shall include quotes from multiple sources. Material prices must include all 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 the NPS.

D. Equipment:

1. Equipment used for the project must be appropriately sized for the 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 must be broken out separately.
3. Regardless of ownership, the rates to be used in determining equipment rental costs shall be the lowest cost from one of the following sources:
 - a. 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. The estimated equipment rates shall include the operating costs of all fuel, oil, lubrication, supplies, small tools, necessary attachments, ground engaging components, tires & tracks, routine repairs and maintenance (cost of major repair and overhaul is not allowed per 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 the full rate for equipment only for the duration that the equipment will be utilized to accomplish the work of the modification.
 6. Standby unit rates used are to be in accordance with paragraph 1.3, D, 2, above. If the US Army Corp of Engineers is utilized then their standby rates prevail. If Bluebook or local equipment pricing is accepted, then ½ of the 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, the established standby rate shall apply from the first day of the delay.
 8. Equipment that is not used and on the jobsite for up to five consecutive days may be classified at standby rates, provided that the equipment is or has been used solely to perform work on the modification and will be necessary to complete additional modification work. Equipment that is 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 31 which 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.....	4.75%
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, than the partnership may only receive home office overhead and profit in the same amount as an individual contractor (refer to par 1.3,E,1 above). It is the responsibility of the partners to decide on the division of revenue.
4. Combined Increases and Decreases: On proposals involving both increases and decreases in the Contract Price, the overhead and profit mark-ups are required on the 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.

END OF SECTION 01 26 01 |

SECTION 01 27 00 – DEFINITION OF CONTRACT LINE ITEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The intent of this section is to explain, in general, what is and what is not included in a contract line item, and the limits or cut-off points where one item ends and another begins.
- B. If no contract line item exists for a portion of the work, include the costs in a related item.
- C. Any estimated quantities of major elements of the work shown in the Contract Plans are approximate. It is the Contractor's responsibility to visit the project site prior to bid to identify existing conditions that will affect the work and determine the quantities of all materials required to complete the work at each location.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF CONTRACT LINE ITEMS

- A. Contract Line Item No. 1 – Base Bid – Building 1: Fixed price, lump sum, that includes all the work shown in the Construction Drawings and called for in the Specifications for construction of the first of the two Phase 1A buildings, generally including, but not limited to, the following major items:
 - 1. Mobilization and demobilization.
 - 2. Construction of the first of the two Phase 1A buildings, which is a 6-plex flat building with 6 one-bedroom apartments, including all building-specific site preparation, foundations, furnishings, and all mechanical, electrical, plumbing, and fire protection systems.
 - 3. Commissioning for all systems for the first of the two Phase 1A buildings as required in the Specifications.
- B. Contract Line Item No. 2 – Base Bid – Building 2: Fixed price, lump sum, that includes all the work shown in the Construction Drawings and called for in the Specifications for construction of the second of the two Phase 1A buildings, generally including, but not limited to, the following major items:
 - 1. Mobilization and demobilization.
 - 2. Construction of the second of the two Phase 1A buildings, which is a 6-plex flat building with 6 one-bedroom apartments, including all building-specific site preparation, foundations, furnishings, and all mechanical, electrical, plumbing, and fire protection systems.
 - 3. Commissioning for all systems for the second of the two Phase 1A buildings as required in the Specifications.

- C. Contract Line Item No. 3 – Base Bid – Sitework: Fixed price, lump sum, that includes all the work shown in the Construction Drawings and called for in the Specifications for all sitework project elements that are identified as part of Phase 1A, generally including, but not limited to, the following major items:
1. Mobilization and demobilization.
 2. Installation, maintenance, and removal of erosion control measures.
 3. Coordination with all utilities including electrical, telecommunications/internet, water, and sewer.
 4. Clearing and demolition within the Phase 1A limits, including removal of existing sewer manholes, cleanouts, and associated piping, and removal or abandonment in place of portions of existing waterline.
 5. Construction of the Phase 1A portion of the loop driveway and parking areas, and repaving of part of the existing parking area at the existing housing buildings, including all earthwork, hot mix asphalt paving, curbing, and pavement markings, and all removal of existing pavement.
 6. Construction/installation of all electrical, telecommunications/internet, water, and sewer utility infrastructure required for Phase 1A, including reservicing the two existing housing buildings, and any utility service stubs for future phase buildings that are within the Phase 1A limits.
 7. Site preparation, grading, and site improvements for Phase 1A, including construction of all drainage features required for Phase 1A.
 8. Construction of Phase 1A landscaping improvements, including sidewalks, exterior site lighting, and plantings.
- D. Contract Line Item No. 4 – Base Bid - Utility Fees: For work necessary to be completed by the project's utility companies, including connections, shutdowns, metering, etc. for the project elements included in the Base Bid Contract Line Items No. 1-3. The cost of this project-related work by the utility companies will be reimbursed up to the amount of this Contract Line Item with proof of utility invoices. If the utility work order estimates exceed the total carried under this line item, Contractor shall inform the Contracting Officer in advance of ordering such services for review and authorization by the Contracting Officer. All other utility work related to the Base Bid project elements shall be included in Contract Line Item No. 3 - Base Bid - Sitework.
- E. Contract Line Item No. 5 – Bid Option 1 – Building 1: Fixed price, lump sum, that includes all the work shown in the Construction Drawings and called for in the Specifications for construction of the first of the two Phase 1B buildings, generally including, but not limited to, the following major items. Bid Option 1 – Building 1 may be awarded at any time up to and including 180 calendar days after the award of any of the Contract Line Items that are part of the Base Bid.
1. Mobilization and demobilization.
 2. Construction of the first of the two Phase 1B buildings, which is an 8-bedroom dormitory building, including all building-specific site preparation, foundations, furnishings, and all mechanical, electrical, plumbing, and fire protection systems.
 3. Commissioning for all systems for the first of the two Phase 1B buildings as required in the Specifications.
- F. Contract Line Item No. 6 – Bid Option 1 – Building 2: Fixed price, lump sum, that includes all the work shown in the Construction Drawings and called for in the Specifications for construction of the second of the two Phase 1B buildings, generally including, but not limited to, the following major items. Bid Option 1 – Building 2 may be awarded at any time up to and including 180

calendar days after the award of any of the Contract Line Items that are part of the Base Bid.

1. Mobilization and demobilization.
2. Construction of the second of the two Phase 1B buildings, which is an 8-bedroom dormitory building, including all building-specific site preparation, foundations, furnishings, and all mechanical, electrical, plumbing, and fire protection systems.
3. Commissioning for all systems for the second of the two Phase 1B buildings as required in the Specifications.

G. Contract Line Item No. 7 – Bid Option 1 – Sitework: Fixed price, lump sum, that includes all the work shown in the Construction Drawings and called for in the Specifications for all sitework project elements that are identified as part of Phase 1B, generally including, but not limited to, the following major items. Bid Option 1 – Sitework may be awarded at any time up to and including 180 calendar days after the award of any of the Contract Line Items that are part of the Base Bid.

1. Mobilization and demobilization.
2. Installation, maintenance, and removal of erosion control measures.
3. Coordination with all utilities including electrical, telecommunications/internet, water, and sewer.
4. Clearing and demolition within the Phase 1B limits, including removal of existing sewer manholes, cleanouts, and associated piping, and removal or abandonment in place of portions of existing waterline.
5. Construction of the Phase 1B portion of the loop driveway and parking areas, and construction of additional parking, and repaving of part of the existing parking area, at the existing housing buildings, including all earthwork, hot mix asphalt paving, curbing, and pavement markings, and all removal of existing pavement.
6. Construction/installation of all electrical, telecommunications/internet, water, and sewer utility infrastructure required for Phase 1B, and any utility service stubs for future phase buildings that are within the Phase 1B limits.
7. Site preparation, grading, and site improvements for Phase 1B, including construction of all drainage features required for Phase 1B.
8. Construction of Phase 1B landscaping improvements, including sidewalks, exterior site lighting, and plantings.

H. Contract Line Item No. 8 – Bid Option 1 - Utility Fees: For work necessary to be completed by the project's utility companies, including connections, shutdowns, metering, etc. for the project elements included in the Bid Option 1 Contract Line Items No. 5-7. The cost of this project-related work by the utility companies will be reimbursed up to the amount of this Contract Line Item with proof of utility invoices. If the utility work order estimates exceed the total carried under this line item, Contractor shall inform the Contracting Officer in advance of ordering such services for review and authorization by the Contracting Officer. All other utility work related to the Bid Option 1 project elements shall be included in Contract Line Item No. 7 - Bid Option 1 - Sitework.

END OF SECTION 01 27 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This 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. Requests for Information (RFIs).
 - 5. NPS/DSC SharePoint Project Website.
 - 6. Project meetings.
 - 7. Environmental Coordination.
 - 8. 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 the 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 the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
 5. 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, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Permit requirements.
 7. Pre-installation conferences.
 8. Commissioning activities.

1.4 SUBMITTALS

- A. Division 01 documents: The following items shall be submitted a minimum of one week prior to the Preconstruction Conference. Contracting Officer will notify Contractor of tentative date for the Pre-Construction Conference.
1. Letter designating Project Superintendent.
 2. Construction Schedule.
 3. A comprehensive breakdown of the 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. Satisfactory evidence of liability insurance coverage and workman's compensation for the Contractor and all subcontractors.
 8. Waste Management Plan.
 9. Quality Control Plan.
 10. Temporary Storm Water Pollution Prevention Plan (SWPP or UPPP).
 11. List of Required Construction Permits. Include the following information for each permit:
 - a. Name of Permit.
 - b. The Agency(ies) with Jurisdiction issuing the permit.
 - c. Information required from the Government to complete the permit application.

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI utilizing the form created on the NPS/DSC SharePoint Project website.
1. CO 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 the RFI: Include a 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 the Contract Time or the Contract Sum, Contractor shall state impact in the 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: Utilize the RFI form that can be downloaded from the Workflows website at http://www.nps.gov/dscw/con_rfi217.htm or Software-generated form with substantially the same content as indicated above, approved by the CO.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
 2. Enter the general information at the top of the form.
 3. Under the "Action" section at the bottom of the form, select "Question" then select "CMR" in the drop-down of the "Send to" box.
 4. Enter the details of the question and attach related documents.
 5. Select "Submit Form" at the bottom of the page.
- D. Contracting Officer's Action: CO will review each RFI, determine action required, and respond. CO will determine the critical nature of each RFI and issue a 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 the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.

- f. Incomplete RFIs or inaccurately prepared RFIs.
2. CO's action may include a request for additional information, in which case time for response will date from time of receipt of additional information.
3. CO's action on RFIs may result in the need for a change to the Contract Time or the Contract Sum. All contract changes will be processed following the terms and conditions of the contract.

1.6 PROJECT MEETINGS

- A. Preconstruction Conference: Before start of construction, Contracting Officer will arrange an on-site meeting with Contractor. The 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 01 documents.
 5. Coordination of Subcontractors.
 6. Labor law application.
 7. Modifications.
 8. Payments to Contractor.
 9. Payroll reports.
 10. Contract time.
 11. Liquidated damages.
 12. Contractor Performance Evaluation.
 13. Display of Hotline posters.
 14. Notice to proceed.
 15. Correspondence procedures.
 16. NPS/DSC SharePoint Project website.
 17. Acceptance/rejection of work.
 18. Progress meetings.
 19. Submittal procedures.
 20. NPS Final Accessibility Inspection.
 21. Environmental requirements.
 22. Permit requirements.
 23. As-constructed drawings
 24. Saturday, Sunday, holiday and night work.
 25. Reference materials.
 26. Value engineering.
- B. Progress Meetings: The Contractor shall schedule weekly meetings with the Contracting Officer and be responsible for the following:
 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 at these meetings. All participants at the meeting shall be familiar with the 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. The meeting agenda will include the following:
 - a. Approval of minutes of previous meetings.
 - b. Submittal status.
 - c. Requests for information (RFI) and other issues.
 - d. Modifications.
 - e. Work in progress and projected.
 - 1) Status of required inspections (Special Inspections, Accessibility, etc.)
 - f. Inspections of work in progress and projected (Special inspections,
 - g. Construction Schedule update (provide updated CPM).
 - h. Status of Project Record Drawings
 - i. Other business relating to work.
 - j. Permit requirements.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.7 ENVIRONMENTAL COORDINATION

- A. Contractor's Environmental Manager: Designate an on-site party responsible for overseeing the Contractor's conformance to environmental goals for the 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 those of this project; must be familiar with environmental regulations applicable to construction operations.
- B. Contractor's Environmental Training Program: Contractor shall provide environmental training for workers performing work on the project site. Training shall include the following:
 1. Overview of environmental issues related to the Project.
 2. Review of site specific procedures and management plans:
 - a. Construction Waste Management.
 - b. Temporary Storm Water Pollution Prevention.
 3. Pollution Prevention (P2) practices.
 4. Compliance with environmental regulations: As specified in Regulatory Requirements. Submit Contractor 40 CFR employee training records upon request of Contracting Officer.
- C. Provide documentation for environmental procedures as specified herein and in accordance with approved Waste Management Plan, and Storm Water Pollution Prevention Plan.

1.8 PERMITS

A. General:

1. Permits and Responsibilities: Construction 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. Construction Contractor shall also be responsible for damages to persons or property that occur as a result of Construction 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, Construction Contractor will not be considered an agent of the Government. Construction Contractor shall comply with appropriate Federal, State and local laws.

B. 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.
2. Contractor is responsible for compliance with the following Environmental Permits that are being obtained for the project by NPS:
 - a. Clean Water Act Section 404, Maine General Permit – Residential, Commercial, and Institutional Developments, and Recreational Facilities, USACE New England District
 - b. Natural Resource Protection Act, Tier 1 Permit, Maine State Department of Environmental Protection, Eastern Maine Regional Office
 - c. Stormwater Permit-by-Rule/Notice of Intent to Comply with the Maine Construction General Permit, Maine State Department of Environmental Protection, Eastern Maine Regional Office

C. 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 project management and communication software when permits are obtained.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 16 – CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section consists of Construction Schedule requirements including but not limited to the following:
 - 1. Schedule of Values
 - 2. Construction Schedule Requirements.
 - 3. Construction Schedule Updates.
 - 4. Time Impact Analysis.
- B. Purpose: The purpose of the Construction Schedule is to ensure adequate planning, coordination, scheduling, and reporting during execution of the work by the Contractor. The Construction Schedule will assist the Contractor and Contracting Officer in monitoring the progress of the work, evaluating proposed changes, and processing the Contractor's monthly progress payment.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the Schedule of Values for the 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. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Float: Float is not for the exclusive use or benefit of either the Government or the Contractor but is jointly owned.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for the 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: All schedules and reports submitted shall be posted on the NPS DSC SharePoint project website, provided in the native electronic file format. It is the intent of the Government to limit the number of printed reports to only those reports determined by the project team to be essential.
- B. Schedule of Values: After contract award and before the Pre-Construction conference submit a schedule of dollar values based on the Contract Price Schedule.
- C. Construction Baseline Schedule: After contract award and before the Pre-Construction conference, submit two paper copies of baseline schedule, large enough to show entire schedule for entire construction period.
- D. Construction Schedule Updates: On or before the 7th day preceding the progress payment request date, submit estimates of the percent completion of each schedule activity and necessary supporting data. Provide two paper copies.

1.4 QUALITY ASSURANCE

- A. The Contractor shall meet with the Contracting Officer on the day of the preconstruction conference to go over the following:
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, work stages, area separations, interim milestones, and partial Government occupancy.
 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 a protocol for naming and transmitting electronic schedules.

- B. Contractor's Schedule Representative: Before or at the preconstruction conference, designate an authorized representative to be responsible for the preparation and maintenance of the Construction Schedule. A resume outlining the qualifications of the Scheduler shall be submitted to the Contracting Officer for acceptance. The Scheduler shall have prepared and maintained at least 5 previous schedules of similar size and complexity similar to this Contract, demonstrating proficiency in the use of scheduling software. The authorized representative will be responsible for preparing the Baseline Schedule, all required updates, revisions, Time Impact Analyses, and preparation of 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 the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. In developing the Construction Baseline Schedule, ensure that the Subcontractor's work at all tiers, as well as the prime Contractor's work, is included and coordinated.
 - 2. Secure time commitments for performing critical elements of the Work from parties involved.
 - 3. Coordinate each construction activity in the network with other activities and schedule them 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. The work activities broken out within the schedule of values shall be integrated into and made a logical part of the construction baseline schedule submitted under this specification. The total costs for the component work activities shall equal the contract price for that lump-sum item. The 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. The total cost of all items shall equal the contract price. The Schedule of Values will form the basis for progress payments.
- D. An acceptable Schedule of Values shall be agreed upon by the Contractor and Contracting Officer before the first progress payment is processed.

2.2 CONSTRUCTION SCHEDULE REQUIREMENTS

- A. Construction Baseline Schedule: Prepare Construction Baseline Schedule using a computerized, resource-loaded, time-scaled CPM 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 all work within applicable completion dates, regardless of Governments acceptance of the 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 the preliminary CPM network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the 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 CPM schedule within the limitations of the Contract Time.
 4. The Construction Baseline Schedule as developed shall show the sequence and interdependence of activities required for complete performance of the work. Ensure all work sequences are logical and the Construction Baseline Schedule shows a coordinated plan of the work.
 5. Resource loading of each activity shall include all personnel by labor category and equipment type and capacity proposed to complete the activity in the duration shown.
 6. Consider seasonal weather conditions in planning and scheduling all work influenced by high and low ambient temperatures, wind, or precipitation to ensure completion of all work within the contract time.
 7. Time Frame: Proposed duration assigned to each activity shall be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity.
 - a. An early finish date may be shown but the late finish date must be the same date as the last day of the contract period. An early completion schedule must contain the following:
 - 1) Insert an activity titled "Project Float" as a successor to the last activity in the 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 the Contract Period.

- b. Contract completion date shall not be changed by submission of a schedule that shows an early completion date.
 - c. The 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 a calendar that is based on a 7 day week to be used on any activities that are based on calendar days. Apply this calendar to administrative tasks or any other tasks that are not affected by non-working days (Federal Holidays, weather, etc.).
 - 2) Project Calendar: Include a calendar that is based on the planned work week for the project. Include Federal Holidays, weekends, and any other non-work days indicated in the contract documents. Apply this calendar to activities which are not anticipated to be affected by weather.
 - 3) Weather Calendar: Utilize the Project Calendar and show anticipated normal downtime related to weather as non-working time. Weather days shall be based on data for the local area from a reliable source like the National Oceanic and Atmospheric Administration (NOAA), National Park Service records, or source acceptable to the Contracting Officer. Apply this calendar to activities that are anticipated to be affected by weather.
 - e. Activity Duration: Define activities so no activity is longer than 15 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 the following long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in the schedule. Procurement cycle activities include, but are not limited to, 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 Division 01 Specification 01 77 00 Closeout Procedures.)
8. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
- 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 the effect of the following items on the schedule:
 - 1) Coordination with existing construction.
 - 2) Uninterruptible services.
 - 3) Use of premises restrictions.
 - 4) Provisions for future construction.
 - 5) Seasonal variations.
 - 6) Environmental control.
 - 7) Permit provisions.

9. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- C. Joint Review, Revision, and Acceptance:
1. Within seven calendar days of receipt of the Contractor's proposed Construction Baseline Schedule, the Contracting Officer and Contractor shall meet for joint review, correction, or adjustment of the initial Construction Baseline Schedule. Any areas which, in the opinion of the Contracting Officer, conflict with timely completion of the project shall be subject to revision by the Contractor.
 2. Within seven calendar days after the joint review between the Contractor and Contracting Officer, the Contractor shall revise and resubmit the Construction Baseline Schedule in accordance with agreements reached during the joint 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 the Contractor or Contracting Officer, shall be corrected by the Contractor within seven calendar days and shall not affect the contract period.
 4. Upon acceptance of the Construction Baseline Schedule by the Contracting Officer, save the schedule as a baseline and update on a monthly basis. The construction schedule update will be used to evaluate the Contractor's monthly applications for payment based upon information developed at the monthly Construction Schedule update meeting.
- D. Recovery Schedule: When periodic schedule update indicates the Work is 14 or more calendar days behind the current accepted schedule, a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule must also be submitted. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- E. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.
1. Use Microsoft Project or Primavera, Software: The software shall be the latest version of Microsoft Project, Primavera, Project Planner, SureTrak, or approved equal.

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE UPDATES

- A. Progress Meeting Updates: Provide a two week look-ahead schedule, derived from the currently accepted schedule, before each weekly progress meeting. Utilize the look-ahead schedule to facilitate and take notes on discussions held during the progress meeting.
- B. Monthly Schedule Updates:
 1. General: Update the Construction Schedule on a monthly basis to reflect actual construction progress and activities throughout the 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: The Contractor shall meet with the Contracting Officer each month at a Construction Schedule update meeting to review actual progress made through the status date of the Construction Schedule update, including dates activities were started and/or completed and the percentage of work completed on each activity started and/or completed.
 3. Narrative: The report shall include a brief description of the actual progress made during the update period; actual and potential delaying activities; any impediments to progress; issues related to inclement weather; progress toward established milestones and project float. The report shall include a brief description of the work anticipated to be performed in the next month. Any minor revisions to the schedule should be identified so they can be evaluated and accepted or rejected.
 4. As the Work progresses, indicate Actual Completion percentage for each activity.
 5. If the schedule update shows a late finish date after the contract completion date, at a minimum, include the following in the narrative with your submission:
 - a. Any known delays.
 - b. Actions that will be taken to get back on schedule.
 - c. Pending modifications.
 - d. Impediments or constraints affecting progress.
 6. Progress Payments: The monthly updating of the currently accepted Construction Schedule shall be an integral part of the process upon which progress payments will be made under this contract. If the Contractor fails to provide schedule updates or revisions, then a portion of the monthly payment may be retained until such 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 the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.
- 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 the actual prosecution and progress of the work, the Contracting Officer will request, and the Contractor shall submit, a revision to the Construction Schedule. The Contractor may also request reasonable revisions to the currently accepted Construction Schedule in the event the Contractor's planning for the work is revised. If the Contractor desires to make changes, the Contractor shall notify the Contracting Officer in writing, stating the reason for the proposed revision. Accepted revisions will be incorporated into the currently accepted Construction Schedule for the next monthly schedule update.
 2. Procedure: If revision to the currently accepted Construction Schedule is contemplated, the Contractor or Contracting Officer shall so advise the other in writing at least seven calendar days prior to the next monthly schedule update meeting, describing the 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 the following:
 - 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.

END OF SECTION 01 32 16

SECTION 01 33 23 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This 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 the 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. Types of submittals are indicated in individual specific sections.
 - 1. Contracting Officer reserves the 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 them for legibility, accuracy, completeness, and compliance with Contract Documents.
 - 1. Coordinate each 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 the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Contracting Officer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Submittal List: A submittal list has been attached to the end of this Specification Section. The intent is to provide an overall summary of submittal requirements and not a comprehensive list. The requirements of the individual Specification Sections, terms and conditions of the Contract still apply regardless of what is shown on the submittal list.
- D. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence when an e-mail notification is received by the Contracting Officer (or designee) indicating the submittal has been posted on the NPS SharePoint website and is ready for review. When the Contracting Officer has completed their review, an e-mail notification will be sent to the Contractor indicating the submittal has been processed. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
 - 1. Action Submittals
 - a. Initial Review: Allow 30 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
 - b. Re-submittal Review: Allow 30 days for review of each re-submittal.
 - 2. Informational submittals
 - a. Review: Allow 10 days for review of each submittal.
- E. Approved Equals:
 - 1. For each item proposed as an “approved equal,” 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.
 - 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 the installation of an approved item and make all changes required in other elements of the work because of the substitution.
 - e. Waives all claims for additional expenses that may be incurred as a result of the substitution.

1.4 CONTRACTOR’S USE OF CAD FILES

- A. General: At Contractor’s written request, copies of CAD files will be provided to Contractor for Contractor’s use in connection with Project, subject to the following conditions:
 - 1. Files will be provided as is.

2. No format or other changes to files or changes to the objects in the drawing will be done by the Government.
3. The Contractor acknowledges that the CAD files are representational of the design intent for the Project and are not represented or warranted to be accurate.
4. Use of CAD files is not a defense for failure to conform with the requirements of the Contract Documents.
5. Reliance on dimensional or other information contained or inherent in electronic drawing is at the Contractor's sole risk.
6. No transfer of electronic data to a third party shall be permitted.

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. Include the following information, as applicable:
 - 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. Operational range diagrams.
 - f. Compliance with specified referenced standards.
 - g. Testing by recognized testing agency.
 4. Submit product data in PDF 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 the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Templates and patterns.

- d. Schedules.
 - e. Notation of coordination requirements.
 - f. Notation of dimensions established by field measurement.
 - g. Relationship to adjoining construction clearly indicated.
 - h. Seal and signature of professional engineer if specified.
2. Submit shop drawings as a 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 CM-SPE on the NPS SharePoint website for processing and documentation of action on submitted samples.
 - 3. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Submittal Number and title of appropriate Specification Section.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the 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 the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit four 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 submittal 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, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 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: The Contractor is encouraged to submit for approval products made out of recycled or environmentally responsible material. Every effort will be made by the 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 SharePoint website.
 - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - 3. Informational submittals that do not comply with the requirements specified in the Contract Documents will be rejected and one copy will be returned.
- B. Coordination Drawings: Comply with the requirements specified in Section 01 31 00 “Project Management and Coordination.”
- C. Contractors Construction Schedule: Comply with the requirements specified in Section 01 32 16 “Construction Schedule.”
- D. Accident Prevention Plan: Comply with the requirements specified in Section 01 35 23 “Safety Requirements.”
- E. Waste Recycling Plan: Comply with the requirements specified in Section 01 74 19 “Construction Waste Management and Disposal.”
- F. Quality Control Plan: Comply with the requirements specified in Section 01 40 00 “Quality Requirements.”
- G. Storm Water Pollution Prevention Plan: Comply with the requirements specified in Section 01 57 23 “Temporary Storm Water Pollution Prevention” and any storm water permit requirements identified in Section 01 31 00.
- H. LEED™ Submittals: Comply with the 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.”
- I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- J. Installer Certificates: Prepare written statements on manufacturer’s letterhead certifying that Installer complies with the requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- K. Manufacturer Certificates: Prepare written statements on manufacturer’s letterhead certifying that manufacturer complies with the requirements in the Contract Documents. Include evidence of manufacturing experience where required.

- L. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with the requirements in the Contract Documents.
- M. 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 the requirements in the Contract Documents.
- N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- O. 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.
- P. 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 the requirements in the Contract Documents.
- Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with the requirements specified in Section 01 78 23 "Operation and Maintenance Data."
- R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.
- T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Statement on condition of substrates and their acceptability for installation of product.
 - 2. Summary of installation procedures being followed, whether they comply with the 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.
- U. 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 the Contract and for compliance with the 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 the back of the submittal; an incorrect format of submittals is provided; the 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 the Contractor's own risk.
- B. Action Submittals: Contracting Officer will review each submittal, generate comments on corrections or modifications required, and indicate the appropriate action on the CM-SPE Transmittal Form. The submittal will be marked in one of three ways as defined below:
 - 1. APPROVED: Acceptable with no corrections.
 - 2. APPROVED WITH NOTATIONS: Minor corrections or clarifications required. All comments are clear and no further review is required. The Contractor shall address all 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. The Contracting Officer will identify the reasons for disapproval. The 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 |

ACAD 309000 - Harden Farm Employee Housing

SUBMITTAL			REQUIREMENTS (indicate with an "X")							
Spec. Sec.	Par. No.	Description	INFORMATIONAL				ACTION			
			CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS		SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS	
033000	1.4	Cast-in-Place Concrete								
		Concrete Mix Design and Reinforcement Types/Shops		X			X		X	
		Minutes of Preinstallation Conference		X						
		Testing Results		X						
044030	1.3	Dry Laid Stone Masonry								
		Product Data	X					X		
		Work and Protection Plan		X						
061000		Rough Carpentry								
	1.3	Product Data - Treated Wood and Factory-Fabricated Products							X	
	1.4	Material Certificates and Evaluation Reports		X						
061600		Sheathing								
	1.2	Preservative Treated Plywood	X		X					
		Fire-Retardant Treated Plywood	X		X					
		Composite Insulating Wall Sheathing	X		X					
		Subflooring	X		X					
		Fasteners	X		X					
061745		Wood Trusses and Joints								
	1.3A	Product Data - Metal Plate Connectors, Truss Accessories, Fasteners							X	
	1.3B, C	Shop Drawings & Delegated Design Submittal		X			X		X	
	1.3D	Qualification Data		X						
	1.3E, F	Material & Product Certificates		X						
	1.3G	ICC-ES Evaluation Reports for Metal Plate Connectors		X						
064023		Interior Architectural Woodwork								
	1.3	Anchors, Adhesives, Shop Finishing Materials			X					
		Panel Products			X					
		Interior Trim			X					
		Closet and Utility Shelving			X					
071100		Bituminous Dampproofing								
	1.2	Dampproofing			X					
072100		Thermal Insulation								
	1.2	Foam Board Insulation			X					
		Fiber Blanket Insulation			X					
		Spray Foam Insulation			X					
		Vapor Retarders			X					

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Spec. Sec.	Par. No.	Description	INFORMATIONAL				ACTION			
			CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS		SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS	
072500		Weather Barriers								
	1.2	Weather Resistive Barrier	X		X					
		Flexible Flashing			X					
		Fluid Applied Flashing			X					
		Drainage Material			X					
073113		Asphalt Shingles								
	1.3	Asphalt Shings			X			X		
		Underlayment Materials			X					
		Ridge Vents			X			X		
		Asphalt Roofing Cement			X					
		Flashing Sealant			X					
073129		Wood Shingles and Shakes								
	1.2	Shingles					X		X	
		Drainage Mat			X					
		Metal Flashing and Trim						X		
074600		Siding and Soffits								
	1.3	Siding and Trim			X			X		
		Rodent Mesh			X					
0784113		Penetration Firestopping								
	1.2	Firestopping			X				X	
		Product Schedule		X						
079200		Joint Sealants								
	1.3	Sealants		X	X			X		
081400		Wood Doors								
	1.2	Exterior Doors		X	X		X	X		
		Interior Doors		X	X		X			
081423	1.2	Clad Wood Doors								
		Fiberglass Doors		X	X		X	X		
083113		Access Doors and Frames								
	1.2	Access Panels		X	X					
085000	1.3	Windows								
		Fiberglass Windows		X			X	X		
087100	1.5	Door Hardware								
		Door Hardware		X	X					
088000		Glazing								
	1.5	Glazing for Windows			X					

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Spec. Sec.	Par. No.	Description	INFORMATIONAL				ACTION			
			CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS		SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS	
		Glazing for Accessories			X					
092900		Gypsum Board								
	1.2	Interior Gypsum Board			X					
093013		Ceramic Tiling								
	1.4	Tile			X		X	X		
		Tile Backing Panels			X					
		Waterproof Membrane			X					
		Crack Isolation			X					
		Metal Edge Stops			X					
096513		Resilient Base and Accessories								
	1.2	Rubber Base		X	X			X		
		Resilient Molding		X	X			X		
096518		Resilient Tile Flooring								
	1.3	Resilient Flooring			X		X	X		
		Luxury Vinyl Tile			X		X	X		
		Adhesives			X					
099100		Painting								
	1.4	Interior Paint			X					
		Exterior Paint			X					
101419		Dimensional Letter Signage								
	1.2	Signage			X		X			
101453	3.1	Traffic Signage								
		Sign List		X						
102800		Toilet, Bath, and Laundry Accessories								
	1.3	Grab & Towel Bars		X	X					
		Toilet Tissue Dispensers		X	X					
		Framed Mirorr		X	X					
104413		Fire Protection Cabinets								
	1.2	Fire Protection Cabinets			X		X			
104416		Fire Extinguishers								
	1.2	Product Data							X	
105723		Closet and Utility Shelving								
	1.3	Wire Shelving and Brackets			X		X			
113013		Residential Appliances								
	1.2	Product Data							X	
123213		Manufactured Wood-Veneer-Faced-Casework								

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SUBMITTAL			REQUIREMENTS (indicate with an "X")						
Spec. Sec.	Par. No.	Description	INFORMATIONAL				ACTION		
			CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS		SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS
	1.5	Wood Veneer Casework			X		X		
		Casework Hardware and Accessories			X				
123623		Plastic-Laminate-Clad Countertops							
	1.2	Countertops			X		X	X	
211313		Wet-Pipe Fire-Suppression Sprinkler System (13D)		X					
	1.5.A	Product Data			X		X		X
	1.5.B	Design Drawings/Calculations		X			X		
	1.5.C	Field Test Reports & Certificates	X	X			X		
	1.5.D	Maintenance Data			X				X
220000		Plumbing General Provisions							
	3.3	Tests - Pressure		X					
220700		Plumbing Insulation							
	2.1	Pipe Insulation			X		X		
221100		Water System							
	2.2	Copper Tubing (Hot/Cold)			X		X		
	2.3	Solder			X		X		
	2.4	Valves			X		X		
	2.5	Water Hammer Eliminators			X		X		
	2.7	Hose Bibbs			X		X		
	2.8	Electrical Hot Water Heaters			X		X		
	2.9	Expansion Tanks			X		X		
221300		Sanitary System							
	2.2	Piping, Venting, Fittings, Etc.			X		X		
	2.3	Floor Drains			X		X		
224000		Plumbing Fixtures							
	2.1	Fixtures, Toilets, Lavs, Showers, Faucets, Etc.			X		X		
230000		Heating, Ventilation & Air Conditioning							
	2.1	Piping, Drains, Vents, Refrigerant			X		X		
	2.2-2.4	Valves, Etc.			X		X		
	2.6	Ventilation Fans			X		X		
	2.7	Fire Dampers			X		X		
	2.8-2.9	Ductwork			X		X		
	2.1	Dampers/Actuators			X		X		
	3.5	Maintenance Manuals & Operating Instructions			X				X
	3.5	Balance Report	X	X			X		X

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SUBMITTAL			REQUIREMENTS (indicate with an "X")							
Spec. Sec.	Par. No.	Description	INFORMATIONAL				ACTION			
			CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS		SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS	
230165		Variable Refrigerant Flow								
	1.4	VRF Guide, Dimensional Data, Product Data, Design Report, Piping/Wiring, Schedules		X	X			X		X
	1.5	Operating Manuals			X					X
	1.6	Qualifications	X							
	1.7	Warranty	X							
	2.2	MCU			X		X			
	2.3	Cassettes			X		X			
	2.4	Wall Mounted Indoor Units			X		X			
	2.5	Accessories, Kits, Controllers, Etc.			X		X		X	
230529		Hangers and Supports for HVAC								
	1.2	Hangers, Shields, Fasteners, Pipe Stands, Supports, Etc.			X		X			
230593		Testing, Adjusting, and Balancing	X		X		X			
230700		HVAC Insulation								
	1.2	Insulation, Cements, Adhesives, Sealants, Jackets, Tapes			X		X			
230900		Automatic Temperature Controls			X		X			
232300		Refrigerant Piping and Accessories								
	2.1-2.3	Piping, Supports, Specialties			X		X			
233300		Air Duct Accessories								X
		Product Data								
237200		Air-to-Air Energy Recovery Equipment			X		X			
238333.1		Electric Radiant Heaters								
	2.1	Baseboard Heat			X		X			
	2.2	Electric Unit Heater			X		X			
260519		Power Conductors and Cables			X		X			
260526		Grounding and Bonding								
	2.1-2.4	Grounding Rods, Conductors, Connectors, Electrodes			X		X			
260529		Hangers and Supports for Electrical Systems			X		X			
260533		Raceways & Boxes for Electrical Systems			X		X			
260541		Underground Electrical Construction								
	2.1	Precast Structures			X		X			
	2.2	Pull Boxes			X		X			
	2.3	Ducts/Conduits			X		X			
	2.5	Warning Tape			X		X			
	2.6	Pull Rope			X		X			

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SUBMITTAL			REQUIREMENTS (indicate with an "X")										
Spec. Sec.	Par. No.	Description	INFORMATIONAL				ACTION						
			CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS		SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS				
260543		Underground Ducts and Raceways for Electrical Systems											
	1.4	Shop Drawings	X					X					
260544		Sleeves/Seals			X			X					
260923		Lighting Control Devices			X			X					
262416		Panel Boards, Cabinets, Trim, Breakers			X			X					
262726		Wiring Devices			X			X					
262728		Disconnect Switches, Fuses, Cabinets			X			X					
265100		Interior Lighting - LED, Lighting, Lamps, Drivers, Emergency Lighting, Exit Signage			X			X					
265619		Exterior Lighting - LED, Lighting, Photocells, Drivers			X			X					
272000		Data Communication, Boxes, Jacks, Wire			X			X					
273000		Voice Communication, Boxes, Jacks, Wire			X			X					
283100		Fire Detection & Alarm, Schematic, Devices, Detectors, Strobes, Horns, Annunciator, Panels, Etc.			X			X					
310000	1.5	Earthwork											
		Off-Site Fill Material Samples							X				
		Material Supplier			X								
		Geotextile Product Data			X								
311100	1.4	Clearing and Grubbing											
		Permits and Notices Authorizing Site Clearing			X								
		Certificates of Utility Service Severances			X								
		Permits for Transport and Disposal of Debris			X								
		Demolition Procedures and Operational Sequence			X								
		Calculations			X								
312113	1.4	Radon Mitigation											
		Shop Drawings						X					
		Product Data								X			
312500	2.1	Erosion and Sedimentation Control											
		Silt Fence									X		
		Geotextile Product Data									X		
313219.23	1.3	Geotextile Layer Separation											
		Material Certificate			X								
321216	3.02	Asphalt Pavement											
		Job Mix Formula									X		
		List of Materials			X								

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SUBMITTAL			REQUIREMENTS (indicate with an "X")										
Spec. Sec.	Par. No.	Description	INFORMATIONAL				ACTION						
			CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS		SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS				
		Aggregate Quality Test Results	X										
321610	1.4	Curbing											
		Shop Drawings/Manufacturer's Literature			X			X					
		Representative Sample Tests	X						X				
321723	1.3	Pavement Markings											
		Product Data/Manufacturer Instructions									X		
329200	1.2	Seeding											
		Seed Certification	X										
		Product Data										X	
329300	1.4	Planting											
		Representative Samples							X				
		Product Data	X		X								
329400	1.4	Topsoil											
		Representative Samples							X				
		Soil Test	X	X									
		Sources of Imported Topsoil		X									
331000	1.5	Water Utilities											
		Shop Drawings						X					
333900	1.02	Sanitary Utility Sewerage Structures											
		Materials List											
		Shop Drawings											
334000	1.3	Storm Drainage Utilities											
		Shop Drawings						X					
334020	1.02	Warning and Tracer Tape											
		Product Data			X								

SECTION 01 35 23 - SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes establishing an effective accident prevention program and providing a safe working environment for all personnel and visitors.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Comply with contract clauses entitled "Accident Prevention" and "Permits and Responsibilities". In case of conflicts between Federal, State, and local safety and health requirements, the most stringent shall apply. Equipment or tools not meeting OSHA requirements will not be allowed on the project sites. Failure to comply with the requirements of this section and related sections may result in suspension of work.
- B. Qualifications of Employees:
 - 1. All employees must be physically and able to perform their assigned duties in a safe manner.
 - 2. Do not allow employees to perform work 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.
 - 3. Operators of vehicles, hoisting equipment, and hazardous plant equipment shall be able to understand signs, signals, and operating instructions, and be fully capable of operating such equipment. Provide operating instructions for all equipment. Newly hired operators shall be individually tested by an experienced operator or supervisor to determine if they are capable of safely operating equipment. Retain copies of all operators licenses and/or certifications onsite.

1.4 ACCIDENT REPORTING

- A. Reportable Accidents (per OSHA 29CFR 1904): A project reportable accident is defined as death, occupational disease, traumatic injury to employees or the public, fires, and property damage by accident in excess of \$100. Notify Contracting Officer immediately in the event of a reportable accident. Within 7 days of a reportable accident, fill out and forward to Contracting Officer an Accident/Property Damage Report (Form CM-22). Form may be obtained from the Contracting Officer.

PART 2 - PRODUCTS

2.1 ACCIDENT PREVENTION PLAN (APP)

- A. The Plan shall be written to comply with OSHA and project requirements (a generic plan is not acceptable) including but not limited to the following:
 - 1. Name of responsible supervisor to carry out the program.
 - 2. Weekly and monthly safety meetings shall be documented with topic and attendees.
 - 3. First aid and rescue procedures.
 - 4. Outline of each phase of the work, the hazards associated with each major phase, and the methods proposed to provide for property protection and safety of the public, National Park Service personnel, and Contractor's employees. Identify the work included under each phase, with a Job Hazard Analysis (JHA)/Job Safety Analysis (JSA), etc.
 - 5. Training, both initial and continuing.
 - 6. Planning for possible emergency situations, such as cave-ins, earthquake, explosions,, fires, floods, power outages, slides, and wind storms. Such planning shall take into consideration the nature of construction, site conditions, and degree of exposure of persons and property.

2.2 FIRST AID FACILITIES

- A. Provide adequate facilities for the number of employees and appropriate to the hazards associated with the types of ongoing construction work at the site.

2.3 PERSONNEL PROTECTIVE EQUIPMENT

- A. Meet requirements of applicable ANSI standards. Selection shall conform to OSHA 29CFR 1926.95 Subpart E.

PART 3 - EXECUTION

3.1 EMERGENCY INSTRUCTIONS

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

3.2 FIRE AND LIFE SAFETY

- A. Comply with the requirements of NFPA 241 (Standard for Safeguarding Construction, Alteration, and Demolition Operations).
- B. Store hazardous materials in accordance with manufacturer's and OSHA 29CFR1926 Subpart D requirements. Maintain readily available, on site, MSDS/Safety Data Sheets (SDS) for each chemical.

1. Immediately report all 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 the emergency response kit.

3.3 PROTECTIVE EQUIPMENT

- A. Inspect personal protective equipment daily and maintain in a serviceable condition. Clean, sanitize, and repair personal items, as appropriate, before issuing them to another individual.
- B. Inspect, maintain, and document other protective equipment and devices before use and on a periodic basis to ensure safe operation. Retain inspection documentation onsite.

3.4 SAFETY MEETINGS

- A. As a minimum, conduct one weekly 15-minute "toolbox" safety meetings. These meetings shall be conducted by a foreman or supervisor and attended by all construction personnel at the worksite. Topics need to coincide with work scheduled for the following week. Document and submit meeting minutes to the Contracting Officer within one day after the meeting.
- B. Conduct monthly safety meetings for all levels of supervision. Meetings shall be attended by all contractors and subcontractors performing work on the site. Notify the Contracting Officer of meeting dates and times. These meetings shall be used to review the effectiveness of the Contractor's safety effort, to resolve current health and safety problems, to provide a forum for planning safe construction activities, and for updating the Accident Prevention Plan. The Contracting Officers Representative will attend the meeting and enter the results of the meetings into the daily log.

3.5 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

- A. A hard hat use area shall be designated by the Contractor. The hard hat area shall be posted by the Contractor in a manner satisfactory to the Contracting Officer.
- B. It is the Contractor's responsibility to require all those working on or visiting the site to wear hard hats and other necessary personal protective equipment in good repair at all times. As a minimum, maintain six hard hats and all other APP required equipment.

3.6 TRAINING

- A. First Aid: Provide adequate training to an adequate number of 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. Hazardous materials are defined as explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful substances that could cause death or injury.

END OF SECTION 01 35 23

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements. The quality of all work shall be the 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 the Contract Document requirements.
- C. See Divisions 02 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 that actual products incorporated into the work and completed construction comply with requirements.
- C. Preconstruction Testing: Tests and inspections that are performed specifically for the project before products and materials are incorporated into the work to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are 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.
- E. Source Quality Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Field Quality Control Testing: Tests and inspections that are performed on-site for installation of the work and for completed work.
- G. Testing Agency or Laboratory: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter.” It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

1.3 CONFLICTING REQUIREMENTS

- A. Reference Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Contracting Officer for a decision before proceeding.
- B. Minimum Quality Levels: The quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Contracting Officer for a decision before proceeding.

1.4 SUBMITTALS

- A. Quality Control Plan:
 1. After contract award and before the Pre-Construction conference, submit for approval a written Contractor Quality Control (CQC) plan.
 2. If the plan requires any revisions or corrections, the Contractor shall resubmit the plan within 10 days.
 3. The Government reserves the right to require changes in the plan during the contract period as necessary to obtain the quality specified.
 4. No change in the approved plan may be made without written concurrence by the Contracting Officer.
- B. Qualification Data: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Contractor's Quality Control Daily Reports: Submit showing all inspections and tests on the first workday following the date covered by the report. Quality Control Supervisor shall utilize the DSC forms available by accessing the DSC Workflows website, <http://www.nps.gov/dscw/publicforms.htm>.
 1. Review CMR Dailies and reconcile any differences prior to posting CQC Dailies on the SharePoint Project Website.
- D. Test Reports
 1. Test reports shall be completed by the person performing the 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 the test was performed.
- E. Accessibility Inspection Report:

1. Fill out the applicable sections of the Accessibility Inspection Report and attach to the Quality Control Daily Report.
2. Utilize the attached Accessibility Inspection form to document compliance with the Architectural Barriers Act Accessibility Standards (ABAAS).
3. Inspect at various stages of construction as needed to insure the finished product meets the standards.
4. Submit report not later than one calendar day after the inspection was performed.

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

G. If the CQC plan and Quality Control Daily Reports are not submitted as specified, the Contracting Officer may retain all payments until such time a plan is accepted and implemented, or may retain payments for work completed on days there are no Quality Control Daily Reports.

H. Permits, Licenses, and Certificates: For 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 the work.

1.5 QUALITY ASSURANCE

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

B. Contractors Quality Control Staff:

1. The Contractor's Quality Control Supervisor may also perform other duties.
2. The Contractor's designated Quality Control Supervisor shall be on the project site whenever contract work is in progress.
3. The Contractor's job supervisory staff may be used to assist the Quality Control Supervisor supplemented, as necessary, by additional certified testing technicians.

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

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

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

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

1. Requirement for specialists shall not supersede building codes and regulations governing the work.
- H. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by Contract, is acceptable to the Contracting Officer.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
 3. All measuring devices, laboratory equipment, and instruments shall be calibrated at established intervals against certified standards in accordance with NIST requirements. Upon request, measuring and testing devices shall be made available for use by the Government for verification tests.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.6 QUALITY CONTROL

- A. The Contractor is responsible for all testing and inspections. Inspect and test work as needed to ensure that the quality of materials, workmanship, construction, finish and functional performance are in compliance with applicable specifications and drawings.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- 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 that replaced work that failed to comply with the 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 the work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit 3 copies of the certified written report of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the work.
- 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 the following:
1. Access to the work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 QUALITY CONTROL PLAN

- A. The Quality Control Plan shall include:
1. A list of personnel responsible for quality control and assigned duties. Include each person's qualifications.
 2. A copy of a letter of direction to the Contractor's Quality Control Supervisor outlining assigned duties.
 3. Names, qualifications, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms.
 4. Methods of performing, documenting, and enforcing quality control of all work.
 5. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.

PART 3 - EXECUTION

3.1 OFF-SITE CONTROL

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

3.2 ON-SITE CONTROL

- A. Notification:
1. Notify the Contracting Officer at least 48 hours in advance of the preparatory phase meeting.
 2. Notify the Contracting Officer at least 24 hours in advance of the 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, the Contractor's Quality Control Supervisor and the foreman responsible for the feature of work shall be in attendance.
2. Review all applicable specifications sections and drawings related to the feature of work.
3. Ensure that copies of all referenced standards related to sampling, testing, and execution for the feature of work are available on site.
4. Ensure that provisions have been made for field control testing.
5. Examine the work area to ensure that all preliminary work has been completed.
6. Verify all field dimensions and advise the Contracting Officer of discrepancies with contract documents.
7. Ensure that necessary equipment and materials are at the project site and that they comply with approved shop drawings and submittals.
8. Document all preparatory phase activities and discussions on the Contractor's Quality Control Daily Report.

C. Initial Phase:

1. As soon as work begins, inspect and test a representative portion of a particular feature of work for quality of workmanship.
2. Review control testing procedures to ensure compliance with contract requirements.
3. Document all initial phase activities and discussions on the 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 the same feature of work for the following reasons:

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

3.3 DOCUMENTATION

- A. Maintain Quality Control Daily Reports, Daily Test Report Information Sheets, and Accessibility Inspection Reports (Forms may be downloaded from the DSC Workflows website, <http://www.nps.gov/dscw/publicforms.htm>.) of quality control activities and tests.
- B. Quality Control Daily Reports may not be substituted for other written reports required under clauses of the contract, such as Disputes, Differing Site Conditions, or Changes.

3.4 ENFORCEMENT

- A. The Contractor shall stop work on any item or feature pending satisfactory correction of any deficiency noted by the quality control staff or the 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 that are as invisible as possible.
- 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 |

Statement of Structural Tests and Special Inspections

National Park Service (NPS) - Denver Service Center (DSC) | 6-29-21

Park: Acadia National Park

Project Management Information System (PMIS) Number: 309000

Project Name: Harden Farm Employee Housing


Structural Engineering Firm: Hedefine Engineering & Design, Inc.

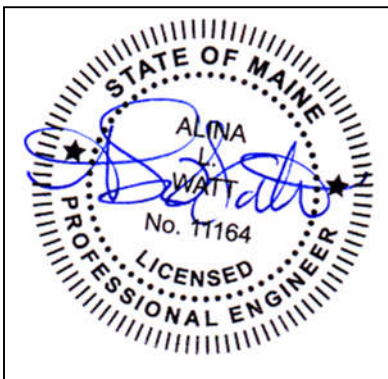
This Statement of Structural Tests and Special Inspections is being submitted as required by Chapter 17 of the **2021 International Building Code** (IBC-21). It includes the following:

1. Seismic requirements
2. Wind requirements
3. Qualification Requirements for Inspectors and Testing Technicians
4. Listing of Required Structural Tests and Special Inspections

The Construction Contractor's Quality Control Supervisor will provide copies of all special inspection reports and associated documentation to the Contracting Officer (CO). The Construction Contractor will be required to correct all deficiencies discovered in the Special Inspection and Structural Testing program.

Prepared By: Alina Watt, P.E., Hedefine Engineering & Design, Inc.
(Type or print name)

Signature:  Date: 5/21/2024



Stamped by Professional Engineer (PE) or Structural Engineer (SE)

Seismic and Wind Requirements

Seismic Requirements, IBC-21 Section 1704.3

Description of seismic-force-resisting system and designated seismic systems subject to special inspections:

$S_s = 0.224g$, $S_1 = 0.065g$, Site Class D, Risk Category II. The seismic-force-resisting system is the sheathed light framed wood walls, designed using equivalent lateral force method.

N/A - exempted by IBC 1705.13 Point #1.

Wind Requirements, IBC-21 Section 1704.3

Description of wind-force-resisting system and designated wind systems subject to special inspections:

$V_{ult} = 110$ MPH, Risk Category II, Exposure B, $C_{pi} = +/- 0.18$. The wind-force-resisting system is the sheathed light framed wood walls, designed using equivalent lateral force method.

N/A - exempted by IBC 1705.12 Point #1.

Instructions:

1. Under [Listing of Required Structural Tests and Special Inspections](#):
 - a. **Required?** - Place an **X** for all Special Inspections and Tests required for this project.
 - b. **Required Qualifications** - Provide qualifications for the special inspector, using the [Qualification Requirements for Inspector and Testing Technicians](#) list below, for all required Structural Tests and Special Inspections.
 - c. **Continuous** - If marked with an **X**, continuous special inspection shall be as defined in Chapter 2, IBC-21.
 - d. **Periodic** - If marked with an **X**, provide the minimum number of tests, i.e. 20% of all field welds, or the amount of work to be inspected (e.g. 10% of all wall surfaces).
2. Attach completed Statement of Structural Tests and Special Inspections to the end of NPS DSC Division 1 Specifications **Section 01 40 00 Quality Requirements**.

Qualification Requirements for Inspectors and Testing Technicians

PE/SE	Structural Engineer – licensed PE or SE specializing in the design of buildings and structures
PE/GE	Geotechnical Engineer – licensed PE specializing in soil mechanics and foundations
EIT	Engineer-In-Training – graduate engineer who has passed the Fundamentals of engineering examination
ET	Engineering Technician - experienced field inspector, retained or employed by approved agency and approved by building official

American Concrete Institute (ACI) Certification

ACI-CCSI	Concrete Construction Special Inspector
ACI-LTT	Concrete Laboratory Testing Technician Level 1 or 2
ACI-STT	Concrete Strength Testing Technician
ACI-FTT	Concrete Field Testing Technician – Grade I

American Society of Non-Destructive Testing (ASNT) Certification

Non-Destructive Testing Technician – Level II or III

American Welding Society (AWS) Certification

AWS-CWI	Certified Welding Inspector
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Exterior Design Institute (EDI) Certification

EDI-EIFS	Certified EIFS inspector
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International Code Council (ICC) Certification

ICC-PCSI	Prestressed Concrete Special Inspector
ICC-RCSI	Reinforced Concrete Special Inspector
ICC-SSI	Soils Special Inspector
ICC-SFSI	Spray-applied Fireproofing Special Inspector
ICC-SMSI	Structural Masonry Special Inspector
ICC-SSBSI	Structural Steel and Bolting Special Inspector
ICC-SWSI	Structural Welding Special Inspector

National Institute for Certification in Engineering Technologies (NICET) Certification

NICET-CT Concrete Technician – Levels I, II, III and IV
NICET-GET Geotechnical Engineering Technician - Levels I, II, III and IV
NICET-ST Soils Technician - Levels I, II, III and IV

Other

Listing of Required Structural Tests and Special Inspections

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
Concrete Construction (IBC-21 Section 1705.3)					
X	1. Inspect reinforcing steel and placement.	PE/SE, EIT, or ET		X	2x per bldg: footing rebar frost wall rebar
X	2. Inspection of anchors cast in concrete.	PE/SE, EIT, or ET		X	1x per bldg
X	3. Inspection of anchors post-installed in hardened concrete members.	PE/SE, EIT, or ET		X	1x per bldg
	4. Verify use of approved design mix.	ACI-FTT or ET		X	
X	5. Prior to placement fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	ACI-FTT	X		
X	6. Inspect for maintenance of specified curing temperature and techniques.	ACI-FTT or ET		X	1x at beginning of concrete placement and again each change of season during concrete activity
Wood Construction (IBC-21 Section 1705.5)					
X*	1. Inspect prefabricated wood structural elements in accordance with Section 1704.2.5. (AS APPLICABLE)	PE/SE or EIT		X	1x per building type *Not required if conditions of Sect. 1704.2.5.1 are met and certificate of compliance is provided by the fabricator
Soils (IBC-21 Section 1705.6)					

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	1. Verify materials below shallow foundations are adequate to achieve the required bearing capacity.	PE/SE/GE or EIT		X	
	2. Verify excavations are extended to proper depth and have reached proper material.	ET		X	
X	3. Perform classification and testing of compacted fill materials.	ACI-LTT		X	1-2 test per lift (depth per specifications) per building footprint; testing frequency may be modified once compaction methods are established producing consistent results
X	4. During fill placement, verify use of proper materials and procedure in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.	PE/SE, EIT or ET	X		Continuous observations until consistent method is established resulting in confirmed densities meeting spec.
X	5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	PE/SE, EIT or ET		X	once per building
Wind Resistance (IBC-21 Section 1705.12)					
	1. Provide inspections when required by Section 1705.12.	Exempted			
Seismic Resistance (IBC-21 Section 1705.13)					
	1. Provide inspections when required by Section 1705.13.	Exempted			

SECTION 01 42 00 - REFERENCES

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: The amount of biobased carbon in the material or product as a percentage of weight (mass) of the total organic carbon in the material or product.
- C. Chain-of-Custody: Process whereby a product or material is maintained under the physical possession or control during its entire life cycle.
- D. Deconstruction: Disassembly of buildings for the 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 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 at <http://www.epa.gov/oppt/epp/>.
- 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 the 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 with Federal Trade Commission (FTC) Guide for the 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 the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Contracting Officer for a decision before proceeding.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association (The) www.aluminum.org	(703) 358-2960
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
API	American Petroleum Institute www.api.org	(202) 682-8000
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500

AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818

NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PGI	PVC Geomembrane Institute http://pgi-tp.cee.uiuc.edu	(217) 333-3929
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Turfgrass Producers International www.turfgrassod.org	(800) 405-8873 (847) 649-5555
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902

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

DIN	Deutsches Institut für Normung e.V. www.din.de	49 30 2601-0
ICC	International Code Council www.iccsafe.org	(888) 422-7233

ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
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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 the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-6257
DOJ	Department of Justice www.justice.gov	(202) 514-2000
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478

OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934

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 the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAABAAG	Americans with Disabilities Act, Architectural Barriers Act, Accessibility Guidelines www.access-board.gov	(202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil/ Available from Defense Standardization Program www.dsp.dla.mil	(215) 697-2664
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
FP-03 U.S. Customary Units	Standard Specifications for Construction of Roads and Bridges on Federal Highway Project, FP-03, U.S. Customary Units http://flh.fhwa.dot.gov/resources/pse/specs/	

- ENVIRONMENTAL REFERENCE STANDARDS

American Forest and Paper Association:

Sustainable Forestry Initiative

American Association of State Highway and Transportation Officials (AASHTO): 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)

American Society for Testing and Materials International (ASTM):

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
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
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
C936 Standard Specification for Interlocking Concrete Paver Units
C989 Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m³))
D2369 Standard Test Method for Volatile Content of Coatings
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
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
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
D5505 Standard Practice for Classifying Emulsified Recycling Agents
D5539 Standard Specification for Seed Starter Mix
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
D5852 Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
D6155 Standard Specification for Nontraditional Coarse Aggregates for Bituminous Paving Mixtures
D6629 Standard Guide for Selection of Methods for Estimating Soil Loss by Erosion
D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
E1609 Standard Guide for Development and Implementation of a Pollution Prevention Program

Center for Resource Solutions
Green-e program

EPA:

Comprehensive Procurement Guidelines
ENERGY STAR
Environmentally Preferable Purchasing Program Final Guidance
GreenScapes program
Heat Island Initiative
National Environmental Performance Track
Pollution Prevention (P2)
Product Stewardship Program
Significant New Alternatives Policy (SNAP) Program

Federal Trade Commission:

Guide for the Use of Environmental Marketing Claims

J. Forest Stewardship Council:

Chain-Of-Custody
Forest Management

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

US Department of Agriculture:

Biobased Products – Definitions and Descriptions

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 57 23 - TEMPORARY STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Federal Regulations for controlling discharges of pollutants (including chemicals, erodible material, and trash) from municipal separate storm sewer systems, construction sites, and industrial activities, were brought under the National Pollution Discharge Elimination System (NPDES) permit process by amendments to the Clean Water Act (CWA), and promulgation of federal stormwater regulations issued by the U.S. Environmental Protection Agency (USEPA). The USEPA uses the amount of ground disturbance as a measure of a project potential to generate pollution from erosion. NPDES Phase I regulates discharges from construction sites that disturb 5 acres or more. NPDES Phase II regulations expand the existing General Permit requirements under Phase I to include/regulate discharges from construction sites that disturb land equal to or greater than one (1) acre and less than 5 acres, known as Small Construction Activity. Construction disturbances 1 acre and above typically require a formal NPDES permit and a formal Stormwater Pollution Prevention Plan (SWPPP) must be submitted to the Agency(ies) with Jurisdiction for review and approval.
- 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 the 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 the utility of the environment for aesthetic, cultural, or historical purposes.
- C. National Pollution Discharge Elimination System (NPDES) Phase I: Regulates discharges from construction sites that disturb 5 acres or more.
- D. NPDES Phase II: Regulations expand the existing General Permit requirements under Phase I to include and regulate discharges from construction sites that disturb land equal to or greater than one (1) acre and less than 5 acres, known as Small Construction Activity.
- E. Storm Water Pollution Prevention Plan (SWPPP): Developed and implemented stormwater management measures to protect surface water from pollutants during construction activities disturbing an acre or more in compliance with federal, state, and local requirements for permit approval under the NPDES program.

1.3 SUBMITTALS

- A. After contract award and before the pre-construction conference, prepare and submit:
 - 1. A SWPPP showing that the SWPPP satisfies all Federal and State NPDES permit requirements;
- B. Inspection Schedule: Submit schedule for inspection and monitoring of all storm water 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 any other materials proposed for use on this project.

1.4 QUALITY ASSURANCE

- A. The Contractor shall prepare and submit a plan to the Contracting Officer (CO) for review and concurrence.
- B. Orientation Meeting: The Contractor shall be responsible for arranging and conducting an Erosion and Sediment Control meeting/briefing to inform all parties scheduled to be on-site during the project of the measures to be implemented for proper erosion and sediment control (may be included as part of the Pre-Construction Meeting).
 - 1. Installation of silt fences, storm drain protection, and all other forms of erosion and sediment control shall not begin until after this meeting has occurred.
- C. Pollution Prevention and Erosion Control Manager: The Contractor shall designate the Pollution Prevention and Erosion Control Manager who will be responsible for the implementation, inspection, maintenance, and amendments to the approved plan.
 - 1. The Pollution Prevention and Erosion Control Manager shall be familiar with temporary storm water pollution prevention procedures and Best Management Practices (BMPs) and shall ensure that emergency procedures and the plan are updated as needed and available for inspection.
 - 2. When changes in the approved plan are required, the Pollution Prevention and Erosion Control Manager shall prepare and certify an amendment and submit to the CO for review and concurrence.

PART 2 - PRODUCTS

2.1 TEMPORARY STORM WATER POLLUTION PREVENTION PLAN:

- A. Provide a SWPPP which satisfies all Federal and State NPDES permit requirements and includes the following information and forms:
 - 1. Site description.

2. Identification and contract information for Pollution Prevention and Erosion Control Manager.
3. Expected sequencing of operations and construction schedule.
4. Weather monitoring procedure.
5. Descriptions and details BMPs for of pollution prevention and erosion controls, including dust control.
6. Pollution prevention and erosion control plans.
7. Controls for other potential onsite storm water pollutants.
8. Applicable specifications.
9. Maintenance and inspection procedures and forms.
10. Description of potential non-storm water discharges at site.
11. Notice of Intent (NOI) form.
12. Notice of Termination (NOT) form.
13. Contractor and Sub-contractor Certification forms.
14. Other record keeping forms and procedures.
15. Housekeeping Best Management Practices, including vehicle wash-down areas, protection of equipment storage and maintenance areas, and sweeping of roadways related to hauling activities.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION

- A. Protection of Natural Resources: Comply with applicable regulations and these specifications. Preserve the natural resources within the project boundaries and outside the limits of work performed under this Contract in their existing condition or restore to an equal or improved condition as approved by the CO.
- B. Construction Zone: Arrange construction activities to minimize pollution (i.e., erosion, trash, etc.) to the maximum practical extent.
 1. Clearing, excavation, and grading shall be limited to those areas of the project site necessary for construction. Minimize the area exposed and unprotected.
 2. Clearly mark and delineate the limits of work activities.
 3. Equipment shall not be allowed to operate outside the limits of work or to disturb existing vegetation.
 4. Excavation and grading shall be completed during the dry season to the maximum extent possible
 5. Material should be stored away from locations where water is present to the greatest extent practicable.

3.2 REGULATORY REQUIREMENTS

- A. Permits: The Contractor shall obtain all required NPDES permits in a manner that results in no impacts to scheduled work. The Contractor shall account for the possibility of significant lead time in scheduling and executing the work.

1. Implement the requirements of the NPDES permit for erosion control due to storm water runoff during construction.
 2. Implement all good housekeeping practices, inspections and record keeping.
 3. Prior to construction, the Contractor and all subcontractors shall sign certifications (included in the plan) that they understand the requirements of the NPDES permit.
 4. All subcontractors shall comply with the requirements of the NPDES under the supervision of the Contractor.
 5. The accepted plan must comply with the terms and conditions of the EPA permit.
- B. Notice of Intent (NOI): The Contractor shall file a Notice of Intent and formal SWPPP as required to the Agency(ies) with Jurisdiction.
- C. Notice of Termination (NOT): After Substantial Completion of the construction project, file a Notice of Termination (NOT) with the Agency(ies) with Jurisdiction.
- D. CO Notification: The Contractor shall notify the CO in writing and by telephone of the following events:
1. The required 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 all sediment control structures.

3.3 TEMPORARY STORM WATER POLLUTION PREVENTION PLAN

- A. Review and Acceptance: The Contractor and the CO will jointly review the draft Plan and agree to any needed revisions. The Contractor shall incorporate all revisions, sign, and submit the final Plan to the CO. The final Plan will be the document enforced on the project.
1. The accepted Plan will describe and ensure implementation of the practices which will be used to reduce the pollutants in storm water discharges.
 2. The Contractor shall maintain a current copy of the Plan and all associated records and forms at the jobsite throughout the duration of the project.
 3. The Plan shall be available at all times for public inspection and for the inspection and use of the CO.
 4. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.
- B. Implementation: Implement the Plan as required throughout the construction period and maintain all erosion control elements in proper working order.
1. Do not perform clearing and grubbing or earthwork until the Plan has been implemented.
- C. The SWPPP (including inspection forms) and all data used to complete the NOI shall be provided to the CO after Substantial Completion of the project.

3.4 SITE INSPECTIONS AND PLAN REVISIONS

- A. Inspections: The Contractor and the CO will perform a weekly inspection of the site.
 - 1. The inspection shall include disturbed areas that have not been completely stabilized, areas used for storage of materials, locations where vehicles enter or exit the site, and all other erosion and sediment controls that are included in the Plan.
 - 2. Inspections shall be documented.
 - 3. The inspection forms shall be retained onsite in the Plan notebook throughout the construction period.
- B. Plan Revisions: It may be necessary to revise the Plan during construction to make necessary improvements, revisions, or to respond to unforeseen conditions noted during construction or site inspections.
 - 1. The Plan shall specify the mechanism whereby revisions may be proposed by the Contractor or the CO.
 - 2. The Contractor and the CO will jointly review each revision to the Plan before changes are incorporated and implemented. The Contractor will then provide a revised copy of the Plan to the CO.
 - 3. Accepted modifications will be implemented within 7 calendar days following the date of the 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 the Government.

3.5 HOUSEKEEPING AND SITE MANAGEMENT

- A. Materials stored on site should be stored in conformance to federal, state, local, and manufacture's regulations and specifications. Additionally, BMPs should be used to minimize the risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.
- B. Solid waste should be managed in conformance to federal, state, and local regulations. BMPs should be used to minimize the risk of materials coming into contact with the environmental conditions (i.e. water and wind) that could disperse them.
- C. The project should include a spill prevention and control plan with provisions placed in the SWPPP.
- D. Hazardous waste (including contaminated soil) should be managed in conformance to federal, state, local and NPS regulations and guidelines.

3.6 EROSION CONTROL MEASURES

- A. Erosion control measures shall consist of any and all BMPs for storm water discharges, including but not limited to 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 to control run-on and run-off into other areas, including creeks, streams, marshes, access roads, well areas, and the staging areas.
- C. Erosion control measures shall be used to contain only direct precipitation in the construction zone. The contained water shall be allowed to percolate into the ground or drain slowly through the drainage filter sediment traps.
- D. Earthen sediment traps or holding ponds shall not be used unless accepted by the CO.
- E. Reduce runoff velocity as well as direct surface runoff around and away from all fuel containment, storage, and borrow areas.
- F. Divert surface runoff around and away from cut and fill slopes.
- G. Place drainage filters around all catch basins to create sediment traps to control run-off from the construction area.
- H. Excess water used for dust control shall be contained within the demolition areas by the erosion control measures.
- I. The Contractor shall prevent the deposition of materials onto paved areas. The Contractor shall inspect the paved areas for deposited materials weekly and remove the materials immediately.
- J. Furnish, install, maintain, and operate necessary control measures and other equipment necessary to prevent erosion as described in the approved SWPPP.
- K. Before the work begins, sufficient equipment shall be available on the site to assure that the operation and adequacy of the erosion control system can be maintained.

3.7 REPORTING

- A. If a discharge occurs or if the project receives a written notice or order from any regulatory agency, the Contractor will immediately notify the CO and will file a written report to the Agency(ies) with Jurisdiction within 7 days of the discharge event, notice, or order. Corrective measures shall be implemented immediately following the discharge, notice, or order. The report to the Agency(ies) with Jurisdiction shall contain the following items at a minimum:
 1. The date, time, location, nature of operation, and type of discharge, including the cause or nature of the notice or order.
 2. The BMPs deployed before the discharge event, or prior to receiving the notice or order.
 3. The date of deployment and type of BMPs deployed after the discharge event, or after receiving the notice or order, including additional BMPs installed or planned to reduce or prevent re-occurrence.
 4. An implementation and maintenance schedule for any affected BMPs.

3.8 SEDIMENT DISPOSAL

- A. Sediment excavated from temporary sediment control structures shall be disposed on the site with general fill, or with topsoil. Sediment shall be allowed to dry out as required before reuse.
- B. Contractor shall place the 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.

3.9 REMOVAL OF TEMPORARY STORM WATER POLLUTION CONTROL MEASURES

- A. All temporary control measures shall be removed with permission of the CO within 20 working days after final acceptance of the project, and/or once grading is completed and slopes have stabilized. |

END OF SECTION 01 57 23

SECTION 01 67 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and environmental requirements.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- D. 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: The amount of biobased carbon in the material or product as a percentage of weight (mass) of the total organic carbon in the material or product.

- E. Chain-of-Custody: Process whereby a product or material is maintained under the physical possession or control during its entire life cycle.
- 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 for more information <http://www.epa.gov/oppt/epp/>.
- G. Stewardship: Responsible use and management of resources in support of sustainability.
- H. Sustainability: The maintenance of ecosystem components and functions for future generations.
 - 1. 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 with ISO 140001 Standard for the Use of Environmental Marketing Claims.
 - 2. Rapidly Renewable Material: Material made from plants that are typically harvested within a ten-year cycle.
 - 3. Regional Materials: Materials that are manufactured and extracted, harvested, or recovered within a radius of 500 miles from the Project location.

1.3 SUBMITTALS

- A. Record Submittals as specified in – Sustainable Design Close-Out Documentation, submit the following:
 - 1. Affirmative Procurement Reporting Form. Submit on form in Appendix A of this Section, or similar form as approved by Contracting Officer.
 - 2. Submit environmental data in accordance with Table 1 of ASTM E2129 for the following products:
 - a. Paints & Coatings
 - 3. Material Safety Data Sheets (MSDS): For each product required by OSHA to have a MSDS, submit an MSDS. MSDS shall be prepared within the previous five years. Include information for MSDS Sections 1 – 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 MSDS.

- l. Section 12: Ecological Information. Include data regarding environmental impacts during raw materials acquisition, manufacture, and use. Include data regarding environmental impacts in the event of an accidental release.
 - m. Section 13: Disposal Considerations. Include data regarding the proper disposal of the chemical. Include information regarding recycling and reuse. Indicate whether or not the product is considered to be "hazardous waste" according the US EPA Hazardous Waste Regulations 40 CFR 261.
 - 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 MSDS was prepared.
4. Chain Of Custody: Submit chain-of-custody documentation for sustainable forestry for the following products:
 - a. Rough Carpentry

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 will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Contractor is encouraged to obtain materials in biodegradable or recyclable/reusable packaging which uses the minimum amount of packaging possible.
- C. Storage:
 1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by the elements, under cover in a 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 a well-drained area on solid surfaces to prevent mixing with foreign matter.

1.6 PACKAGING

- A. Where Contractor has the option to provide one of the 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 10 percent recovered fiber content of carrier board in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.
- E. Provide minimum 5 percent 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 the greatest extent possible.
 1. To the greatest extent possible, provide products and materials that have 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 the use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI or the Clean Air Act Amendments of 1990, or equal 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 the total value of the materials in the project.

1.8 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to the National Park Service.
 - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for the National Park Service.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 - 3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Government reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Contracting Officer will make selection.
 - 5. Where products are accompanied by the term "match sample," sample to be matched is Governments.
 - 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements or approved equal.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements or approved equal.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements or approved equal.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements or approved equal.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, 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 a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product, system, or approved equal.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers, or approved equal. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a 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 the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, 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 the 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 the following conditions are not satisfied, Contracting Officer will return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION

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 w/ recycled content Pre-con- sumer	Total \$ value w/ recycled content Post- con- sumer	Total \$ value w/ bi- obased 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 con- tent)						
Parking Stops (Plastic/Rubber)						
Patio Blocks/Rub- ber						
Patio Blocks/Plas- tic						
Playground Sur- faces						
Concrete w/ fly ash						
Concrete w/ slag cement						
Concrete w/ low cement content						
Plastic lumber						
Building Insula- tion						
Rock Wool						
Fiber glass						
Cellulose						
Perlite Comp Board						
Plastic Rigid Foam						

Glass Fiber Reinf Foam						
Phenolic Rigid Foam						
Ceramic tile						
Resilient flooring						
Floor Tiles/Rub- ber						
Floor Tiles/Plas- tic						
Running Tracks						
Carpet (PET)						
Paint						
Reprocessed La- tex Paint White & Light Colors						
Reprocessed La- tex Dark Colors						
Consolidated La- tex Paint						
toilet/shower parti- tions (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. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 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 land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Quantity Surveys: Submit two copies showing quantities of work performed and actual construction completed and in place.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- 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 the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to the Contracting Officer in accordance with Division 01 Specification 01 31 00 "Project Management and Coordination".

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the existing benchmarks. If discrepancies are discovered, notify Contracting Officer promptly.
- B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
 - 1. Land surveyor.
 - 2. Close text surveys with an error of closure equal to or less than the established standard.

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as 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 that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.
- I. Quantity surveys: Shall be conducted, and the data derived from these surveys shall be used in computing the quantities of work performed and the actual construction completed and in place.
 - 1. The Contractor shall conduct the original and final surveys and surveys for any periods for which progress payments are requested. All these surveys shall be conducted under the direction of a representative of the Contracting Officer, unless the Contracting Officer waives this requirement in a specific instance. The Government shall make such computations as are necessary to determine the quantities of work performed or finally in place. The Contractor shall make the computations based on the surveys for any periods for which progress payments are requested.
 - 2. Promptly upon completing a survey, the Contractor shall furnish the originals of all field notes and all other records relating to the survey or to the layout of the work to the Contracting Officer, who shall use them as necessary to determine the amount of progress payments. The Contractor shall retain copies of all such material furnished to the Contracting Officer.

3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
 - 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 that are not hazardous to health or property and that will not damage exposed surfaces.
 - 1. Utilize non-toxic cleaning materials and methods.

- a. Comply with 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 as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- K. Final Cleaning: At completion of Work, remove all remaining waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces; leave Project clean and ready for occupancy.

- 1. Provide final cleaning in accordance with ASTM E1971.

3.6 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.

3.7 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

END OF SECTION 01 73 40]

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Site improvement materials resulting from demolition or selective demolition operations.
- C. 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 the construction, demolition, or renovation of a structure which exceeds 2.5 inch (60 mm) 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 the 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: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
- G. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.
- H. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) 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 the potential to meet the definition of a 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.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Project shall minimize creation of construction, deconstruction, and demolition waste to protect and restore natural habitat and resources. Factors that contribute to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination shall be minimized. A Waste Management Plan shall be developed to ensure that existing site and building materials are reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.
- B. Salvage /Recycle Requirements: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 percent 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, 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. Other mixed construction and demolition waste as appropriate
- C. If any waste materials encountered during the deconstruction/demolition or construction phase are found to contain lead, asbestos, 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 the deconstruction/demolition phase shall be reused in the 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 the quality standards set forth in these specifications. Contractor shall ensure that the 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 the Contracting Officer 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.

1.4 SUBMITTALS

- A. Waste Management Plan: After award of contract and prior to the scheduled Pre-Construction Conference, Contractor shall submit a draft Waste Management Plan to the Contracting Officer

for approval. Submit 3 copies of plan. Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.

- B. Progress Documentation: Supplemental to the Waste Management Plan, document solid waste disposal, diversion, and cost/revenue analysis and submit completed worksheet on a monthly basis. Use Appendix A - Project Waste Management Plan Worksheet, and report totals to date for all column headings. Use Appendix B for solid waste volume to weight conversions.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit 3 copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. 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.
- H. LEED™ Submittal: LEED™ letter template for Credit MR 2.1, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- I. Qualification Data: For Waste Management Coordinator.
- J. Progress payment requirements:
 - 1. With each Application for payment, submit 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.
- K. Closeout Submittals
 - 1. With Closeout Submittals, submit a summary of the Project Waste Management Plan worksheet for solid waste disposal and diversion. Submit on form in Appendix A of this Section.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED™-

Accredited Professional, certified by the USGBC, as waste management coordinator. Waste management coordinator may also serve as LEED™ coordinator.

- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Meeting: Conduct separate meeting or cover in the Pre-Construction Conference and comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

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 that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials 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.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
1. Landfill tip fees/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 the Contracting Officer. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a 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 first 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 a specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return.
 2. Waste and recycling bins are to be placed near each other, and close to the point of waste generation but out of the traffic pattern.

3. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid co-mingling of materials.
4. Bins shall be protected during non-working hours from off-site contamination.
5. Garbage dumpsters should be checked periodically to monitor recyclables being thrown away or if there are undocumented materials that could be recycled.

G. Materials handling procedures: Materials to be recycled shall be protected from contamination and shall be handled, stored, and transported in a manner that meets the requirements set by the designated facilities for acceptance. Establish a defined area for the operations of each trade, especially woodcutting so that off-cuts will be 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 a 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: 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 a secure area until delivery to Government.
5. Transport items to storage area within the park boundary 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 Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

- a. Inspect containers and bins for contamination and remove contaminated materials if found.
- 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
- 4. Store components off the ground and protect from the weather.
- 5. Remove recyclable waste off Governments property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Grind asphalt to maximum 4-inch (100-mm) size.
- B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum 4-inch (100-mm) size.
- 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.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.
- C. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

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 of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Governments property and legally dispose of them.

3.7 ASBESTOS CEMENT PIPE REMOVAL

- A. Record Drawings indicate that the existing water and sewer pipe on the property is 6" Asbestos Cement Pipe.
- B. The project will consist of the intact removal and disposal of approximately 1,500 linear feet of buried 6" diameter asbestos cement water and sewer pipe.
- C. All work shall be performed in general accordance with Maine Department of Environmental Protection (MaineDEP) asbestos regulations.
- D. All asbestos removal activities shall be conducted by a MaineDEP licensed asbestos contractor.
- E. Contractor shall prepare a written Work Plan detailing the methods that will be used to safely excavate, remove, handle, transport, and dispose of the asbestos cement pipe. The Work Plan shall be submitted for review and approval by the National Park Service's Environmental Consultant prior to the start of work.
- F. The Work Plan should include the following procedures at a minimum:
 - 1. The contractor shall excavate on each side of the pipe without damaging the pipe. Hand excavation in the areas immediately surrounding the pipe is required to ensure no damage.
 - 2. Pipe shall be removed intact whenever possible. Pipe sections will be wrapped in 2-layers of 6-mil poly sheeting and taped at all seams, then placed in a covered waste container for proper transportation and disposal.
 - 3. Where it is necessary for the contractor to break the pipe into manageable size sections for removal and disposal, the contractor shall perform the following steps:
 - a. Hand excavation on each side and beneath location of planned break.
 - b. Place a layer of 6 mil poly sheeting under the pipe where break will occur.
 - c. Break pipe using dust minimizing techniques such as cracking the pipe with hand tools and spray the pipe with amended water mist while breaking.
 - d. Remove the intact sections of pipe. After the pipe is cleared, fold the poly sheeting in onto itself, immediately bag in 6-mil bags goosenecked and taped, then dispose of as asbestos waste.
 - 4. Any pieces of broken pipe found during excavation shall be picked up by hand, double bagged, and treated as asbestos waste.

5. If pulverized pipe is observed in soil, the soil containing the pulverized pipe shall be skimmed until visually clear. The affected soil must be double bagged and handled as asbestos waste.
- G. All asbestos waste shall be double bagged or wrapped with 2 layers of sealed 6 mil poly sheeting or bags and placed in a covered waste container.
- H. All locations where asbestos piping was removed shall be visually inspected by the National Park Service's Environmental Consultant prior to backfilling the area. If any asbestos waste/debris/dust is observed, the contractor shall be responsible for skimming the soil and disposing of any of this soil and debris as asbestos waste until visually clear.
- I. All asbestos waste shall be transported to and disposed of in an approved asbestos waste landfill in accordance with applicable local, State, and Federal regulations.
- J. All waste manifests shall be submitted to the Contracting Officer immediately. Final payment for services will not be made until manifests are received.

END OF SECTION 01 74 19 |

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

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 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 the Contracting Officer for inspection at the time of monthly progress payment requests. If project record drawings are not current, the Contracting Officer may retain an appropriate amount of the progress payment.
- C. On completion of the total project, submit complete record drawings. Include shop drawings, sketches, and additional drawings that are to be included in the 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. The terms and conditions of the contract still require you to satisfy the requirements of the individual specification sections. Specific warranties, guarantees, workmanship bonds, final certifications, and similar documents.
 - 2. Project Record Documents, operation and maintenance manuals, final completion construction digital images recorded on CD-R or DVD-R with index and descriptions, and similar final record information.
 - 3. Complete final cleaning requirements.

1.4 FINAL INSPECTION, SUBSTANTIAL COMPLETION AND ACCEPTANCE PROCEDURES

- A. Request a final inspection in writing when a project or designated portion of a project is substantially complete. The Contracting Officer will proceed with the inspection within 30 calendar days of receipt of the written request or will advise the Contractor of items that prevent the project from being substantially complete.
- B. If the work is determined to be substantially complete, following the final inspection. Contracting Officer will prepare a Punch List and issue a Letter of Substantial Completion.
- C. If the work is not determined to be substantially complete following the final inspection, Contracting Officer will notify Contractor in writing. Contractor shall request a new final inspection after completing the work. Re-inspection costs may be charged against the Contractor in accordance with the Inspection of Construction contract clause.
- D. Contractor shall complete the Punch List within 30 calendar days, documented weather permitting.
- E. If Contractor completes all items of work on the Punch List and all contractually required items, Contracting Officer will issue Letter of final acceptance of work.
- F. If the Contractor fails to complete the work within the time frame, the Contracting Officer may correct the work with an appropriate reduction in contract price or charge for re-inspection costs in accordance with the Inspection of Construction contract clause.

1.5 PERMIT CLOSURE AND TRANSFER

- A. After substantial completion and the Punch List has been completed, the permits shall be closed and documented by the Agency(ies) with Jurisdiction for the permit.
- B. If responsibility for permits is to be transferred to the Park, the Park shall be informed of the permit provisions completed and responsibilities that will transfer to park staff.

1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Contracting Officer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. See Division 01 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.

END OF SECTION 01 77 00

Closeout and Operation & Maintenance (O&M) Requirements Template

National Park Service (NPS) - Denver Service Center (DSC) | 1-27-21

Topic	Specification Section	Requirement	Submittal Date	Completed	Received by Park
Project Record Drawings	01 77 00	Final Project Record Drawings			
	08 31 13	Access door Record documents			
System Demonstration and Training	21 13 13	Sprinkler System Testing			
	23 09 00	HVAC Controls			
	23 01 65	VRF System/Heat Pump System			
	23 72 00	ERV			
Extra Stock	09 65 13	Not less than 10 linear feet per 500 linear feet of resilient base installed			
	09 65 19	Not less than 2% of installed area of each kind of Resilient flooring product			
	09 91 00	5% of the painted area but not less than 1 gallon of each material and color applied			
	23 72 00	ERV (2) Spare Filter Changes			
Reports	21 13 13	Sprinkler Testing Report			
	22 11 00	Water System Pressure Test Report			
	23 05 93	HVAC Testing Balancing Report			
Keys & Keying Schedule	08 31 13	For Fire rated access doors - schedule of room name and number in which access door is located			
	08 71 00	Final keying schedule			
O&M Data Warranties Guarantees	07 31 13	Asphalt Shingle O&M data & material warranty			
	07 31 29	Wood shingle O&M data, material warranty, installer warranty			
	07 49 00	Siding O&M data, manufacturer warranty			
	07 91 00	Joint sealant installer warranty two years from substantial completion			
	08 14 00	Wood door O&M data, manufacturer warranty			
	08 14 23	Clad wood door O&M data, manufacturer warranty,			
	08 50 00	Window O&M data, manufacturer warranty 10 years from substantial completion			
	08 71 00	Door hardware O&M data, manufacturer warranty			
	08 80 00	Glazing manufacturer's warranty 10 years from substantial completion			
	09 30 13	Ceramic tile and grout O&M data, manufacturer warranty			
	10 14 19	Dimensional letter signage O&M data			
	10 28 00	Toilet & bath accessories O&M data, manufacturer warranty 15 years from substantial completion			
	10 44 13	Fire Protection cabinets O&M data			
	10 44 16	Fire extinguisher O&M data, manufacturer warranty six years form substantial completion			
	11 30 13	Residential appliance O&M data for each appliance, manufacturer warranty 2 years from substantial completion			
	12 21 13	Horizontal louver blind O&M data			
	12 32 13	Manufactured Wood-veneer faced cadework to have manufacturer warranty five years from substantial completion			
	21 13 13	Sprinkler System			
	22 40 00	Plumbing Fixtures, tanks, etc.			
	23 01 65	VRF			
	23 09 00	HVAC Controls			
	23 72 00	ERV			
	23 83 33.1	Electric Heaters			
26 09 23	Lighting Controls				

Topic	Specification Section	Requirement	Submittal Date	Completed	Received by Park
	26 51 00	Interior Lighting			
	26 56 19	Exterior Lighting			
	28 31 00	Fire Alarm Devices			
Compliance Certificates	06 40 23	Quality Standard compliance certificate			
	07 84 13	Penetration firestopping Installer compliance certificates			
	12 32 13	Manufactured Wood-Veneer faced casework Quality standard compliance certificate			
	12 36 23	Plastic Laminate clad countertops Quality standard compliance certificate			

DIVISION 02 - SITE WORK

SECTION 02 41 20 – STRUCTURE EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work consists of excavating material for the construction of structures. The work includes excavating, preparing foundations, bedding, and backfilling.

PART 2 - MATERIALS

2.1 MATERIALS

- A. Backfill Material. Furnish a well-graded, compactable material free of excess moisture, muck, frozen lumps, roots, sod, or other deleterious material conforming to the following:
 - 1. For all structures and pipes other than plastic pipe:
 - a. Maximum particle size 3 inches
 - b. Soil classification, AASHTO M 145 A-1, A-2, or A-3
 - 2. For plastic pipe:
 - a. Maximum particle size 1½ inches
 - b. Soil classification, AASHTO M 145 A-1, A-2-4, A-2-5, or A-3
- B. Foundation Fill. Furnish granular material free of excess moisture, frozen lumps, roots, sod, or other deleterious material and conforming to the following:
 - 1. Maximum particle size 2 inches
 - 2. Soil classification, AASHTO M 145 A-1-a
 - 3. Material passing No. 200 sieve, 6% max.
AASHTO T 27 and T 11
- C. Bedding Material. Furnish material free of excess moisture, muck, frozen lumps, roots, sod, or other deleterious material conforming to the following:
 - 1. Maximum particle size 1/2 inch or half the corrugation depth, whichever is smaller
 - 2. Soil classification, AASHTO M 145 A-1, A-2-4, A-2-5, or A-3
- D. Unclassified Borrow. Furnish granular material free of excess moisture, muck, frozen lumps, roots, sod, or other deleterious material conforming to the following:
 - 1. Maximum particle size 24 inches
 - 2. Soil classification, AASHTO M 145 A-1, A-3, or A-2-4

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

- A. Preparation for Excavation

1. Clear the area of vegetation and obstructions in accordance with Specification 31 11 00.

B. General

1. Excavate foundation pits to a width and length that allows room for work. When excavation is complete, request approval as to the character and suitability of the foundation material. The foundation shall provide a firm foundation of uniform density throughout its length and width.

Follow OSHA safety regulations (29 CFR, Part 1926, Subpart P, Excavation) for sloping the sides of excavations, using shoring and bracing, and for using other safety features. Provide one copy of the design that demonstrates conformity with OSHA safety regulations. Remove safety features when no longer necessary. Remove shoring and bracing to at least 2 feet below the surface of the finished ground.

Saw cut existing pavements or concrete structures adjacent to the area to be excavated that are designated to remain.

Conserve suitable material for backfill from excavated material. Do not deposit excavated material in or near a waterway. Do not stockpile excavated material or allow equipment closer than 2 feet from the edge of the excavation.

Dispose of unsuitable or excess material legally off the project. Shape and compact the waste material in its final location.

Remove all water necessary to perform work

C. Dewatering

1. While placing concrete, locate and operate pumps outside the foundation form. If pumping is permitted from the interior of any foundation enclosure, pump in a manner to avoid removal or disturbance of concrete material.

D. Bedding

1. Place bedding as follows:
 - a. Construct bedding when required by the contract. Place and shape bedding material in compacted layers not exceeding 6 inches in depth. Compact each layer according to Subsection 3.1 F.

E. Backfill

1. Backfill as follows:
 - a. General. Place backfill in horizontal layers that, when compacted, do not exceed 6 inches in depth. Compact each layer according to Subsection 3.1 F. Bring backfill up evenly on all sides of the structure, and extend each layer to the limits of the excavation or to natural ground. Do not place backfill against concrete less than 7-days-old or until 80 percent of the design strength is achieved.
2. Patching existing pavement areas. Construct the top 15 inches with 12 inches of crushed aggregate according to Specification 32 11 23 and 3 inches of asphalt concrete according to Specifications 32 12 16.01 and 32 01 16.71.

F. Compacting

1. Determine optimum moisture content and maximum density according to AASHTO T 99, method C. Adjust the moisture content of the backfill material to a moisture content suitable for compaction.

Compact material placed in all layers to at least 95 percent of the maximum density. Determine the in place density and moisture content according to AASHTO T 310 or other approved test procedures.

Do not apply density requirements as measured by AASHTO T 310 to material that is incapable of being tested or compacted to maximum values determined by AASHTO T 99. For these materials, fill the voids around the rock in each layer with earth or other fine material. Compact each layer, full width, until there is no visible evidence of further consolidation.

END OF SECTION 02 41 20

SECTION 02 72 20 – CULVERTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of furnishing and installing new pipe culverts, resetting existing culverts in conjunction with full depth pavement patch repair, and cleaning of existing pipes remaining in place, as noted on the Drawings. This includes, but is not limited to, all excavation, stockpiling of excavated materials, removal and disposal of existing culverts, bedding, furnishing and installing of new culvert pipe, backfill, compaction and reconstruction of the road necessary to complete the work.

PART 2 - PRODUCTS

2.1 CULVERTS

A. HDPE Culvert Pipe

- 1. Pipe shall have the diameter shown in the drawings. Pipe shall conform to the requirements of AASHTO M 294 Type S. All polyethylene pipe shall be smooth lined and shall meet the pipe stiffness requirements below. The manufacturing plants of polyethylene pipe shall participate annually in the National Transportation Product Evaluation Program (NTPEP) process for plastic pipe and resins which includes audits by the AASHTO Materials Reference Laboratory (AMRL). Plants shall be listed as “Compliant” on the NTPEP website and take immediate corrective action for any deficiencies found during audits.
- 2. Pipe Stiffness Requirements:

Diameter	AASHTO M 294 Dual-Wall Pipe Stiffness (KPa @ 5% Deflection)
12”	345
15”	290
18”	275
21”	260
24”	235
27”	205
30”	195
36”	150
42”	140
48”	125
54”	110
60”	95

B. Corrugated Metal Pipe

1. Pipe shall have the diameter shown in the drawings. Pipe and special fittings such as elbows, tees, and wyes shall conform to the requirements of AASHTO M 196/M 196M, Type I, IR, or II. Special sections, such as elbows and metal end sections, shall be of the thickness called for on the plans and shall conform to the applicable requirement of AASHTO M 196/M 196M. Aluminum sheet shall conform to the requirements of AASHTO M 97/M 197M.
2. Pipe Nominal Wall Thickness Requirements:

Diameter	AASHTO M 197
12"	0.075"
15"	0.075"
18"	0.075"
21"	0.075"
24"	0.075"
27"	0.105"
30"	0.105"
36"	0.105"
42"	0.105"
48"	0.105"
54"	0.105"
60"	0.105"

C. Reinforced Concrete Pipe

1. Pipe shall have the diameter shown in the drawings. This pipe shall conform to the requirements of AASHTO M 170/M 170. Elliptical pipe shall conform to the requirements of AASHTO M 207M/M 207. Unless otherwise specified, pipe wall design and use of elliptical reinforcement in circular pipe are optional. Pipe arch shall conform to the requirements of AASHTO M 206M/M 206.
2. Fine Aggregate: Fine aggregate for concrete shall consist of natural sand or, when approved by the Resident, other inert materials with similar characteristics or combinations thereof, having strong, durable particles. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of construction or mix without permission of the Contracting Officer.

All fine aggregate shall be free from injurious amounts of organic impurities. Should the fine aggregate, when subjected to the colorimetric test for organic impurities, AASHTO T 21, produce a color darker than the reference standard color solution (laboratory designation Plate III), the fine aggregate shall be rejected.

Fine aggregate shall have a sand equivalent value of not less than 75 when tested in accordance with AASHTO T 176.

Fine aggregate sources shall meet the Alkali Silica Reactivity (ASR) requirements of Section 703.0201.

The fineness modulus shall not be less than 2.26 or more than 3.14. If this value is exceeded, the fine aggregate will be rejected unless suitable adjustments are made in proportions of coarse and fine aggregate. The fineness modulus of fine aggregate shall be determined by adding the cumulative percentages of material by weight retained on the following sieves: Nos. 4, 8, 16, 30, 50, 100 and dividing by 100.

Fine aggregate, from an individual source when tested for absorption as specified in AASHTO T 84, shall show an absorption of not more than 2.3 percent.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
3/8 inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10
No. 200	0-5.0

- 3. Course Aggregate: Coarse aggregate for concrete shall consist of crushed stone or gravel having hard, strong, durable pieces, free from adherent coatings and of which the composite blend retained on the 3/8 inch sieve shall contain no more than 15 percent, by weight of flat and elongated particles when performed in accordance with test method ASTM D 4791, Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate, using a dimensional ratio of 1:5.

The coarse aggregate from an individual source shall have an absorption no greater than 2.0 percent by weight determined in accordance with AASHTO T 85 modified for weight of sample.

The composite blend shall have a Micro-Deval value of 18.0 percent or less as determined by AASHTO T 327 or not exceed 40 percent loss as determined by AASHTO T 96.

Coarse aggregate sources shall meet the Alkali Silica Reactivity (ASR) requirements of Section 703.0201.

Coarse aggregate shall conform to the requirements of the following table for the size or sizes designated and shall be well graded between the limits specified.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves			
Grading	A	AA	S	LATEX
Aggregate Size	1 inch	¾ inch	1 ½ inch	½ inch
2 inch			100	
1 ½ inch	100		95-100	
1 inch	95-100	100		
¾ inch		90-100	35-70	100
½ inch	25-60			90-100
3/8 inch		20-55	10-30	40-70
No. 4	0-10	0-10	0-5	0-15
No. 8	0-5	0-5		0-5
No. 16				
No. 50				
No. 200	0-1.5	0-1.5	0-1.5	0-1.5

4. Fine and coarse aggregate sources shall meet the following Alkali Silica Reactivity (ASR) requirements:

All coarse and fine aggregates proposed for use in concrete shall be tested for Alkali Silica Reactivity (ASR) potential under AASHTO T 303 (ASTM C 1260), Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction, prior to being accepted for use. Acceptance will be based on testing performed by an accredited independent lab submitted to the Department. Aggregate submittals will be required on a 5-year cycle, unless the source or character of the aggregate in question has changed within 5 years from the last test date.

As per AASHTO T 303 (ASTM C 1260): Use of a particular coarse or fine aggregate will be allowed with no restrictions when the mortar bars made with this aggregate expand less than or equal to 0.10 percent at 30 days from casting. Use of a particular coarse or fine aggregate will be classified as potentially reactive when the mortar bars made with this aggregate expand greater than 0.10 percent at 30 days from casting. Use of this aggregate will only be allowed with the use of cement-pozzolan blends and/or chemical admixtures that result in mortar bar expansion of less than 0.10 percent at 30 days from casting as tested under ASTM C 1567.

Acceptable pozzolans and chemical admixtures that may be used when an aggregate is classified as potentially reactive include, but are not limited to the following:

- a. Class F Coal Fly Ash meeting the requirements of AASHTO M 295
- b. Ground Granulated Blast Furnace Slag (Grade 100 or 120) meeting the requirements of AASHTO M 302
- c. Densified Silica Fume meeting the requirements of AASHTO M 307
- d. Lithium-based admixtures
- e. Metakaolin

Pozzolans or chemical admixtures required to offset the effects of potentially reactive aggregates will be incorporated into the concrete at no additional cost to the Government.

Precast reinforced concrete special section shall conform to the requirements of the cited specifications to the extent to which they apply.

5. Pipe Nominal Wall Thickness Requirements:

Diameter	AASHTO M170 CLASS III WALL A	AASHTO M170 CLASS III WALL B	AASHTO M170 CLASS III WALL C
12"	1 ¾"	2"	2 ¾"
15"	1 7/8"	2 ¼"	3"
18"	2"	2 ½"	3 ¼"
21"	2 ¼"	2 ¾"	3 ½"
24"	2 ½"	3"	3 ¾"
27"	2 5/8"	3 ¼"	4"
30"	2 ¾"	3 ½"	4 ¼"
36"	3"	4"	4 ¾"
42"	3 ½"	4 ½"	5 ¼"
48"	4"	5"	5 ¾"
54"	4 ½"	5 ½"	6 ¼"
60"	5"	6"	6 ¾"

2.2 BEDDING AND BACKFILL

- A. Material for bedding and backfilling pipe culverts shall be clean, uniformly graded, hard durable particles or fragments of stone or gravel, and sand, containing no particle larger than 2 inches and no more than 10 percent silt or clay particles.

PART 3 - EXECUTION

3.1 GENERAL

- A. The pipe culvert construction shall be completed at each location before the final pavement treatment operations are begun in that section, unless otherwise directed by the Contracting Officer.

3.2 EXCAVATION

- A. Carefully remove existing stone inlets and headwalls as necessary for the removal of existing pipes and the installation of new pipes.
- B. Excavate existing road materials as necessary. Carefully stockpile these materials separately from other excavated and existing materials for reuse in reconstructing the road after culvert installation. Take all necessary precautions to prevent stockpiled material from integrating with unsuitable materials.
- C. Excavate to 12 inches below bottom of proposed pipe grade. All material unsuitable for reuse as backfill, including existing culverts, shall become the property of the Contractor and be removed from the Park.

3.3 BEDDING CULVERTS

- A. Bed pipes on a 12-inch layer of uniformly graded existing or gravel borrow material and shape to conform reasonably close to the lower 10% of the pipe barrel with recesses excavated for the bell of the pipe. If the existing excavated material is unsuitable for bedding, gravel borrow shall be used, as directed by the Contracting Officer.

3.4 PLACEMENT OF CULVERT

- A. Lay pipe to the specified line and grade, with a firm bearing throughout each length and with bell ends uphill. Pipe ends shall be recessed behind headwalls as shown in the Drawings to reduce their visibility by Park users. Necessary pipe cutting shall be made with power equipment designed for the purpose.
- B. Join pipe sections in conformance with the procedures recommended by the manufacturer.

3.5 BACKFILLING AND COMPACTING

- A. The Contractor shall not backfill culvert trenches until pipe bedding and placement has been approved by the Contracting Officer.
- B. Backfill material shall consist of suitable material obtained from excavations or gravel borrow material, as directed by the Contracting Officer. Existing material used for backfill shall be free from organic matter, rubbish, debris and rocks greater than 3 inches in diameter.
- C. Placement/Compaction: Place backfill below the haunches of the pipe in 6 inch layers and compact to not less than 95% of maximum density simultaneously on both sides of the pipe with approved mechanical tampers which shall not come in contact with the pipe. Place backfill above the haunches 6-inch layers and compact with mechanical compactors approved by the Contracting Officer. Backfill material shall be moist prior to and during compaction.
- D. Reconstruct the road within the limits of the culvert trench to match the adjacent existing elevation of the road surface.
- E. Grade inslopes to provide a smooth consistent inslope that matches into the adjacent undisturbed slopes.

3.6 CLEANING AND MAINTENANCE

- A. Clean existing culverts and inlets to remain in place where called for in the Drawings and as directed by the Contracting Officer. Remove sticks, twigs, leaves, stones, gravel, trash and other debris by approved methods.
- B. Maintain all new culverts, existing culverts that have been cleaned, and existing roadway ditches throughout the duration of the contract, free of debris and construction materials.

3.7 HEADER STONES, HEADWALLS AND INLETS

- A. Construct new culvert header stones and portions of headwalls and drop inlets as specified in Section 04 40 30, Dry-Laid Stone Masonry and as shown in the Drawings.

END OF SECTION 02 72 20

DIVISION 03 - CONCRETE

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes; includes concrete accessories including the following:
 - 1. Insulation for below-slab applications.
 - 2. Vapor retarders.
 - 3. Waterstops.
 - 4. Topping materials.
- B. Drawing Designations: SF1, SFR1, SFR2, SFR3, S1, S2, S3, SC4, WP1, and FC3.
- C. Related Requirements:
 - 1. Section 07 11 00 "Dampproofing."
 - 2. Section 07 21 00 "Thermal Insulation" for insulation applied to concrete wall faces.
 - 3. Division 07 Sections for vapor retarders used in other assemblies.

1.2 COORDINATION

- A. Coordinate embedded anchors.
- B. Coordinate expansion joint types with penetrations and edge conditions.
- C. Coordinate concrete finishes required by other work.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- B. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- C. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.
- D. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated and required for installation. Include the following:
 - 1. Admixtures: 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.
 - 2. Reinforcement product information and types.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - 2. Include substantiating test data to show compliance with ACI 318 Chapter 5.
- C. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.
- B. Installer Qualifications:
 - 1. Concrete: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and supervisor who is an ACI-certified Concrete Flatwork Technician.
 - a. Installer shall be experienced cast-in-place concrete installer, as evidenced by not less than five consecutive years' experience, specializing in installing cast-in-place concrete similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. 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 according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

- E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated, as documented according to ASTM E548.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equal certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.
- F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."
- G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specification for Structural "Concrete", Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 3. ACI 318, "Building Code Requirements for Structural Concrete"
 4. ACI 302, "Guide for Concrete Floor and Slab Construction"
 5. ACI 305, "Recommended Practice for Hot Weather Concreting"
 6. ACI 306, "Recommended Practice for Cold Weather Concreting"
 7. ACI 308, "Guide to Curing"
- H. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor.
 - b. Entity responsible for concrete design mixes.
 - c. Ready mix concrete manufacturer or representative.
 - d. Concrete subcontractor.
 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, curing procedures, construction contraction and isolation joints, forms and bracing procedures, vapor-retarder installation, and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
 3. Review form sequencing, placement and removal.
 4. Review special finishing, including methods for matching and conditions required for successful matching of finishes.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 - 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
 - f. Permeability.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Comply with ASTM C94 and ACI 301.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. APA High-density overlay (HDO), Class 1, or better.
 - b. APA Medium-density overlay (MDO), Class 1, or better, mill-release agent treated and edge sealed.
 - c. APA Structural 1 Plyform, B-B, or better, mill oiled and edge sealed.

- d. APA Plyform Class I, B-B or better, mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces without spiral or vertical seams where exposed and not exceeding specified formwork surface class.
 - 1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum unless otherwise indicated.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/ A706M, deformed.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets. Plain welded wire reinforcement shall have a minimum yield strength of 75,000 psi.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet. Deformed welded wire reinforcement shall have a minimum yield strength of 80,000 psi.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain steel bars, cut bars true to length with ends square and free of burrs.

- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice" of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports, or concrete dobies.

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

- 1. Portland Cement: ASTM C595, Type 1L
 - a. For cement used in exposure class S1 or greater, provide Type 1L cement that has been tested according to ASTM C 1012 and meets the sulfate resistance criteria in ACI 318-14 Table 26.4.2.2(c). See drawings for the required exposure classes of various applications.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

C. Normal-Weight Aggregate: ASTM C33, coarse aggregate or better, graded. Provide aggregates from a single source.

- 1. Maximum Coarse-Aggregate Size: 3/4 inch.
- 2. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.

D. Water: ASTM C94/C94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260.

- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494/C 494M, 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.
- C. High Early-Strength Admixture: Low-additive admixture for internal curing, in lieu of chemical admixtures and applied curing compounds, including spray and water curing.
 - 1. Product:
 - 2. Application: Contractor's option at interior concrete slabs.
- D. Integral color for concrete sidewalks: Color to be selected by COR.

2.7 CURING MATERIALS

- A. General: Curing materials used shall be guaranteed by manufacturer, prior to application and use, to not affect the bond or performance of applied finishes. Named products may be used where manufacturer's documentation is provided during Submittals.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F: Black.
 - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
 - c. Ambient Temperature Above 85 deg F: White.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

2.8 INSULATION, BELOW-SLAB

- A. General: For below-slab insulation, provide one of the listed types below, in the R-value indicated on drawings.
- B. Rigid Cellular Polystyrene: ASTM D6817, Type as indicated on structural drawings.
 - 1. Dimensional tolerance: Within 0.5 percent in length, width and thickness.

2. Thickness: As indicated. Provide thickness required to achieve R-value indicated.
 3. R-Value: As published by manufacturer for type required, with minimum thermal resistivity per inch thickness as follows:
 - a. EPS19: 3.80 degree F x h x sq. ft./ Btu x in. at 75 deg F.
 - b. EPS29: 4.20 degree F x h x sq. ft./ Btu x in. at 75 deg F.
 4. Connectors: Insulation manufacturer's multibarbed, galvanized-steel sheet connector; type as required for application.
- C. Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type indicated and required for application.
1. Compressive Strength:
 - a. Type IX: 25-psi minimum.
 - b. Type XIV: 40-psi minimum.
 - c. Type XV: 60-psi minimum.
 2. R-Value: As published by manufacturer for type required.

2.9 VAPOR RETARDERS

- A. Sheet Vapor Retarders: ASTM E1745, Class A; 10 mil minimum thickness. Include manufacturer's recommended adhesive, pressure-sensitive tape, termination bars and mastic.

2.10 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete. Approved for use with waterproofing in Division 07.
1. Provide manufacturer's recommended adhesive and sealants required for installation.

2.11 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
1. At Round, Curved Penetrations or Joints: Provide closed cell, neoprene filler. WR Meadows Dock-o-Foam or equal; compatible with sealants and use indicated.
 2. Joint filler sealants are specified in Section 07 92 00 "Joint Sealants".
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class, suitable for application temperature and grade to suit requirements, and as follows:
 - 1. Types I and II for non-load bearing and types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.12 REPAIR MATERIALS

- A. Products to be used in locations permanently exposed to the weather shall be approved by the manufacturer for use in exterior environments.
- B. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C595 portland cement, Type 1L
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.
- C. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C595 portland cement, Type 1L
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 and in accordance with the following:
 - 1. Compressive Strength:
 - a. Structures: Refer to Structural Drawings.
 - b. Concrete non-structural site paving: See Civil Drawings.

2. Maximum Water-Cementitious Materials Ratio:
 - a. Structures: Refer to Structural Drawings.
 - b. Concrete non-structural site paving: See Civil Drawings.
 3. Air Content:
 - a. Structures: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having the air content specified on the Structural Drawings.
 - b. Concrete non-structural site paving: Air content shall be 6 percent plus or minus 1.5 percent for 1-inch nominal aggregate size.
 4. Slump Limit:
 - a. Structures: Refer to General Structural Notes
 - b. Concrete non-structural site paving: See Civil Drawings.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- C. Admixtures, General: Use admixtures according to manufacturer's written instructions. Do not add multiple admixtures simultaneously.
1. Use moisture-vapor reducing admixture in concrete slabs at Contractor's option, including on-grade, suspended or composite types.
 2. Use water-reducing, high-range water-reducing or plasticizing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 3. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 4. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Surface Finish-3.0: ACI 117 Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Surface Finish-2.0: ACI 117 Class Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- B. Expansion Joint Material: Place expansion joint material where indicated.
 - 1. Refer to "Isolation Joints" below.
 - 2. All plumbing piping, HVAC and sewerage piping penetrating slabs shall have expansion joint material at interface with concrete. No piping shall be embedded in concrete without expansion joint material.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete if concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the CO.

3.4 INSULATION INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.
- E. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- F. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

3.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 2. Terminate vapor retarder and seal all penetrations.
 - a. At vertical edge of slab terminations, terminate in a manner to prevent water intrusion during and post-construction. Coordinate termination required with other trades.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.7 JOINTS

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

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the CO.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use a bonding agent or roughen interface to 1/4-inch amplitude at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

- A. Coordinate with Division 07 Waterproofing Sections following waterstop manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, firmly pressing into place. Install in longest lengths practicable and splice joints following manufacturer's instructions for continuous installation without breaks.
- C. Install at the following locations:
1. Subgrade cold joints.
 2. All other below-grade conditions recommended by the waterproofing manufacturer.
 3. Above-grade and at grade, exterior-exposed concrete joints.
 4. Concrete planters and water retention enclosure cold joints.
 5. All other above-grade conditions recommended by the waterproofing manufacturer.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify the following:
 - 1. That installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
 - 2. That all standing water and pooling water on vapor retarders have been removed.
 - 3. That all vapor retarder terminations and penetrations are complete.
 - 4. That all waterstops have been installed.
 - 5. That all plumbing, HVAC, and sewerage piping and related penetrations have expansion material placed around items penetrating concrete, and as required by Plumbing code. No piping shall be directly cast-in concrete.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by the Contracting Officer.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- C. Adjust mix as required to maintain specified air content at the point of discharge.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equal of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish, Exposed: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities according to ACI 301 Surface Finish-3.0 (SF-3.0) and as follows:
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.
 2. ACI 301 Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/8 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class A.
 3. Grout-Cleaned Rubbed Finish: Where remediation is required and “sack and patch” is specified for surface treatment.
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the

consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.

- d. Wet concrete surfaces.
 - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
 - f. Maintain required patterns or variances as shown on drawings or to match approved mockups.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of ¼ inch (6mm) in one direction.
 - 1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and 1/16 inch in 2 feet.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with the CO before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. 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: Provide 4-inch-thick concrete pads under mechanical equipment as required or thickness indicated. Reinforce as indicated. Dowel to floor structure around perimeter of pad. Refer to Mechanical drawings for locations. Pad size to extend 6-inches beyond edge of equipment on all sides unless otherwise indicated. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

- E. Cure concrete according to ACI 308.1 by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of a floor covering used on Project.
 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.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least six months. 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 joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. General: At exposed areas, do not proceed with required repairs without written permission to proceed from the Contracting Officer.
 - 1. Repair mortar color shall be provided in mockup for review at areas scheduled to be concealed.
 - 2. Installer shall mockup proposed mix used for color matching at exposed areas, in an area sufficient for review and comparison and with similar conditions required for patching.
- B. Defective Concrete: Repair and patch defective areas when approved by the CO. Remove and replace concrete that cannot be repaired and patched to the CO's approval.
- C. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- D. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the CO.
- E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct slabs scheduled for polishing where tolerances are not achieved. Cut, grind and remove slab to a depth acceptable for reinstallation of monolithic topping to specified tolerances.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 6. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- F. Perform structural repairs of concrete, subject to the CO's approval, using epoxy adhesive and patching mortar.
- G. Repair materials and installation not specified above may be used, subject to the CO's approval.

3.16 TOPPING INSTALLATION

- A. Topping: Prepare slabs and install following manufacturer's written instructions. Finish to match adjacent, existing slabs, to elevations indicated and finish as specified.

3.17 FIELD QUALITY CONTROL, VAPOR RETARDER

- A. Quality Assurance: Contractor shall perform examinations of installation at frequent intervals during installation and at completion prior to concrete placement, and as recommended or requested by the Contracting Officer. At installation completion, manufacturer's service representative shall review final installation.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed vapor retarder installation, including accessories and terminations.
- C. Inspections: Vapor retarder materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of vapor retarder has been achieved with no gaps or holes.
 2. Maximum exposure time of materials to UV deterioration has not been exceeded.
 3. Laps in sheet materials have complied with the minimum requirements and have been taped, and terminations follow manufacturer's details.
 4. Compatible materials have been used.

5. Transitions at changes in direction and structural support at gaps have been provided.
 6. Connections between assemblies have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 7. Transitions to waterproofing materials are correctly installed and terminated or lapped.
 8. All penetrations are sealed, with tape or mastic applied on exposed edges, with no fishmouths.
- D. Remove and replace vapor retarder materials where inspections indicate that they do not comply with specified requirements.
- E. Additional inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.18 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency as assigned in Division 01, to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform tests, and inspections and to submit test reports.
- C. Inspections: As indicated on the Structural Drawings.
- D. Concrete Tests: As indicated in the Statement of Special Inspections and Testing sheets of the Drawings.
1. 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.
 2. 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. Test results shall be reported in writing to the Contracting Officer, concrete manufacturer, Building Official, 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, type of break for both 7- and 28-day tests, and air content.
 4. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Contracting Officer but will not be used as sole basis for approval or rejection of concrete.
 5. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Contracting Officer. 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 the Contracting Officer.

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

E. Measure floor and slab flatness and levelness within 24 hours of finishing.

3.19 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.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces and saw cut and exposed joint edges during construction.
9. Protect concrete surfaces scheduled to receive polished concrete finish using Contractor's floor slab protective covering.

END OF SECTION 03 30 00

DIVISION 04 – MASONRY

SECTION 04 40 30 – DRY-LAID STONE MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work of this section consists of the following:
 - 1. Construction of new dry-laid stone masonry headwalls.
 - 2. Excavation of earth material, placement of geotextile, and backfill as required for construction of new dry-laid stone masonry as noted above.

1.2 QUALITY ASSURANCE

- A. The general provisions of the Contract, including General Requirements and Technical Special Provisions, and relevant sections of these Specifications, apply to the work specified in this Section.
- B. Prior to commencement of any stone work covered by this specification, the Contractor shall submit to the Contracting Officer a written work and protection plan. Work may commence only after written approval by the Contracting officer of the proposed work and protection plan.
- C. Field-Sample Panels: Prior to the start of the dry-laid stone masonry work (construction of new), two field sample panels shall be prepared to demonstrate proper stone work and core packing. Create panels where directed by the Contracting Officer. Provide notification at least one week prior to beginning work, so that Contracting Officer may be present to observe test panels. Do no stone work until Contracting Officer has reviewed and approved preparation work and samples in each area. No additional work shall be performed without prior written approval of test panels. Retain acceptable panels in undisturbed condition, suitably marked, during construction as a standard for judging work.
- D. The Contractor is advised that the type and quality of the materials and the quality of workmanship will be strictly monitored during the work.

1.3 SUBMITTALS

- A. Product Data: Samples of new stone for new construction and core packing material. Upon review Contracting Officer may request test reports and certifications substantiating the products comply with these specifications and applicable ASTM specifications.
- B. Work and Protection Plan: Submit a written plan for the new headwall construction work. Describe in detail:
 - 1. All materials, equipment and techniques to be used.
 - 2. Documentation of existing conditions.
 - 3. Methods for protecting surrounding areas, completed work, landscaping, pedestrians, and vehicles from damage/injury.

4. Methods for supporting and protecting stone work to remain.
5. Work site lay out.
6. Documentation of existing conditions.
7. Support of stone work to remain.

1.4 COORDINATION, SEQUENCING AND SCHEDULING

- A. Sequence of Work: Perform work of this section and other sections in the optimum sequence to prevent damage to or interference with other work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stone: Stone for replacing existing stones that are missing or damaged in existing stone masonry shall match the remaining existing stone in coloration, size, and type as approved by the Contracting Officer. Stone for construction of new work at a particular location shall be very similar in coloration and type to the nearest existing dry-laid stone masonry of approximately similar dimensions as approved by the Contracting Officer.
- B. Core stone: Core stone for retaining walls and headwalls shall be angular broken or crushed stone well graded for packing 80% of all voids, beginning slightly smaller than the adjacent face stones. Material uniformly graded or too small will be rejected.
- C. Geotextile: Geotextile behind headwalls and retaining walls, where called for in the Contract Plans, shall meet the requirements of Table 1 below. All property values, with the exception of Apparent Opening Size (AOS), represent Minimum Average Roll Value (MARV) in the weakest principal direction and shall meet or exceed the values stated below. Values for AOS represent maximum average roll values. Both woven and non-woven geotextiles are acceptable; however, no "slit-film" woven fabrics will be permitted

Table 1 - Erosion Control Geotextile Property Values

Other Properties	Test Method	Requirements Percent In-Situ Soil		
		Passing #200 (0.075 mm ^a)		
		<15	15 to 50	>50
Geotextile class: Woven monofilament geotextiles All other geotextiles		Class 2 Class 1		
Permittivity ^{a, b}	ASTM D 4491	0.7/sec	0.2/sec	0.1/sec
Apparent Opening Size (AOS) mm (maximum) ^{a, b, c, d}	ASTM D 4751	0.43	0.25	0.22 ^{c, d}
Ultraviolet Stability (Retained Strength)	ASTM D 4355	50% after 500 hours of exposure		

^aBased on grain size analysis of in situ soil in accordance with AASHTO T 88.

^bThese default filtration property values are based on predominant particle sizes of the in situ soils. In addition to the default permittivity value, the Resident may require geotextile permeability and/or performance testing based on engineering design for drainage systems in problematic soil environments.

^cSite specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodable soils such as non-cohesive silts; gap graded soils; alternating sand/silt laminated soils; dispersive clays; and/or rock flour.

^dFor cohesive soils with a plasticity index greater than 7, geotextile maximum average roll value for apparent opening size is 0.30mm.

- D. Backfill Material: Backfill material, where called for in the Contract Plans, shall consist of sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay, frozen material and other deleterious substances. The gradation of that portion passing a 3-inch sieve shall meet the gradation requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
No. 40	0-70
No. 200	0-20

PART 3 - EXECUTION

3.1 CONSTRUCTION OF NEW DRY-LAID STONE MASONRY HEADWALLS

- A. New stone wingwalls and headwalls, as identified in the Contract Plans or by the Contracting Officer, shall be constructed of new stone in accordance with this specification and the details in the Contract Plans.
- B. Exposed portions of new dry-laid stone masonry wingwalls and headwalls shall have stone very similar in coloration and type to the nearest existing dry-laid stone masonry wingwalls and headwalls of approximately similar dimensions as approved by the Contracting Officer.

END OF SECTION 04 40 30

**DIVISION 06 – WOOD,
PLASTICS, AND COMPOSITES**

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with timber.
3. Framing with engineered wood products.
4. Shear wall panels.
5. Rooftop equipment bases and support curbs.
6. Wood blocking and nailers.
7. Wood furring and grounds.
8. Wood sleepers.
9. Plywood backing panels.
10. Termite protection flashing.

B. Drawing Designations: S2, S3, SC1, SC3, WE1A, WE1B, WE4, WP2, WP4, WP6, and WP7.

C. Related Requirements:

1. Section 06 16 00 "Sheathing" for sheathing, subflooring, and underlayment.
2. Section 06 17 45 "Wood Trusses and Joists" for wood trusses made from dimension lumber.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.
- E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate

- type of preservative used and net amount of preservative retained.
2. If applicable, include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. If applicable, for fire-retardant treatments include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Engineered wood products.
 4. Shear panels.
 5. Power-driven fasteners.
 6. Post-installed anchors.
 7. Metal framing anchors.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC

Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 2. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry

- or concrete walls.
- 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
- 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
 - 1. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade unless otherwise indicated.

1. Application: Interior partitions not indicated as load bearing.
2. Species: As indicated.

- a. Southern pine or mixed southern pine; SPIB.
- b. Spruce-pine-fir; NLGA.

B. Load-Bearing Partitions: **No. 2** grade, unless otherwise indicated.

1. Application: Exterior walls and interior load-bearing partitions.
2. Species: As indicated.

C. Ceiling Joists: **Construction or No. 2** grade.

1. Species:

- a. Southern pine or mixed southern pine; SPIB.
- b. Spruce-pine-fir; NLGA.

D. Joists, Rafters, and Other Framing Not Listed Above: Select Structural No. 2 grade unless otherwise indicated.

1. Species:

- a. Southern pine or mixed southern pine; SPIB.
- b. Spruce-pine-fir; NLGA.

E. Exposed Framing Indicated to Receive a Stained or Natural Finish: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species: As indicated.
2. Grade: No. 1.

2.5 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber (LVL): Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Extreme Fiber Stress in Bending, Edgewise: **2900 psi** for 12-inch nominal-depth members.
2. Modulus of Elasticity, Edgewise: **1,900,000 psi**

- C. Parallel-Strand Lumber (PSL): Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
 - 1. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal-depth members.
 - 2. Modulus of Elasticity, Edgewise: 2,200,000 psi.

2.6 SHEAR WALL PANELS

- A. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.
 - 1. Insulated structural sheathing by Huber may be used as noted, providing fastener type and spacing and panel edge blocking is installed as published by manufacturer and as noted on plans.
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.7 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
 - 7. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber matching dimensional framing, unless otherwise indicated.
- C. Concealed Boards: 15 percent maximum moisture content. Match dimensional framing grade and species.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.8 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness and thickness as required for weight of items attached to provide adequate support.

2.9 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES report as appropriate for the substrate.
 - 1. Material, Interior: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 - 2. Material, Exterior: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.10 METAL FRAMING ANCHORS

- A. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
 - 1. Thickness: As indicated but not less than 0,050 inch.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.

- D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
 - 1. Use for exterior locations and where indicated.
- E. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.
- F. I-Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
- G. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
- H. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.
- I. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch-minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.
- J. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
- K. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.
- L. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
- M. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.
- N. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
 - 1. Bolt Diameter: As indicated.
 - 2. Width: As indicated.
 - 3. Body Thickness: Minimum 0.108 inch.
 - 4. Base Reinforcement Thickness: Minimum 0.108 inch.
- O. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
- P. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.11 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.
- E. Termite Protection Flashing: Sill flashing placed over concrete and under sole plates to prevent termite intrusion into wood construction. Comply with Section 07 62 00 "Sheet Metal Flashing and Trim."
 - 1. Material: Galvanized steel, 28-gauge.
 - a. Provide separator with preservative-treated wood.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- E. Install shear wall panels to comply with manufacturer's written instructions.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install termite protection flashing under sole plates and sill plates, under sill sealers over concrete. Lap splices 6 inches with butyl sealant. Set flashing in continuous bead of sealant.
 - 1. Coordinate with siding and other interfacing finishes.
- H. Do not splice structural members between supports unless otherwise indicated.

- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- K. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.
- O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener

- locations, using a template made of sheet metal, plastic, or cardboard.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.
- Q. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 INSTALLATION OF WALL AND PARTITION FRAMING

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
 1. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

- D. Provide diagonal bracing at locations indicated.

3.5 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior wall and roof sheathing.
2. Subflooring.
3. Structural insulated panels.

B. Drawing Designations: S2, S3, FC1, FC2, RF1, RF3, WE1A, WE1B, WS1, and WS4.

C. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for plywood backing panels.
2. Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Structural insulated panels.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
2. For testing and inspecting agency providing tests and inspections related to air-barrier and water-resistant glass-mat gypsum sheathing: an independent agency, qualified according to ASTM E329 for testing indicated, and certified by Air Barrier Association of America, Inc.

1.4 DELIVERY, STORAGE, AND HANDLING

- #### A.
- Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- #### A.
- Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- #### A.
- Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- #### B.
- Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- #### C.
- Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- #### A.
- Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in

contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
 1. Roof and wall sheathing within 48 inches of fire and party walls.
 2. Roof sheathing where indicated.
 3. Subflooring and underlayment for raised platforms.

2.5 SHEATHING, WALL AND ROOF

- A. Plywood Sheathing: DOC PS 1, Exterior, Structural I Exposure 1 sheathing.
 1. Span Rating: As indicated.
 2. Nominal Thickness: As indicated.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.

1. Span Rating: As indicated.
2. Nominal Thickness: As indicated.

2.6 COMPOSITE INSULATING WALL SHEATHING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved substitute:

1. Huber Engineered Woods LLC, Zip System R Sheathing, or approved equal with the following salient characteristics:

B. Performance Requirements:

1. Span Rating and Performance Category of Sheathing Layer: Not less than 24/16; 7/16 performance category
2. Air-Barrier Assembly Air Leakage: Less than 0.04 cfm/sq ft at 1.57 lbf/sq ft per ASTM E2375
3. Water-Vapor Permeance, facer: Minimum 12 perms, ASTM E96/E96M
4. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

C. Composite Insulating Wall Sheathing: Oriented-strand-board Exposure 1 sheathing 7/16 inch thick, with factory-laminated water-resistive barrier exterior facer, and with rigid foam plastic insulating board laminated to interior face.

1. Span Rating and Performance Category of Sheathing Layer: Not less than 24/16; 7/16 Performance Category
2. Edge Profile: Square Edge
3. Thickness: 7/16" panel with 1-1/2" foam.
4. Thermal Resistivity (R Value): 9
5. Exterior Facer: Medium-density, phenolic-impregnated polymer-modified sheet material meeting requirements for ASTM D779 Grade D weather-resistive barrier in accordance with ICC AC38 and AC310, with fastener spacing symbols on exterior facer for 16-inch on center spacing with the following characteristics
 - a. Water Resistance Coatings, ASTM D2247: Pass 14 day exposure test
 - b. Moisture Vapor Transmission, ASTM E96: Not less than 12 Perms
 - c. Water Penetration, ASTM E331: Pass at 2.86 lbs/sq ft.
 - d. Wind Driven Rain, TAS-100: Pass.
 - e. Accelerated Weathering, ASTM G154: Pass
6. Shelf-Adhering Seam and Flashing Tape: Pressure Sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148
 - a. Thickness: 0.012 inch
 - b. Seam and Tape manufacturer as recommended by Composite Insulating Wall Sheathing manufacturer or approved substitution.

2.7 SUBFLOORING

- A. Plywood Subflooring: DOC PS 1, Exterior, Structural I Exposure 1 single-floor panels or sheathing.
 - 1. Span Rating: As indicated.
 - 2. Nominal Thickness: As indicated.

2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M of Type 304 stainless steel or fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.
- B. Nails, Brads, and Staples: ASTM F1667.
 - 1. Composite Insulating Wall Sheathing: ICC AC116 and ICC AC201
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
 - 1. Composite Insulating Wall Sheathing: ICC-ES1539 or NER-272
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.
 - 1. Composite Insulating Wall Sheathing: ASME B18.6.1

2.9 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 and ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Subflooring:
 - a. Glue and nail or screw to wood framing.
 - b. Space panels 1/8 inch apart at edges and ends.
 - 2. Wall and Roof Sheathing:
 - a. Nail or screw to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Space panels 1/8 inch apart at edges and ends.

3.3 COMPOSITE INSULATING WALL SHEATHING INSTALLATION

- A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.
- B. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joist sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier
- C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural reports.

- D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs.
- E. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:
 - 1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners
 - 2. IBC: Table 2304.9.1 Fastening Schedule
 - 3. IRC: Table R602.3(1) "Fastener Schedule for Structural Members" and Table R602.3(2) "Alternate Attachments"
- F. Apply seam tape at all panel seams, penetrations and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

END OF SECTION 06 16 00

SECTION 06 17 45 - WOOD TRUSSES AND JOISTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Shop-fabricated wood roof and girder trusses

B. Drawing Designations: S2, S3, FC1, FC2, RF1, and RF3.

C. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for engineered wood products including wood I-joists and dimensional lumber framing.

1.2 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.3 SUBMITTALS

A. Product Data: For fire-retardant-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification from treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss and joist required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss and joist members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

- C. Delegated-Design Submittal: For wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Qualification Data: For metal connector-plate manufacturer, metal-web truss manufacturer, professional engineer and fabricator.
- E. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- F. Product Certificates:
 - 1. For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.
 - 2. For metal-web wood trusses.
- G. Evaluation Reports: For the following, from ICC-ES:
 - 1. Metal-plate connectors.

1.4 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Contracting Officer and authorities having jurisdiction and is certified for chain of custody by an FSC-accredited certification body where FSC is indicated.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.

- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design wood trusses and joists.
- B. Structural Performance: Metal-plate-connected wood trusses and metal-web wood joists shall be capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Maximum Deflection under Design Loads:
 - a. Wood-Framed Roof Trusses and Girders: Vertical deflection of 1/240 of span.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 SHOP-FABRICATED WOOD TRUSSES AND GIRDERS

- A. Shop-Fabricated Wood Trusses and Girders: Solid lumber chord and webs with metal connector plates.
- B. Minimum Chord Size for Roof Trusses: **2 by 6 inches nominal** for both top and bottom chords.
- C. Minimum Specific Gravity for Top Chords: **0.50**

2.3 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S.
 - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry."

- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
 - 2. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
 - 3. Laminated-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
- D. Machine-Stress Rated Lumber: Structural lumber tested according to ASTM D1990.

2.4 METAL CONNECTOR PLATES

- A. Fabricate connector plates to comply with TPI 1.
- B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
 - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preserved-treated lumber and where indicated.

2.5 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 - 2. Where trusses are exposed to weather, in ground contact, made from pressure-preserved-treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.

2.6 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, shall comply with or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preserved-treated lumber and where indicated.
- D. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to one side of truss, top plates, and side of stud below.
- E. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.
- F. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.
- G. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.
- H. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.
- I. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.
 - 1. Angle clip is 3 by 3 by 0.179 by 8 inches with extended leg 8 inches long. Connector has galvanized finish.
 - 2. Angle clip is 3 by 3 by 0.239 by 10-1/2 inches with extended leg 10-1/2 inches long. Connector has painted finish.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.8 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.9 SOURCE QUALITY CONTROL

- A. Special Inspections: Contractor will engage a qualified special inspector to perform special inspections.
 - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
 - 2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
- B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as

applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 06 10 00 "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- L. Replace wood trusses that are damaged or do not comply with requirements.
 - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Contracting Officer.

3.2 REPAIRS AND PROTECTION

- A. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package and in compliance with code requirements.

END OF SECTION 06 17 45

SECTION 06 40 23 – INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Closet and utility shelving.
3. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
4. Shop priming of interior architectural woodwork.
5. Shop finishing of interior architectural woodwork.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
2. Section 081400 "Wood Doors" for frames for pre-hung doors.

1.2 COORDINATION

- ##### A.
- Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Shop Drawings:

1. Include the following:
 - a. Dimensioned plans, elevations, and sections.
 - b. Attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

4. Apply Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each shop-applied color and finish specified.
 1. Size:
 - a. Panel Products: 12 inches by 12 inches.
 - b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
- D. Samples for Verification: For the following:
 1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent- finished interior architectural woodwork.
- E. Qualification Data: For architectural woodwork fabricator and Installer.
- F. Product Certificates: For the following:
 1. Composite wood and agrifiber products.
 2. Adhesives.
- G. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI's Quality Certification Program or WI's Certified Compliance Program certificates.

1.5 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program or WI's Certified Compliance Program.
 2. Installer Qualifications: Licensed participant in AWI's Quality Certification Program or Licensed participant in WI's Certified Compliance Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.
- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
 - 1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants and recommended by quality assurance programs for wood types and applications, for the remainder of the construction period.
- B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings
- C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. Provide certificates from AWI or WI certification program indicating that woodwork and installation complies with requirements of grades specified.
 - a. This project has been registered with AWI as AWI Quality Certification Program Number <Insert number>.

2. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: Premium.
 1. Wood Species: Any closed-grain hardwood.
 - a. Provide edge sealed MDF where indicated.
 2. Wood Moisture Content: 5 to 10 percent.
- B. Optional Material: MDF Moldings in profiles indicated.

2.3 CLOSET AND UTILITY SHELVING

- A. Architectural Woodwork Standards Grade: Custom.
- B. Shelf Material: 3/4-inch, of one of the following materials:
 1. Veneer-faced panel product with solid-lumber edge
 2. Solid lumber.
- C. Cleats: Any closed-grain hardwood.
- D. Closet Rods:
 1. Wood: Hardwood; 1-1/2-inch-diameter unless otherwise indicated.
 2. 1-5/16-inch-diameter, chrome-steel tubes complying with BHMA A156.16, L03131.
 3. Brackets: Powder-coated steel in profiles indicated.
- E. Rod Flanges: Stainless steel.
 1. Wood Finish: To be approved by Contracting Officer.

2.4 HARDWOOD SHEET MATERIALS

- A. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 150.
 2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
4. Softwood Plywood: DOC PS 1, medium-density overlay (MDO).
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
 1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
 2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.6 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
- C. Ease edges to radius indicated for the following:
 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- D. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
 1. Disassemble components only as necessary for shipment and installation.
 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 3. Notify The Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
 4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
- E. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
- F. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

- G. MDF Profiles: Seal edges of cut MDF to match smooth face finish using thinned woodwork glue. Apply evenly. Sand smooth as required.

2.7 SHOP PRIMING

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
- B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 09 91 00 "Painting."
 - 1. Back priming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.
- C. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in "Shop Finishing" Article.
 - 1. Back priming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.8 SHOP FINISHING

- A. Finish interior architectural woodwork with transparent finish indicated on Drawings at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
 - a. Back priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Transparent Finish:
 - a. Architectural Woodwork Standards Grade: Premium.
 - b. Finish: System - 5, Varnish, Conversion.
 - c. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - d. Staining: Match approved sample for color.
 - e. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - f. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
 - g. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter according to ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming of concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
 - 1. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- B. Install interior architectural woodwork level, plumb, true in line, and without distortion.
 - 1. Shim as required with concealed shims.
 - 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 1. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
- D. Secure with countersunk, concealed fasteners and blind nailing.
 - 1. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
 - 2. For shop-finished items, use filler matching finish of items being installed.
 - 3. Standing and Running Trim:
 - 4. For opaque-finished assemblies, install with finish screws, countersink, fill with plastic wood filler and sand smooth to match.
 - 5. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 - 6. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary.
 - 7. Scarf running joints and stagger in adjacent and related members.
 - 8. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished latex sealant, painted to match wall.
 - 9. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

3.3 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program or WI's Certified Compliance Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 - 1. Inspection entity shall prepare and submit report of inspection.

3.4 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective woodwork.
 - 1. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
 - 2. Fill nail holes with matching filler where exposed.
 - 3. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- C. Field Finish: See Section 09 91 00 "Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.5 CLEANING

- A. Clean interior architectural woodwork on exposed and semi exposed surfaces.

END OF SECTION 06 40 23

**DIVISION 07 – THERMAL AND
MOISTURE PROTECTION**

SECTION 07 11 00 – BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing.

B. Related Requirements:

1. Section 03 30 00 “Cast-in-Place Concrete” for substrate preparation coordination for surfaces to receive dampproofing.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Compatibility: Dampproofing shall be compatible with all substrates and materials in contact with bituminous dampproofing.

1.4 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from

single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. BASF.
- 2. Henry.
- 3. Karnak Corporation.
- 4. W.R. Meadows, Inc.

- B. Trowel Coats: ASTM D 1227, Type II, Class 1 or Type IV

- 1. Available Products:
 - a. Sealmastic, Type 3; W.R. Meadows
 - b. 785 Asphalt Emulsion Sealer and Dampproofer, Henry.
 - c. MasterSeal 614; BASF
 - d. Karnak 220 AF; Karnac Chemical Corp

- C. Fibered Brush and Spray Coats: ASTM D1227, Type UU, Class 1 or Type IV

- 1. Available Products:
 - a. Sealmastic, Type 2; W.R. Meadows
 - b. 789 Fibered Asphalt Emulsion Sealer and Dampproofer, Henry
 - c. MasterSeal 614, BASF
 - d. Karnak 920 AF; Karnac Chemical Corp

- D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1

- 1. Available Products:
 - a. Sealmastic, Type 1; W.R. Meadows
 - b. 107 Asphalt Emulsion Sealer and Dampproffer, Henry
 - c. MaserSeal 610, BASF
 - d. Karnak 100 AF; Karnac Chemical Corp

2.4 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended

use and compatible with dampproofing.

- B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Patching Compound:
 - 1. Cementitious: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; and compatible with substrate and other materials indicated.
 - 2. Bituminous: Epoxy or latex-modified repair mortar or asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer for application.
- D. Protection Course: Provide one of the following, and compatible with materials in contact with:
 - 1. ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
 - 2. Smooth-surfaced roll roofing complying with ASTM D 6380/D 6380M, Class S, Type III.
- E. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions.
- B. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes, drains and other openings.
- C. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.
- D. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.
- E. Surface Preparation: Remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint,

curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.

1. Clean concrete surfaces according to ASTM D4258.
 - a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic acid solution according to ASTM D4260.
 - b. Smooth-Formed and Trowel-Finished Concrete: Prepare by mechanical abrading or abrasive-blast cleaning according to ASTM D4259.
- F. Repair damaged or unsatisfactory substrate with patching compound.
- G. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 1. Apply primer as recommended by manufacturer.
 2. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
 3. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat or one trowel coat at not less than 4 gal./100 sq. ft.
- B. Unexposed Face of Concrete Retaining Walls at Backfill: Apply one brush or spray coat at not less than 1.25 gal./100 sq.
 1. Do not apply to the back of walls exposed on front faces. Apply cementitious dampproofing to areas concealed where used on same assemblies or applications.

3.5 PROTECTION COURSE INSTALLATION

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-

material and protection-course manufacturers' written instructions for attaching protection course.

1. Install protection course within 24 hours of dampproofing installation (while coating is tacky) to ensure adhesion.

3.6 CLEANING AND PROTECTION

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.
- B. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.
- C. Do not backfill at areas with dampproofing without protection course.

END OF SECTION 07 11 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiberglass batt insulation for walls
2. Closed Cell Spray foam for roofs.
3. Rigid insulation for under concrete slabs.

B. Drawing Designations: WS3 and RF2.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for insulation installed under slabs.
2. Section 06 16 00 "Sheathing" for insulated sheathing installed directly over wood framing.
3. Section 09 29 00 "Gypsum Board" for sound attenuation blankets used as acoustic insulation.

1.2 SUBMITTALS

A. Product Data: For each type of product required for installation.

1. Installation instructions for the following:
 - a. Extruded Polystyrene foam-plastic board insulation.
 - b. Glass-fiber blanket insulation
 - c. Sprayed Foam Insulation
 - d. Vapor retarders

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

D. Product Test Reports: For each product, for tests performed by a qualified testing agency.

E. Research Reports: For foam-plastic insulation, from ICC-ES.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

- B. Formaldehyde-Free: Batt insulation products shall not contain formaldehyde (or formaldehyde precursors). Provide Third Party Certification with UL Environmental Claim Validation; industries.ul.com.
- C. Recycled Content: Batt insulation products shall contain a minimum of 50 percent post-consumer recycled glass content. Provide UL Environmental Claim Validation; industries.ul.com.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FIBERGLASS BATT INSULATION

- A. General: Shall contain minimum 50 percent post-consumer recycled content, as Validated by UL Environment. Formaldehyde-free (no phenol/formaldehyde (PF) binder); Product shall be made with a renewable bio-based thermosetting resin and validated formaldehyde-free by UL Environment
 - 1. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved substitute:
 - a. CertainTeed Corporation.
 - b. Guardian Building Products, Inc.
 - c. John Manville, a Berkshire Hathaway company.
 - d. Knauf Insulation
 - e. Owens Corning

Products shall have the following salient characteristics:

2. R-value: 3.0 to 3.2 per inch of insulation, depending on thickness.
3. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
4. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

2.2 RIGID INSULATION, MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type indicated and required for application.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved substitute:
 - a. DuPont; Styrofoam Square Edge Insulation
 - b. KingSpan; GreenGuard
 - c. OwensCorning; Formular

Products shall have the following salient characteristics:

2. Compressive Strength:
 - a. Type IX: 25-psi minimum, for face of slabs.
 - b. Type XIV: 40-psi minimum, for below slabs on grade.
3. R-Value: 5.0 per inch of insulation
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width
5. Application: Foundation and below slab insulation

2.3 SPRAYED FOAM INSULATION

A. Sprayed Polyurethane Foam Sealant for Perimeter of Doors and Windows:

1. Products
 - a. Great Stuff Window & Door by Dow
 - b. Froth-Pak Foam Sealant by Dow
 - c. Zerodraft Insulating Air Sealant by Zerodraft

Products shall have the following salient characteristics:

2. 1- or 2- component foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

B. Closed-Cell Spray Polyurethane Foam: **Spray foam insulation to be protected by intumescent paint to meet flame spread rating for accessible attic spaces, per code.**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Corbond® Performance Insulation System.
 - b. Gaco Wallfoam 183M Closed Cell Spray Polyurethane Foam by Gaco Western.
 - c. Henry Permax 1.8 Closed Cell Foam Insulation.
 - d. Styrofoam™ SPF Insulation.
 - e. Accella Polyurethane Systems, Bayseal CCX.

Products shall have the following salient characteristics:

2. ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft.
3. Flame/Smoke Properties: 25/450 in accordance with ASTM E84.
4. R-Value, Aged: 6.2 per inch of insulation.

2.4 VAPOR RETARDERS

- A. Vapor Retarders: Polyimide film vapor retarder for use with unfaced, vapor permeable glass fiber and mineral wool insulation in wall and ceiling cavities. Material has a permeance of 1 perm or less when tested to ASTM E 86, dry cup method and increases to greater than 10 perms using the wet cup method.

1. Product: Certainteed MemBrain, or approved substitute

Products shall have the following salient characteristics:

2. Water Vapor Permeance:
 - a. ASTM E 86 dry cup method: 1 perms (57ng/Pa*s*m2).
 - b. ASTM E 86, wet cup method: 10.0 perms (1114ng/Pa*s*m2)
3. Fire Hazard Classification: ASTM E 84:
 - a. Maximum Flame Spread Index, 20.
 - b. Maximum Smoke Developed Index, 55

- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.5 ACCESSORIES

- A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.
- B. Preinstallation Testing: Verify wood framing moisture content.
 - 1. Moisture Testing:
 - a. Use calibrated, pin-type moisture meters, designed for testing wood, to measure moisture content of wood framing and interior face of plywood surfaces.
 - b. Document test locations. Include date, time, location, temperature and relative humidity.
 - 2. Perform tests so that each test does not exceed 30 linear feet and one story; evenly spaced across walls in installation areas.
 - a. Perform additional tests where framing has been exposed to precipitation.
 - 3. Moisture content shall not exceed 18 percent maximum and not greater than allowable percent recommended by insulation manufacturer.
 - 4. Where area(s) exceed moisture limits, dry or postpone installation for duration required to meet specified limits. Retest to verify.
 - 5. Submit test reports.
- C. Do not install insulation in framed cavities until moisture content in wood framing is within acceptable limits.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line, and outward distance indicated.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. On vertical foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
- B. Butt panels together for tight fit.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Comply with MINHERS and RESNET Grade 1 Installation unless more stringent requirements are specified or required.
 - 2. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 3. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members. Install continuously between framing members and other construction, without gaps.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on drawings.

- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- E. Repair tears or punctions in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: The Contracting Officer may engage an independent testing and inspection agency to verify installation requirements have been met, including moisture content of wood.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed insulation and vapor retarder installation before covering with other construction and provide written report stating that installation complies with manufacturer's written instructions.
- C. Inspections: Contractor shall verify installation of vapor retarders are sealed with penetrations and terminations complete prior to start of covering work.

3.8 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.9 WASTE MANAGEMENT

- A. Plan and coordinate the insulation work to minimum the generation of off-cuts and waste. Reuse insulation scraps to the maximum extent feasible.
- B. Separate the recycled waste materials in accordance with the Waste Management Plan and to maximize extent as economically feasible.

END OF SECTION 07 21 00

SECTION 07 25 00 – WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water-resistive barrier, fastened.
2. Flexible flashing, self-adhered membrane flashing.
3. Fluid-applied flashing.
4. Drainage material.

B. Related Requirements:

1. Section 06 16 00 “Sheathing” for substrate preparation.
2. Section 07 21 00 “Thermal Insulation” for vapor retarders used on interior face of exterior framed walls.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. For water resistive barrier, include data on air and water-vapor permeance based on testing according to referenced standards.

B. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

1. Review requirements and installation, special details, mockups, protection, and work scheduling that covers water-resistive barriers and accessories.

1.1 QUALITY ASSURANCE

A. Installer: Approved by the manufacturer of the water-resistive barrier products being applied. Five years successful experience with the installation of the products and complete system of the type required for the Work.

1. Document at least 3 installations of comparable size and complexity to this Project utilizing similar components and assemblies that have been in-service for not less than 2 years. Provide complete service history and contact information.

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Protect stored materials from direct sunlight.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Apply self-adhered materials within the range of ambient and substrate temperatures recommended in writing by manufacturer.

- 1. Protect substrates from environmental conditions that affect performance.
 - 2. Do not apply to a damp or wet substrate or during snow, rain, fog, or mist.

1.4 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace water resistive barrier and associated materials that fails in materials or workmanship within specified warranty period.

- 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary weather-barrier materials and accessories from single source from single manufacturer.
- B. Materials shall be compatible with one another and with materials in contact with water-resistive barriers and accessories.

2.2 WATER RESISTIVE BARRIER, FASTENED

- A. Water Resistive Barrier: spunbonded polyolefin, non-woven, non-perforated, weather barrier, ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.

- 1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

- a. Tyvek by DuPont.
 - b. Or equal.

- 2. Water-Vapor Permeance: 28 perms per ASTM E96/ E96M, Method B.

- 3. Air Permeance: 0.001 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤ 0.04 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2357.

4. Allowable UV Exposure Time: Not less than three months.
5. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285 where required by building code applicable to Project. Surface Burning Characteristics:
 - a. Flame Spread: 10.
 - b. Smoke Developed: 10.

B. Seam Tape: Water-resistive barrier manufacturer's standard 3 inch wide tape for applications.

1. Product: Tyvek Tape by DuPont

C. Fasteners:

1. At Steel Frame Construction: 1-5/8 inch rust resistant screw with 2-inch diameter plastic cap or manufacturer approved 1-1/4 inch or 2-inch metal gasketed washer.
 - Caps: Tyvek Wrap Caps by DuPont
2. At Wood Frame Construction: No. 4 nails with large 1-inch plastic cap fasteners, or 1-inch plastic cap staples with leg length sufficient to achieve a minimum penetration of 5/8-inch into wood stud.
 - Caps: Tyvek Wrap Caps by DuPont
3. At Masonry Construction: Masonry fasteners with 2-inch diameter plastic caps. •

Products:

- Fasteners: Concrete Anchors by Tapcon.
- Caps: Tyvek Wrap Caps by DuPont

D. Sealants: Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.

1. Products:

- Residential Sealant by DuPont.
- Or other sealants recommended by the water-resistive barrier manufacturer.

E. Adhesives:

1. Provide adhesive recommended by water-resistive barrier manufacturer. 2.

Products:

- Liquid Nails LN-109 by PPG Industries, Inc.
- Butyl Liquid by Denso North America.
- High Strength 90 by 3M
- Or other adhesive recommended by the flashing manufacturer.

3. For projects located in California provide primer meeting California VOC requirements.
 - SIA 655 by Henkel.

F. Primers:

1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

2. Products:

- a. High Strength 90 by 3M.
- b. Butyl Spray by Denso.
- c. Permagrip 105 by Henkel.
- d. Stay”-Put SPH by ITW Polymer Sealants North America.
- e. Or other primer recommended by the flashing manufacturer.

G. For projects located in California provide primer meeting California VOC requirements.

1. SIA 655 by Henkel.

2.3 FLASHINGS

A. Provide water-resistive barrier manufacturer’s standard flexible flashings at transitions and penetrations, including liquid flashings where available from manufacturer.

B. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spun bonded polyolefin to produce an overall thickness of not less than 0.030 inch.

1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285 where required.

C. High-Temperature Flashing and Underlayment: Manufacturer’s standard for use under metal flashings.

1. Stability: Stable after testing at 240 def F and flexible at minus 20 deg F; ASTM D1970.

D. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

2.4 SEALANTS

A. Sealant: Comply with Section 07 92 00 “Joint Sealants.”

1. Provide water-resistive barrier manufacturer’s standard sealant at transitions and penetrations.
2. Detail Sealant Product: Moistop Sealant and Liquid Flashing.
3. Weatherseal: Perimeter or windows and doors; concealed to view.

a. Products:

- Dowsil 758 by Dow.
- Spretrem 1 by Tremco.

2.5 DRAINAGE MATERIAL

A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under siding and adhered cast stone veneer.

1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285 where required.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify substrates are smooth without projections that may damage water-resistive barriers.

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

3.2 PREPARATION

A. Install flexible flashings where indicated and required prior to water-resistive barrier installation.

B. Install metal flashings and transitions to other work.

3.3 WATER-RESISTIVE BARRIER INSTALLATION

A. Water Resistive Barrier: Comply with manufacturer's written instructions and warranty requirements.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.
3. Shingle water-resistive barriers to drain. Do not install with reverse laps. Reverse lap installation of any material is not permitted.
4. Where materials have been installed with reverse laps, Contractor shall replace and reinstall with no added cost to Project.

B. Cover exposed exterior surface of sheathing with water-resistive barrier immediately after sheathing is installed.

C. Cover sheathing continuously with water-resistive barrier as follows:

- a. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations. Provide manufacturer's standard detail for bridging movement joints.
- b. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

3.4 FLASHING INSTALLATION

A. Apply flexible and liquid flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.5 SEALANTS

A. Apply sealants where indicated to comply with manufacturer's written instructions. Comply with Section 07 92 00 "Joint Sealants."

3.6 DRAINAGE MATERIAL INSTALLATION

A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Inspections: Contractor and manufacturer's technical representative shall review installation to verify compliance with requirements prior to installation of covering work.

B. Inspections:

1. Site conditions for application temperature and dryness of substrates have been maintained.
2. Continuity of water-resistive barrier system has been achieved throughout the building envelope with no gaps or holes.
3. Installation is shingled to drain.
4. Maximum exposure time of materials to UV deterioration has not been exceeded.
5. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction.
6. Termination mastic, sealant or tap has been applied on cut edges as required and recommended.

7. Flexible flashings have been firmly adhered to substrate, with no fishmouths.
8. Compatible materials have been used.
9. Transitions at changes in direction and structural support at gaps have been provided.
10. Connections between assemblies (water-resistive barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
11. All penetrations have been sealed.

C. Water-resistive barriers will be considered defective if they do not pass inspections.

1. Remove and replace deficient water-resistive barrier components as specified above and as directed by manufacturer's technical representative and Contracting Officer.

D. Prepare inspection reports.

3.8 PROTECTION

A. Protect water-resistive barriers from damage during application and remainder of construction period before concealing.

1. Protect water-resistive barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer.
2. If exposed to these conditions for longer than recommended, remove and replace water resistive barrier or install additional, application after repairing and preparing the overexposed materials according to manufacturer's written instructions.
3. Protect water-resistive barriers from contact with incompatible materials and sealants not approved by manufacturer.

B. Replace damaged water-resistive barrier materials as required and where recommended by manufacturer.

END OF SECTION 07 25 00

SECTION 07 31 13 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber-reinforced asphalt shingles.
 - 2. Underlayment materials.
 - 3. Ridge vents.
 - 4. Metal flashing and trim.

1.2 Drawing Designation: RC1.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Asphalt shingles.
 - 2. Underlayment materials.
 - 3. Ridge vents.
 - 4. Asphalt roofing cement.
 - 5. Elastomeric flashing sealant.
- B. Samples: For each exposed product and for each color and blend specified.
- C. Product test reports.
- D. Research reports for synthetic underlayment.
- E. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized installer who is trained and approved by the manufacturer.

1.6 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
 - 1. Materials Warranty Period: 30 years from date of Substantial Completion, prorated, with first 10 years nonprorated.
 - 2. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 70 mph for five years from date of Substantial Completion.
 - 3. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for 10 years from date of Substantial Completion.
 - 4. Workmanship Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Impact-Resistant, Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multiply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing; with impact resistance complying with UL 2218, Class 4.
 - 1. Basis-of-Design Product: XT30 Traditional Series by Certaineed or approved equal with the following salient characteristics:
 - 2. Butt Edge: Straight cut.
 - 3. Strip Size: Manufacturer's standard.
 - 4. Algae Resistance: Granules resist algae discoloration.
 - 5. Color and Blends: "Weathered Wood."
 - 6. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D3161/D3161M, Class F, and with ASTM D7158/D7158M, Class H.
- C. Energy Performance, ENERGY STAR: Provide asphalt shingles that are listed on the DOE's "ENERGY STAR Roof Product List" for steep-slope roof products.

2.3 UNDERLAYMENT MATERIALS

- A. Organic Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:
 - 1. ASTM D4869/D4869M: Type III.
- B. Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; evaluated and documented to be suitable for use as a roof underlayment under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 50-mil-thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied.
 - 1. Top Surface: Manufacturer's standard slip-resistant texture.

2.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.
- B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.
- C. Roofing Nails: ASTM F1667, aluminum, stainless steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch-diameter, sharp-pointed, with a 3/8- to 7/16-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through sheathing less than 3/4 inch thick.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- D. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, 1-inch-minimum diameter.
 - 1. Provide with minimum 0.0134-inch-thick metal cap, 0.010-inch-thick power-driven metal cap, or 0.035-inch-thick plastic cap; and with minimum 0.083-inch-thick ring shank or 0.091-inch-thick smooth shank of length to penetrate at least 3/4 inch into roof sheathing or to penetrate through roof sheathing less than 3/4 inch thick.

2.5 METAL FLASHING AND TRIM

- A. Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: Stainless steel.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other

characteristics of the item unless otherwise indicated on Drawings.

1. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with asphalt shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.
- B. Asphalt-Saturated Felt: Install on roof deck parallel with and starting at eaves and fasten with underlayment nails.
 1. Single-Layer Installation:
 - a. Lap sides a minimum of 4 inches over underlying course.
 - b. Lap ends a minimum of 4 inches.
 - c. Stagger end laps between succeeding courses at least 72 inches.
 2. Double-Layer Installation:
 - a. Install a 19-inch-wide starter course at eaves and completely cover with a 36-inch-wide second course.
 - b. Install succeeding 36-inch-wide courses lapping previous courses 19 inches in shingle fashion.
 - c. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches.
 - d. Apply a continuous layer of asphalt roofing cement over starter course and on felt surface to be concealed by succeeding courses as each felt course is installed. Apply at locations indicated on Drawings.
 3. Install felt underlayment on roof deck not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of felt over self-adhering sheet not less than 4 inches in direction that sheds water.
 - b. Lap ends of felt not less than 6 inches over self-adhering sheet.
 4. Install fasteners in a grid pattern of 12 inches between side laps with 6-inch spacing at side and end laps.
 5. Terminate felt extended up not less than 4 inches against sidewalls, curbs, chimneys, and other roof projections.

C. Synthetic Underlayment:

1. Install on roof deck parallel with and starting at the eaves.
 - a. Lap sides and ends as recommended in writing by manufacturer, but not less than 4 inches for side laps and 6 inches for end laps.
 - b. Stagger end laps between succeeding courses at interval recommended in writing by manufacturer, but not less than 72 inches.
 - c. Fasten with underlayment nails in accordance with manufacturer's written instructions.
 - d. Cover underlayment within period recommended in writing by manufacturer.
2. Install in single layer on roofs sloped at 4:12 and greater.
3. Install in double layer on roofs sloped at less than 4:12.
4. Install synthetic underlayment on roof deck not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of underlayment over self-adhering sheet not less than 4 inches in direction to shed water.
 - b. Lap ends of underlayment not less than 6 inches over self-adhering sheet.
5. Install fasteners in a grid pattern of 12 inches between side laps with 6-inch spacing at side and end laps.
6. Terminate synthetic underlayment extended up not less than 4 inches against sidewalls, curbs, chimneys, and other roof projections.

D. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck in locations indicated on Drawings.

1. Comply with low-temperature installation restrictions of underlayment manufacturer.
2. Install lapped in direction that sheds water.
 - a. Lap sides not less than 4 inches.
 - b. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.
 - c. Roll laps with roller.
3. Prime concrete, masonry, and metal surfaces to receive self-adhering sheet.
4. Cover underlayment within seven days.

E. Metal-Flashed, Open-Valley Underlayment: Install two layers of minimum 36-inch-wide underlayment centered in valley.

1. Use the same underlayment as installed on field of roof.
2. Stagger end laps between layers at least 72 inches.
3. Lap ends of each layer at least 12 inches in direction that sheds water, and seal with asphalt roofing cement.
4. Fasten each layer to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.
5. Lap roof-deck underlayment over first layer of valley underlayment at least 6 inches.

3.2 INSTALLATION OF METAL FLASHING AND TRIM

- A. Install metal flashings and trim to comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim."
 - 1. Install metal flashings in accordance with recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
 - 2. Bed flanges of metal flashings using asphalt roofing cement or elastomeric flashing sealant.
- B. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by the manufacturer.

3.3 INSTALLATION OF ASPHALT SHINGLES

- A. Install asphalt shingles in accordance with manufacturer's written instructions and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 3/4 inch over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of laminated asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Install first and remaining courses of three-tab-strip asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- E. Fasten asphalt shingle strips with minimum roofing nails not less than the number indicated in manufacturer's written instructions for roof slope and design wind speed indicated on Drawings and for warranty requirements specified in this Section.
 - 1. Locate fasteners in accordance with manufacturer's written instructions.
 - 2. Where roof slope exceeds 18:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
 - 3. Where the roof slope is less than 4:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
 - 4. When ambient temperature during installation is below 50 deg F, hand seal self-sealing asphalt shingles by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
- F. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of

shingle strips.

1. Maintain uniform width of exposed open valley from highest to lowest point.
 2. Extend shingle a minimum of 4 inches over valley metal.
 3. Set valley edge of asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.
 4. Do not nail asphalt shingles to metal open-valley flashings.
- G. Ridge Vents: Install continuous ridge vents over asphalt shingles in accordance with manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- H. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing-shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds.
1. Fasten with roofing nails of sufficient length to penetrate sheathing.
 2. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 07 31 13

SECTION 07 31 29 - WOOD SHINGLES AND SHAKES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-shingle siding.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring.
2. Section 062013 "Exterior Finish Carpentry" for wood exterior-wall trim.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Wood-shingle siding.
2. Drainage mat.

B. Shop Drawings: For metal flashing and trim.

C. Samples: For each exposed product, in sizes indicated.

1. Wood-Shingle Siding: Full size

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Research Reports: For wood products, from ICC-ES, indicating that product is suitable for intended use under applicable building codes.

C. Sample Warranty: For manufacturer's materials warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wood products to include in maintenance manuals.

B. Materials warranties.

C. Installer's warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: CSSB member.
- B. Grading Agency Qualifications: An independent testing and inspecting agency recognized by authorities having jurisdiction as qualified to label wood products for compliance with referenced grading rules.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
- B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
 - 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.8 WARRANTY

- A. Materials Warranty: Manufacturer's warranty administered by CSSB and on CSSB's standard form in which manufacturer agrees to repair or replace CSSB-labeled products that fail in materials within specified warranty period. Material failures include manufacturing defects that result in leaks.
 - 1. Materials Warranty Period: Limited lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from a single source from a single manufacturer.

2.2 WOOD SHINGLE SIDING

- A. Cedar Shingles: Eastern white cedar shingles.
- B. Basis of design Product: Maibec Industries, Inc, or approved equal with the following salient characteristics:
 - 1. Grade: Grade B Clear, Red Label.
 - 2. Size: 16 inches long, 0.40 inch thick.
 - 3. Rebutted and rejointed
 - 4. Smooth-sawn
 - 5. Hip and Ridge Units: Site made.
 - 6. Finish: From Manufacturer's full range

2.3 DRAINAGE MATERIAL

- A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under siding.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advanced Building Products; Mortairvent® 202.
 - b. Benjamin Obdyke: Cedar Breather.
 - c. CavClear/Archovations, Inc.; Rainscreen Mat. (.25")
 - d. Keene Building Products; Driwall™ Rainscreen 020-1.
 - e. Stuc-O-Flex International, Inc.; WaterWay Rainscreen, 7 mm.

Products shall have the following salient characteristics:

- 2. Thickness: Not less than .25 in. per ASTM D5199
- 3. Weight: Not less than 280 GSM per ASTM D3776
- 4. Tensile Strength: Not less than 27 lbf per ASTM D5034
- 5. Compressive Strength: Not less than 160 lf/SF per ASTM D6364
- 6. Flame Spread Index: Not less than 10 per ASTM E84
- 7. Smoke Index: Class A per ASTM E84

2.4 ACCESSORIES

- A. Siding Nails: ASTM F 1667, stainless-steel, Type 304, wire nails, sharp pointed, and of sufficient length to penetrate a minimum of 3/4 inch into sheathing.
 - 1. Shingles: Use box nails.
 - 2. Nails in Contact with Metal Flashing: Use nails made from same metal as flashing.

2.5 METAL FLASHING AND TRIM

- A. Flashing: Provide aluminum flashing at window and door heads and where indicated.

1. Finish for Aluminum Flashing: Siliconized polyester coating, same color as wood trim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through wood roofing.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DRAINAGE MATERIAL INSTALLATION

- A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

3.3 INSTALLATION OF WOOD SHINGLE SIDING

- A. Install wood shingles, beginning at base of wall, with a double-layer starter course in a continuous straight line. Offset joints of double-layer starter course a minimum of 1-1/2 inches.
 1. Extend starter course 1 inch below top of foundation wall.
- B. Install the first course of wood shingles over starter course. Install second and succeeding courses of wood shingles. Offset joints between shingles in succeeding courses a minimum of 1-1/2 inches.
 1. Install shingles in continuous straight-line courses.
 2. Space shingles 1/8 to 1/4 inch apart.
 3. Fasten each shingle with two concealed nails spaced 3/4 to 1 inch from edge of shingle and 1 inch above butt line of succeeding course. For shingles wider than 8 inches, add two concealed fasteners, spaced 1 inch apart, to the center of shingle. Drive fasteners flush with top surface of shingles without crushing wood.
 4. Maintain weather exposure to match existing shingles.
 5. Interior Corner Treatment: Butted against wood stop.
 6. Exterior Corner Treatment: Butted against corner boards.
- C. Weather Exposure and Spacing: 5" exposure.

END OF SECTION 07 31 29

SECTION 07 46 00 - SIDING AND SOFFITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Composite siding, trim and soffits.
2. Rodent mesh.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 07 25 00 "Weather Barriers" for weather-resistive barriers.

1.2 COORDINATION

- ##### A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. During the pre-construction meetings, review the approved design intent and methods required. Repeat this review during the preparation for assembly of the exterior systems mockup.

1.4 SUBMITTALS

- ##### A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch-long-by-actual-width Sample of siding.
2. 12-inch-long-by-actual-width Samples of trim and accessories.

- ##### C. Product Certificates: For each type of fiber-cement siding and soffit and composite siding. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

- ##### D. Research/Evaluation Reports: For each type of fiber-cement siding required and fasteners, from ICC-ES or testing agency acceptable to authorities having jurisdiction.

E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: All products listed in this Section are to be installed by a single installer trained and approved by the composite siding manufacturer or manufacturer's representative.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits or which could involve life safety situations.

B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to fabrication. The General Contractor or Installer shall be responsible for existing site dimensions. Recorded measurements shall be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule.

1.9 WARRANTY

A. Special Warranty, Composite: Manufacturer agrees to repair or replace products that fail in materials within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including cracking and deforming.
- b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 30 years from date of Substantial Completion.

B. Special Warranty, Metal:

C. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking, fading, and deforming.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 5 Hunter color-difference units as measured according to ASTM D2244.
3. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer for each type of siding indicated.
- B. General: Provide all accessories, fasteners, closures and profiles required for complete installation.

2.2 COMPOSITE SIDING, TRIM AND SOFFITS

- A. Basis-of-Design Products: Fiber Cement Collection by Allura, Tru-Exterior or approved equal with the following salient characteristics:

1. Shiplap Siding:
 - a. Thickness: 3/4 inch.
 - b. Size: 6-1/4 inches wide; 12 feet length.
 - c. Texture: Smooth
 - d. Finish: Primed.
 - e. Pattern: As indicated on Drawings
2. Panel Siding:
 - a. Thickness: 5/16 inch.
 - b. Size: 4 feet by 9' or length required.
 - c. Texture: Smooth
 - d. Finish: From full range of MFG standard colors
3. Soffits: Vented and non-vented.
 - a. Thickness: 1/4 inch.
 - b. Vented where required or indicated.
 - c. Size: Width by length required.
 - d. Texture: Smooth.

- e. Finish: From full range of MFG standard colors
4. Trim:
- a. Profiles: As indicated.
 - b. Texture: Smooth.
 - c. Finish: From full range of MFG standard colors
- 2 Factory Priming: Manufacturer's standard acrylic primer.
- 3 General: ASTM C1186, composite board, noncombustible; with a flame-spread index of 25 or less when tested according to ASTM E84.
- 4 Labeling: Provide composite siding that is tested and labeled according to ASTM C1186 Type A by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration and as required for complete installation.
- 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the accessories as indicated in same material as siding and soffits:
- 1. Corner posts.
 - 2. Door and window casings.
 - 3. Fasciae.
 - 4. Moldings and trim.
- C. Flashing: Provide flashing and trim complying with Section 07 62 00 "Sheet Metal Flashing and Trim" where indicated.
- D. Furring: Preservative-treated lumber; see Section 06 10 00 "Rough Carpentry."
- E. Fasteners: Concealed fastened.
- 1. For fastening through or into preservative-treated furring, use stainless-steel fasteners at exterior.
 - 2. For fastening fiber cement [wood siding], use siding nails of sufficient length to penetrate 1-inch.
 - 3. For fastening metal siding, use ribbed bugle-head screws.
 - 4. Size fasteners length to penetrate 1-inch minimum into substrates.
 - 5. For fastening galvanized steel, use hot-dip galvanized-steel fasteners, except where into preservative-treated wood, use stainless steel.
 - 6. Soffit shall be screw-fastened using ribbed bugle-head screws.

F. Insect Screening: Provide at sills and bottom of walls, where shown.

1. As recommended by siding manufacturer for application.
2. Screening: Aluminum, 18-by-16 mesh.

G. Rodent Mesh: Hardware cloth, 1/4-inch 23-gauge, welded steel wire, galvanized after welding.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and soffit and related accessories.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
3. Do not use manufactured units with defective surfaces, sizes, or patterns.
4. Prime cut ends and openings of fiber-cement siding and trim using manufacturer's recommended primer or primer specified in Section 09 91 00 "Painting."

B. Install siding level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut siding to fit adjoining work.
3. Refinish and seal cuts as recommended by manufacturer.
4. Coordinate siding and trim with materials and systems in or adjacent to it.
5. Provide cutouts for mechanical and electrical items that penetrate siding and trim.
6. Fit exterior joints to exclude water.
7. Cope at returns and miter at corners where required or indicated to produce tight-fitting joints, with full-surface contact throughout length of joint.
8. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.

C. Do not align siding joint ends vertically or horizontally unless otherwise indicated.

B. Trim:

1. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.
2. Use scarf joints for end-to-end joints.
3. Stagger end joints in adjacent and related members.

E. Fastening:

1. Fasten to solid substrates in spacing recommended by manufacturer for wind speeds indicated on Structural Drawings.
2. Fasten siding and trim no more than 24 inches o.c. at each stud and furring strip.
3. Fasten complying with Table 2308.6.3(5) "Hardboard Siding" in ICC's International Building Code (IBC).

F. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer. Comply with Section 07 62 00 "Sheet Metal Flashing and Trim."

1. Install joint sealants as recommended by siding manufacturer, where indicated, and as specified in Section 07 92 00 "Joint Sealants."

G. Tolerances:

1. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining siding with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

3.4 ADJUSTING, CLEANING AND PROTECTION

A. Adjust joinery for uniform appearance.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Protect installed siding and trim from damage from weather and other causes during construction.

D. Remove damaged, improperly installed, or otherwise defective materials and replace them with new materials complying with specified requirements.

C. Clean finished surfaces according to manufacturer's written instructions and maintain them in

D. a clean condition during construction.

END OF SECTION 07 46 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetration firestopping systems for the following applications:
 - a. Penetrations in fire-resistance-rated walls.
 - b. Penetrations in horizontal assemblies.
 - c. Penetrations in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equal fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A person experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products

to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

- B. Special Inspections: Allow for 1 of each type of firestopping system to be removed and inspected for conformance with approved submittals. All firestopping shall be inspected prior to the installation of ceilings.
- C. Above Ceiling review: Prior to the installation of ceilings, a review of construction completion shall be conducted for firestopping and other items that will not be visible when the ceilings have been installed.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear the classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Approval in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Hilti, Inc.
 - d. RectorSeal.
 - e. Specified Technologies, Inc.
 - f. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- F. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
 4. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 5. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 6. Special Coating: Corrosion resistant on the interior of fittings.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by the manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
 - 2. Do not install identification on exposed finished wall locations.
 - 3. Provide statement of hour rating for wall assembly.
- B. Penetration Identification: Identify each penetration firestopping system with legible labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Contractor will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Non staining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Latex joint sealants.
6. Acoustical sealants.

B. Drawing Designations.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

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

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

C. 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. Product test reports.

E. Preconstruction field-adhesion-test reports.

F. Field-adhesion-test reports.

G. Sample warranties.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing

indicated.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Colors of Exposed Joint Sealants: As selected for each location and application between each differing material.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Non staining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Non staining, S, NS, 50, NT: Non staining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS,

Class 25, Use NT.

- B. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
- C. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
- D. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.6 JOINT-SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C1330, Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.7 ACOUSTICAL JOINT SEALANTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.
- B. Acoustical Sealant: Manufacturer's standard nonsag, paintable, non-staining latex acoustical sealant complying with ASTM C834.

2.8 MISCELLANEOUS MATERIALS

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

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Non staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses 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 Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent

surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 1 test for the first 150 feet of joint length for each kind of sealant and joint substrate.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 1. Joint Locations:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Tile control and expansion joints.
 - d. Joints between different materials listed above.
 - e. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
 3. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints on vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precaster architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 3. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Urethane, S, P, 25, T, NT.
 3. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints on vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry concrete walls and partitions.
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Urethane, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints on vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
 - c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
 3. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range of colors.
- F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range of colors.
- G. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Butyl-rubber based.
- H. Joint-Sealant Application: Sound-rated assemblies.
1. Joint Locations:
 - a. Perimeter of gypsum board finishes, except for wet areas.
 - b. Other joints as indicated on Drawings.
 2. Joint Sealant: Acoustical sealant.
- I. Joint-Sealant Application: Exterior Joints For Which No Other Sealant Type is Indicated
1. 1. Joint Locations:
 - a. Exterior Joints for which no other sealant type is indicated.
 2. Joint Sealant: Single Component, Nonsag, Silicone Joint Sealant S, NS, 100/50, NT
 3. Joint Sealant Color: As selected by Contracting Officer from manufacturer's full range of colors.
- J. Joint-Sealant Application: Interior Joints For Which No Other Sealant is Indicated
1. Joint Locations:
 - a. Interior joints for which no other sealant is indicated.

2. Joint Sealant: Latex Joint Sealant, Type OP, Grade NF
3. Joint-Sealant Color: As selected by Contracting Officer from manufacturer's full range of colors.

END OF SECTION 07 92 00

DIVISION 08 – OPENINGS

SECTION 08 14 00 - WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Pre-hung wood doors of the following types:
 - a. Solid core, raised panel for interior.
2. Factory priming and finishing.

B. Drawing Designations: DE1, DI1, DI2, DI3, DI4.

C. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for framed openings.
2. Section 08 71 00 "Door Hardware" for hardware installed in prehung doors and for hardware grades applicable to prehung doors.
3. Section 09 91 00 "Painting" for shop primers and field painting wood doors and frames.

1.2 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

1. For exterior doors, show glazing performance and glazing type.
2. Include installation details for clearances and requirements for setting frames.
3. Include installation instructions.
4. Include details showing mounting heights and hardware installation coordinated with door hardware.

B. Samples: Manufacturer's standard color samples for selection for factory-finished doors.

C. Sample Warranty: For special warranties.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For door hardware and for factory finishes to include in maintenance manuals.

1. Furnish a complete set of specialized tools and maintenance instructions as required for National Park Service's continued adjustment, maintenance, and removal and replacement of door hardware where applicable.

1.4 QUALITY ASSURANCE

- A. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- B. Preinstallation Conference: Conduct conference at project site.
- C. Mockups: Build mockups to verify selections, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup for hinged prehung doors of each type.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless The Contracting Officer specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting package and deliver as required.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at acceptable limits to manufacturers, at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or

- replacement of defective doors.
3. Warranty Period for Exterior Doors: Two years.
 4. Warranty Period for Solid-Core Interior Doors: Life of installation.
 5. Warranty Period for Interior Hollow-Core Doors: Two years.
 6. Insulating Glass Vision Panels: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wood doors through one source from a single manufacturer for each type.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Door Thermal Transmittance: Maximum whole fenestration product U-factor of **0.40**, according to AAMA 1503, ASTM E1423, or NFRC 100.

2.3 MATERIALS

- A. Lumber: Comply with Section 06 40 23 "Interior Architectural Woodwork."
 1. Opaque Finishes and Frames: AWI listed closed grain hardwood.
- B. Panel Products: Any of the following unless otherwise indicated:
 1. Particleboard: ANSI A208.1, Grade M-2.
 2. Medium-density fiberboard (MDF,) complying with ANSI A208.2, Grade 130.
 3. Hardboard complying with ANSI A135.4.
 4. Veneer-core plywood.
- C. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.
- D. Hardware, Factory-Installed: Comply with Section 08 71 00 "Door Hardware."

2.4 WOOD DOORS

- A. Quality Standard:
 1. In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."
 2. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D5572 for finger joints and with ASTM D5751 for joints other than finger joints.

B. Interior Panel Doors: Interior pre-hung wood doors. AWI, AWMAC, and WI's Architectural Woodwork Standards.

1. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects except with Contracting Officer's approval. If modifications are proposed, submit comprehensive explanatory data for review.
2. Performance Grade:
 - a. Closets: Standard Duty.
 - b. Bathrooms and Bedrooms: Heavy Duty.
3. Finish: Opaque. Factory primed.
4. Solid-Core Door Construction: Raised-panel construction as follows:
 - a. Clear lumber: edge glued for width. Select lumber for similarity of grain and color and arrange for optimum match between adjacent pieces.
 - b. Edge-glued, clear lumber; glued to both sides of a wood-based panel product. Select lumber for similarity of grain and color and arrange for optimum match between adjacent pieces.
 - c. Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.
 - d. Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
5. Exposed Vertical and Top Edges: Any closed-grain hardwood.
6. Construction: Institutional hollow core.
7. Blocking: Provide wood blocking with minimum dimensions as follows:
 - a. 5-by-18-inch lock blocks at both stiles.
 - b. 5-inch top- and bottom-rail blocking.
 - 1) 10-inch bottom-rail face.
8. Thickness: As scheduled, but not less than 1-3/4-inch.
 - a. Panel: Not less than 1/2-inch.

2.5 FRAMES

A. Frames:

1. Architectural Woodwork Standards Grade: Premium.
2. Wood: Solid stock; any listed closed-grain hardwood of mill option.
3. Wood Moisture Content: 5 to 10 percent.
4. Profile: As indicated and required.
5. Construction: Solid Lumber.
6. Finish: Factory primed.
 - a. Aluminum-clad for exterior frames.

2.6 FABRICATION

- A. Fabricate doors in sizes indicated for Project-site installation.
- B. Factory fit doors to frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 - 1. Clearances:
 - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
 - b. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering.
 - c. Where threshold is shown on Drawings or scheduled, provide not more than 3/8 inch from bottom of door to top of threshold.
- C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

2.7 FACTORY PRIMING

- A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises, and all sides of frames with one coat of wood primer specified in Section 09 91 00 "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames before installing units.
 - 1. Verify rough openings are installed with minimum 1/4-inch clearance on all sides. Do not install units in openings where clearances encroach on minimum specified clearances.
 - 2. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 3. Reject doors with defects. Review all doors with contractor and the Port prior to installing. Defects include but not limited to the following:
 - a. Stains or other surface marks.
 - b. Chipped, checked, blistered, scratches, or any damage to any exposed wood surface.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Sections "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Provide minimum 1/4-inch shim space around doors.
 - 2. Install units level and plumb.
- C. Shop or Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- D. Touch-up at hardware openings. Prime all surfaces prior to installing hardware. No exposed unfinished wood is permitted.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 00

SECTION 08 14 23 - CLAD WOOD DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes wood doors of the following type:

1. Fiberglass clad wood doors and frames

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood door indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.

C. Samples for Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

D. Product Schedule: For wood doors. Use same designations indicated on Drawings.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of wood door.

F. Maintenance Data: For operating hardware, weather stripping and finishes to be included in maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating wood doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

- B. Source Limitations: Obtain wood doors through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of wood doors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.
 - 1. Do not modify intended aesthetic effects, as judged solely by Contracting Officer, except with Contracting Officer's approval. If modifications are proposed, submit comprehensive explanatory data to Contracting Officer for review.
- D. Sample Installation: Before installing door units, install a sample door to demonstrate installation procedure. Install to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Coordinate the presence of Contracting Officer, door manufacturer representative, and air barrier manufacturer representative.
 - 2. Review, discuss, and coordinate the interrelationship of doors with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.
 - 3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
 - 4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.
 - 5. Approval of sample is for relationship of door with air barrier installation, and aesthetic qualities of workmanship.
 - 6. Approved sample may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify wood door openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating wood doors without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - c. Faulty operation of door and hardware.

- d. Deterioration of wood, metals, vinyl, other materials, and finishes beyond normal weathering.
 - e. Failure of insulating glass.
2. Warranty Period:
- a. Window: Ten years from date of Substantial Completion.
 - b. Glazing: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 1. Fiberglass-Clad Wood Doors and Frames:
 - a. Jeld-Wen Doors.
 - b. Therma-Tru Doors
 - c. Or equal, as prior approved by Contracting Officer.

2.2 MATERIALS

- A. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
- B. Fiberglass Pultrusions: Manufacturer's standard fiber reinforced material consisting of glass fibers and polyester resin pultruded into cladding with factory applied finish.
- 1. Factory Finish: Manufacturer's standard baked on acrylic urethane finish.
- C. Clad Trim and Glazing Stops: Hollow extrusions or clad-wood material and finish to match clad frame members.
- D. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood door members, cladding, trim, hardware, anchors, and other components.
- 1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match the finish of member or hardware being fastened, as appropriate.

- E. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions.
- F. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions.
- G. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when wood door is closed.
 - 1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
- H. Replaceable Weather Seals: Comply with AAMA 701/702.

2.3 FIBERGLASS CLAD DOORS AND FRAMES

- A. Basis of Design: Jeld-Wen Doors; SP8-684CL-1P, Smooth Pro, 2-Panel, Half-lite Door.
- B. Frame Description:
 - 1. Interior: Clear pine exposed surfaces.
 - a. Kiln dried to a moisture content no greater than twelve (12) percent at the time of fabrication.
 - b. Water repellent and preservative treated in accordance with ANSI / NWWDA I.S.4.
 - 2. Exterior: Fiberglass reinforced plastic.
 - 3. Composite frame thickness: 1-7/32 inches.
 - 4. Frame depth: 4-9/16 inches. Beige fiberglass reinforced plastic sill with oak interior sill liner.
- C. Panel Description:
 - 1. Exterior: fiberglass reinforced plastic.
 - 2. Composite panel thickness: 1-3/4 inches with corner keys and sealant injection.
 - 3. Stile dimensions: 3-5/8 inches.
 - 4. Rail dimensions: top rail 3-5/8 inches, bottom rail 6 inches.
- D. Hardware:
 - 1. Hinges: 4 inch butt hinges that contain both horizontal and vertical adjustment feature
 - a. Three hinges on all operator panels.
 - b. Finish: Brushed Stainless
- E. Weather Strip:

1. All units are constructed with weather strip at all panel perimeter joints.
2. Jambs, Head jamb, astragal, and mull post utilize a dual bulb weather strip.
3. Sill weather strip to seal against the bottom rail.
4. Frame weather strip is black in color, sill weather strip is black or beige in color.

2.4 ACCESSORIES

- A. Membrane Strip Flashing: Pressure-sensitive butyl flashing tape for sealing around doors in exterior wall.

2.5 FABRICATION

- A. Fabricate wood doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
- B. Weather Stripping: Provide full-perimeter weather stripping.
- C. Factory machine doors for openings and for hardware that is not surface applied.
- D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

2.6 WOOD FINISHES

- A. Pultruded Fiberglass. Factory baked on acrylic urethane. Meets AAMA 624-10 requirements.
 1. Color: As selected by Contracting Officer from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight door installation.
 1. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches of opening.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install membrane strip flashing in accordance with manufacturer's recommendations and details on the drawings.

3.3 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
- B. Install doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating leaves, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Clean exposed surfaces immediately after installing doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect door surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor door surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact door surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 14 23

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames for walls, ceilings and crawlspaces.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

- A. Basis-of-Design Attic Access: E-Z Hatch by Battic Door Energy R-50 or approved equal with the following salient characteristics:
- B. Flush Access Doors with Exposed Flanges:
 - 1. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: As required.
 - 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory primed.
 - 5. Frame Material: Same material, thickness, and finish as door.
 - 6. Latch and Lock: Cam latch, screwdriver operated.
- C. Flush Access Doors with Concealed Flanges:
 - 1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: As required.

4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
5. Frame Material: Same material and thickness as door.
6. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

- A. Wood: Comply with Section 06 40 23 “Interior Architectural Woodwork.”
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- E. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- F. Stainless Steel Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- G. Aluminum Extrusions: ASTM B221, Alloy 6063.
- H. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- I. Frame Anchors: Same material as door face.
- J. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install holes cut through finish.
 - 1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 50 00 - WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Windows, of the following type:

a. Fiberglass.

B. Drawing Designations: WD1, WD2 and WD3.

C. Related Requirements:

1. Section 07 25 00 "Weather Barriers" for water resistive barriers and flashings used in window opening installations.
2. Section 07 92 00 "Joint Sealants" for sealants used in installation.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for windows.

B. Shop Drawings: For windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

- C. Product Schedule: For windows. Use the same designations indicated on Drawings.
- D. Qualification Data: For Installer.
- E. Product Test Reports: For each type of window, for tests performed by a qualified testing agency, and for each class and performance grade indicated, tested at AAMA gateway size.
 - 1. Provide documentation from window manufacturer indicating performance grade required per AAMA/WDMA/CSA 101/I.S.2/A440 for project wind speeds and location on building.
 - a. Include design pressures in pounds per square foot format, both inward and outward pressures, for each window and elevation, complying with ASCE 7-12 “Minimum Design Loads for Building and Other Structures”.
 - 2. Provide manufacturer test reports indicating product compliance with indicated requirements.
 - 3. Include documentation indicating fastening size, material, type and spacing complying with project design pressures.
- F. Field quality-control reports.
- G. Sample Warranties: For manufacturer's warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to window manufacturer for installation of units required for this Project.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless The Contracting Officer specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, and air infiltration.
 - c. Faulty operation of movable sash and hardware.

- d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
2. Warranty Period:
- a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain windows from single source from single manufacturer.
- B. Source Limitations: Obtain sliding glass doors from single source from single manufacturer.

2.2 WINDOWS AND SLIDING DOORS

- A. Frames and Sashes: Complying with AAMA/WDMA/CSA 101/I.S.2/A440 and performance indicated.
- B. Fiberglass.
 - 1. Basis-of-Design Products: Anderson Corporation A100 Series or approved equal with the following salient characteristics:
 - 2. Materials Composition: Extruded composite profile consisting of 40 percent reclaimed pre-consumer wood fiber and 60 percent thermostatic polymer by weight.
 - 3. Frame Style: 1-3/8-inch Fin Setback.
 - 4. Operating Type: Single Hung.
 - 5. Integral Frame Color: White.
 - 6. Gypsum Board Returns: Provide at interior face of frame.
 - 7. Frame Attachment:
 - a. Deflection clips and strap anchors.
 - b. Integral Nail-Flange: Provide at units indicated.
 - c. Provide integral steel-reinforcement in frame extrusion for fastening where strap fastening is indicated.
- C. Insulating-Glass Units: ASTM E2190.
 - 1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: Clear.
 - b. Kind: Fully tempered at operable units, where required by code and where indicated on drawings.
 - 2. Lites: As indicated on drawings
 - 3. Filling: Fill space between glass lites with air and/or argon.

4. Low-E Coating: On second or third surface.
- D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.3 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Window Certification: WDMA certified with label attached to each window.
 2. Sliding Door Certification: AAMA certified with label attached to each door.
- B. Performance Standards:
1. Manufacturer shall verify performance grade required based on location and elevation. Refer to Structural Drawings for Design Criteria.
 2. Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - a. Minimum Performance Class: AW; as required for project conditions.
 - b. Minimum Performance Grade: 40 and as required for project conditions.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.
- E. **Sound Transmission Class (STC):** Rated for not less than 26 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.
- F. **Outside-Inside Transmission Class (OITC):** Rated for not less than [26] OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.
- G. **Windborne-Debris Impact Resistance:** Comply with Section 08 05 11 "Performance Requirements for Openings."

2.4 HARDWARE

- A. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: As selected during submittals from manufacturer's full range.
- B. Sliding Door Hardware and Frame Accessories:
1. Threshold and Sill Cap/Track: Provide manufacturer's standard threshold and track of

thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to exterior.

- a. Color: Manufacturer's standard; match frame.
 - b. Low-Profile Floor Track: ADA-ABA compliant.
2. Drip Caps: Extruded aluminum, factory fabricated and finished to match door frame; designed to direct water away from building when installed horizontally at head of sliding wood-framed glass doors.
 3. Limit Stops: Resilient rubber.
 4. Door Pulls: Provide manufacturer's standard metal pull grips.
 5. Lock: Install manufacturer's keyed cylinder lock and multipoint locking device on each movable panel, lockable from the inside, and outside where scheduled. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.
 - a. Keying System: Keyed to match other building entrances.
 6. Security Foot Bolt: Provide security foot-operated dead bolt attached to bottom rail of movable sliding door panels to lock the panel when fully closed and when partially open to permit ventilation.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

2.5 ACCESSORIES

- A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.
1. Material: Manufacturer's standard.
 2. Pattern: As indicated on Drawings.
 3. Profile: As indicated on Drawings.
 4. Color: As scheduled.
- B. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For the application of hardware, use fasteners that match finish hardware being fastened.
- C. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding wood-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
1. Windborne-Debris Resistance: Provide anchors of same design used in windborne-debris resistance testing.

2.6 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide a screen for each operable exterior sash. Screen wickets are not permitted.
 - 1. Type and Location:
 - a. Full, inside for project-out.
 - b. Full, outside for project-in.
 - c. Full, outside for sliding.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
 - 2. Finish for Interior Screens: Baked-on organic coating in color matching window frame.
 - 3. Finish for Exterior Screens: Baked-on organic coating in color matching windows.
- C. Glass-Fiber Mesh Fabric: 18-by-14 or 18-by-16 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.
 - 1. Mesh Color: Manufacturer's standard.
- D. Aluminum Wire Fabric: 18-by-16 mesh of 0.011-inch-diameter, coated aluminum wire.
 - 1. Wire-Fabric Finish: Charcoal gray.

2.7 FABRICATION

- A. Fabricate windows and sliding doors in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

2.8 WOOD FINISHES

- A. Factory-Applied Primer: Provide manufacturer's standard factory-applied prime coat complying with WDMA T.M. 11.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in the manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E2112, Section 5.12, "Dissimilar Materials."

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.

- C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.
- E. Refinish or replace windows and doors with damaged finishes.
- F. Replace damaged components.

END OF SECTION 08 50 00

SECTION 08 71 00.1 - DOOR HARDWARE (6-UNIT FLATS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for finish hardware in doors.

1.2 DEFINITIONS

- A. Exposed: Hardware, fasteners and accessories visible when an opening is closed, or open, or both, unless specifically modified.

1.3 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Review Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Related Division 08 Sections for doors and corresponding frames are to be prepared and reinforced to receive the installation of the specified hardware without additional in-field modifications.

1.4 PREINSTALLATION MEETINGS

- A. Keying Conference: Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- B. Pre-Submittal Conference: Conduct coordination conference with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Review sequence of operation narratives for each unique access controlled opening.

3. Review and finalize construction schedule and verify availability of materials.
 4. Review the required inspecting, testing, commissioning, and demonstration procedures
- C. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 SUBMITTALS

- A. Product Data: Submit as required for each product to be incorporated into the Work.
1. Provide a listing of all electronic hardware, cross-referenced to the Finish Hardware Submittal and Door Schedule. Include Product Data, voltage requirements, and Installation instructions. Provide terminal-to-terminal wiring diagrams of the system along with riser diagrams and description of system function. Indicate connection points to systems provided under Division 16.
- B. Hardware Schedule: Format acceptable to The Contracting Officer include each door and opening. Organize hardware components into groups, give complete designation of every item, and coordinate hardware mounting and function. Coordinate hardware with Door and Frame Schedule; indicate doors to receive each Hardware Group and coordinate information with work of Related Sections
1. Submit at earliest possible date, and concurrent with information essential to coordinated review; prevent delay to progress of Work for which fabrication must follow acceptance of Hardware Schedule.
 2. Keying Schedule: Append to Hardware Schedule, include door number, location, lock function, heading, keying layout, and quantity of keys required.
- C. Maintenance Tools and Instructions: A complete set of specialized tools and instructions necessary for routine maintenance and repairs of hardware.
1. Maintenance and Operation Manuals: Include copy of the approved Finish Hardware submittals, product data, templates, parts lists and diagrams, installation and maintenance instructions, and wiring diagrams.
- D. Quality Assurance: Document compliance with Supplier and Installer qualifications requirements, and certification for automatic operator installations.

1.6 QUALITY ASSURANCE

- A. Supplier Qualifications: Five years successful experience specializing in furnishing and installing hardware similar in scope and operation to that required for the Project, with a DHI certified Architectural Hardware Consultant, on their staff available to consult with the Contracting Officer and observe the Work at no additional cost to the Project.
1. Each kind of Hardware (Butts, Locksets, Exit Devices, Door Closers, etc.) shall be the product of one manufacturer.
 2. The Hardware supplier shall be a locally factory direct authorized stocking distributor of material provided and shall maintain a stock and parts inventory of all standard items

supplied on the Project for future service to the Contracting Officer.

- B. Pre-Installation Conference: Hardware supplier, installer, and manufacturer's representative, and other trades as necessary to coordinate the Work

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Tag each item separately, coordinate with hardware schedule, and include basic installation instructions. Package items into hardware groups as scheduled. Identical groups may be packaged together.
- B. Deliver hardware groups at times and locations required for installation.
- C. Prevent damage to finished surfaces. Provide removable protective cover on finished surfaces that will be exposed in final installation.

1.8 SEQUENCING AND SCHEDULING

- A. Cylinders & Keying: All cylinders, construction keying and final keying shall be provided & installed by the Contracting Officer. Coordinate proper installation timing with the Contracting Officer's locksmith.

1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Governments 's continued adjustment, maintenance, and removal and replacement of door hardware.

1.10 WARRANTY

- A. Special Warranty: For hardware components and periods listed below provide warranty signed by authorized representatives of the Manufacturer, Supplier and Installer of finish hardware providing for the prompt replacement of defective and non-compliant work. Defective Work includes, but is not limited to, failure of hardware to remain in proper adjustment, and deterioration of finishes in excess of normal wear.
 - 1. Mortise Locks: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Each Type of Hardware: Product of a single manufacturer, regardless of whether multiple manufacturers are listed.

- B. Subject to requirements, provide products of the manufacturers scheduled or approved equals. Product designations of listed manufacturers are used in the schedule to establish minimum requirements of appearance, performance, and manufacture.

2.2 PRODUCTS

- A. Manufacturer Name and Trade Mark Identification: Not exposed when door is closed, except for required fire exit hardware labels. Unfilled symbols on face of rim cylinders are acceptable.
- B. Hardware Manufacturers: Unless otherwise indicated, provide the following.
 - 1. As scheduled and as follows:
 - a. Butts/Hinges: Ives, Bommer, McKinney, Stanley or approved equal.
 - b. Flush Bolts and Dust Proof Strikes: Ives, DCI or approved equal.
 - c. Locks: Schlage or approved equal.
 - d. Cylinder: Schlage or as scheduled or approved equal.
 - e. Kickplates and Armorplates: Ives, Tice, Trimco or approved equal.
 - f. Stops: Ives or approved equal.
 - g. Door Thresholds & Seals: Zero, NGP, Pemko or approved equal.
 - h. Astragals: NGP, Anemostat or approved equal.
 - i. Thresholds: Aluminum, width as required, by NGP or approved equal.

Products shall have the following salient characteristics:

- C. Hardware: Manufactured to conform to published templates, for machine screw installation, using base metal, forming method, and finish specified, and complying with applicable ANSI A156 series standard.
- D. Hinges: Template-Produced, except where both leaves are installed into wood door and frame. Provide three hinges for doors 90 inches and less in height, and one additional hinge for each additional 30 inches of height, or part thereof, unless otherwise indicated. Pairs of doors require a minimum of (3) hinges per door leaf.
 - 1. Size: 4.5 by 4.5 inch up to and including 42 inch wide doors; provide 5 by 4.5 inch hinges for doors wider than 42 inches. Provide wide-throw hinges where trim application or other conditions require for complete range of door movement.
 - 2. All hinges shall be heavy weight type.
 - 3. Pins: Steel in steel hinges, stainless steel elsewhere; non-rising on interior in-swing doors, non-removable elsewhere.
 - 4. Tips: Flat button with matching plug, finished to match leaves.
- E. Cylinders: Interchangeable-core pin tumbler inserts. Furnish temporary inserts for the construction period, install final inserts as directed.
- F. Locks, Latches, and Bolts: Manufacturer's standard wrought box strike with curved lip extended to protect frame, finished to match hardware set. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.
- G. Locksets, Exterior: Schlage ND, Lever Series or approved equal that is BHMA Grade 1

- H. Locksets, Interior: Schlage ELA, Elan Lever or approved equal that is BHMA Grade 2
- I. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by The Contracting Officer. Incorporate decisions made in keying conference
 - 1. Provide keying levels per the Contracting Officer's existing hardware practices and per The Contracting Officer's written direction.
 - 2. Provide key quantities as directed for keying levels but not less than two keys for each cylinder at every keying level.
 - 3. Provide key quantities as directed for keying levels but not less than five each for Master keys, Construction keys and Change keys; two Grand Master keys and 1 Control key.
 - 4. Delivery of Cores, Keys and Cylinders:
 - a. Deliver construction cores, construction master keys, and construction key to Project Site.
 - b. Permanent cores, operating keys, and permanent control keys shall be individually packaged by door, identified by lock.
 - c. After removal of temporary construction cores, ship construction cores, construction keys, and construction control keys to location selected by The Contracting Officer in key conference.
- J. Door Armor and Trim: Kick plates, mop plates, door edging and similar protective components.
 - 1. Fabricate with bevel on four edges (B4E), 2 inches less-than-door-width (LDW) on stop side and 1 LDW on pull side and coordinate with other hardware components to avoid conflict with mounting locations.
- K. Weatherstripping and Gasketing: Type, size, and profile indicated; continuous at head and jambs.
 - 1. Exterior Doors: Weather-strip.
 - 2. Interior Doors: Gasket 20-minute smoke and draft assemblies and other doors as scheduled and indicated.
 - 3. Smoke Gaskets: NFPA 105 tested and labeled per UL 1784.
 - 4. Acoustic Gaskets: ASTM E1408.
- L. Miscellaneous Door Hardware:
 - 1. Silencers: Ives number SR64 for frame material shown or approved equal with the following salient characteristics: Provide three in single door frames, four at double door frames. Omit where prohibited for fire rating, and where continuous bumper-type stripping is provided.
 - 2. Exposed resilient parts of bumpers, stops, gaskets, etc.: Black unless otherwise indicated.
- M. Fasteners: Furnished for each unit of hardware; concealed for hardware exposed when door is closed, and non-corrosive at exterior openings.
 - 1. Finish exposed fasteners to match hardware, and adjacent surfaces.
 - 2. Screws: Unless otherwise indicated, Phillips flat-head screws, self-tapping sheet metal screws are not acceptable.

3. Provide sex-bolts sized for door thickness for closers and exit devices applied to composite wood and mineral core doors.

N. Rescue hardware:

1. Pivot hinges: DAP-3 by Stanley, or approved equal
2. Emergency Door Stop: ES-1 by Stanley, or approved equal
3. Double Lipped Strike: DLS-1 by Stanley, or approved equal

Products shall have the following salient characteristics:

4. Heavy Duty pivot assembly per ANSI 2742
5. Spring action stop per ANSI A1882
6. Strike thickness not less than .075 in, per ANSI A1882

2.3 FINISHING

- A. Provide matching finishes for hardware units at each opening, unless otherwise indicated. Finish Designations are those listed in "Materials and Finishes Standard 1301" by BHMA.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify preparation for items of hardware to be recessed in to floors and other construction.
- B. Verify electrical rough-in is correct and properly coordinate for installation of electrified door hardware with connections to power and sensing or signal systems.

3.2 INSTALLATION

- A. Hardware Mounting Heights: Comply with governing regulations, and Door and Hardware Institute, "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" unless otherwise required.
- B. Install hardware level, plumb, and true to line and location, comply with the manufacturer's instructions and recommendations. Prevent conflicts between mounting heights for each component of hardware.
- C. Adjust and reinforce substrate as necessary for installation and operation, provide backing as wall mounted door stops and other surface mounted hardware; cut and fit as required for installation of hardware, and remove hardware prior to application of final finish; reinstall hardware once finishing is complete.
 1. Where Work cannot be reinforced for fasteners use sleeved through-bolt, or sex screw fastener.

- D. Drill and countersink units not factory-prepared for fasteners. Space fasteners in accordance with industry standards.
- E. Cut and fit threshold and floor covers to profile of door frames with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Permanently anchor thresholds to substrate with No. 10 or larger stainless steel screws. Cut smooth openings for spindles, bolts and similar items as required.
 - 1. Thresholds, Exterior: Set thresholds in sealant, with two beads extending from abutting construction at ends, set in 1-inch from interior side of threshold to permit moisture from draining outward, to exterior.
- F. Push-Pull Units: Fasten using manufacturer's special concealed system, matched pairs can be through-bolted.

3.3 FIELD QUALITY CONTROL

- A. Field Inspection: Provide for inspection of completed installation by manufacturer's field representative and the hardware supplier for components and Hardware Sets required for the Work.
 - 1. Provide certification of proper installation and adjustment of hardware for each opening.

3.4 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate freely and smoothly as intended for the application made
- B. Door Closer Adjustment: After mechanical systems have been balanced, adjust Door Closers operating speed and force to comply with barrier free access and life safety requirements.
- C. Clean adjacent surfaces soiled by hardware installation.
- D. Final Adjustment: Inspect and adjust hardware one week prior to scheduled inspection for final acceptance, and instruct The Contracting Officer's personnel in adjustment and maintenance of hardware.
 - 1. Clean operating items as necessary to restore proper function and finish of hardware and doors.
 - 2. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.5 HARDWARE SCHEDULE

- A. Hardware Groups: As scheduled. Each application of the Groups indicated shall provide the listed components in the quantity required for complete installation and operation. It is the bidder's responsibility to accurately furnish the proper quantities, items, sizes, weights and functions as

required by the plans and specifications. If an opening has, through error, been omitted from the following hardware sets, it shall be the bidder's responsibility to supply hardware of equal quality and quantity, as that which is specified for a comparable opening.

ENTRY SET

Doors 300, 400

Hinges

Lockset (Entry)

Closer

Kickplates both side of doors

Weatherstripping

Silencers

Threshold

Wall Stop

PRIVACY SET 1

Doors 302, 402,

Hinges

Lockset (Privacy)`

Closer

Rescue Hardware

Threshold

PRIVACY SET 2

Doors 303, 403

Hinges

Lockset (Privacy)`

Closer

Rescue Hardware

Wall Stop

HALF DUMMY SET

Doors 303A, 403A, 306A, 406A

Hinges

Lockset

STORAGE SET 1

Doors 304, 404, 305, 405

Hinges

Lockset (storage)

Closer

STORAGE SET 2

Doors 111

Hinges

Lockset (storage)

Closer

Kickplate

Weatherstripping

Threshold

END OF SECTION 08 71 00.1

SECTION 08 71 00.2 - DOOR HARDWARE (8- BEDROOM DORMS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for finish hardware in doors.

1.2 DEFINITIONS

- A. Exposed: Hardware, fasteners and accessories visible when an opening is closed, or open, or both, unless specifically modified.

1.3 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Review Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Related Division 08 Sections for doors and corresponding frames are to be prepared and reinforced to receive the installation of the specified hardware without additional in-field modifications.

1.4 PREINSTALLATION MEETINGS

- A. Keying Conference: Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- B. Pre-Submittal Conference: Conduct coordination conference with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Review sequence of operation narratives for each unique access controlled opening.

3. Review and finalize construction schedule and verify availability of materials.
 4. Review the required inspecting, testing, commissioning, and demonstration procedures
- C. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 SUBMITTALS

- A. Product Data: Submit as required for each product to be incorporated into the Work.
1. Provide a listing of all electronic hardware, cross-referenced to the Finish Hardware Submittal and Door Schedule. Include Product Data, voltage requirements, and Installation instructions. Provide terminal-to-terminal wiring diagrams of the system along with riser diagrams and description of system function. Indicate connection points to systems provided under Division 16.
- B. Hardware Schedule: Format acceptable to The Contracting Officer include each door and opening. Organize hardware components into groups, give complete designation of every item, and coordinate hardware mounting and function. Coordinate hardware with Door and Frame Schedule; indicate doors to receive each Hardware Group and coordinate information with work of Related Sections
1. Submit at earliest possible date, and concurrent with information essential to coordinated review; prevent delay to progress of Work for which fabrication must follow acceptance of Hardware Schedule.
 2. Keying Schedule: Append to Hardware Schedule, include door number, location, lock function, heading, keying layout, and quantity of keys required.
- C. Maintenance Tools and Instructions: A complete set of specialized tools and instructions necessary for routine maintenance and repairs of hardware.
1. Maintenance and Operation Manuals: Include copy of the approved Finish Hardware submittals, product data, templates, parts lists and diagrams, installation and maintenance instructions, and wiring diagrams.
- D. Quality Assurance: Document compliance with Supplier and Installer qualifications requirements, and certification for automatic operator installations.

1.6 QUALITY ASSURANCE

- A. Supplier Qualifications: Five years successful experience specializing in furnishing and installing hardware similar in scope and operation to that required for the Project, with a DHI certified Architectural Hardware Consultant, on their staff available to consult with the Contracting Officer and observe the Work at no additional cost to the Project.
1. Each kind of Hardware (Butts, Locksets, Exit Devices, Door Closers, etc.) shall be the product of one manufacturer.
 2. The Hardware supplier shall be a locally factory direct authorized stocking distributor of material provided and shall maintain a stock and parts inventory of all standard items

supplied on the Project for future service to the Contracting Officer.

- B. Pre-Installation Conference: Hardware supplier, installer, and manufacturer's representative, and other trades as necessary to coordinate the Work

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Tag each item separately, coordinate with hardware schedule, and include basic installation instructions. Package items into hardware groups as scheduled. Identical groups may be packaged together.
- B. Deliver hardware groups at times and locations required for installation.
- C. Prevent damage to finished surfaces. Provide removable protective cover on finished surfaces that will be exposed in final installation.

1.8 SEQUENCING AND SCHEDULING

- A. Cylinders & Keying: All cylinders, construction keying and final keying shall be provided & installed by the Contracting Officer. Coordinate proper installation timing with the Contracting Officer's locksmith.

1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Governments 's continued adjustment, maintenance, and removal and replacement of door hardware.

1.10 WARRANTY

- A. Special Warranty: For hardware components and periods listed below provide warranty signed by authorized representatives of the Manufacturer, Supplier and Installer of finish hardware providing for the prompt replacement of defective and non-compliant work. Defective Work includes, but is not limited to, failure of hardware to remain in proper adjustment, and deterioration of finishes in excess of normal wear.
 - 1. Mortise Locks: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Each Type of Hardware: Product of a single manufacturer, regardless of whether multiple manufacturers are listed.

- B. Subject to requirements, provide products of the manufacturers scheduled or approved equals. Product designations of listed manufacturers are used in the schedule to establish minimum requirements of appearance, performance, and manufacture.

2.2 PRODUCTS

- A. Manufacturer Name and Trade Mark Identification: Not exposed when door is closed, except for required fire exit hardware labels. Unfilled symbols on face of rim cylinders are acceptable.
- B. Hardware Manufacturers: Unless otherwise indicated, provide the following.
 - 1. As scheduled and as follows:
 - a. Butts/Hinges: Ives, Bommer, McKinney, Stanley or approved equal.
 - b. Flush Bolts and Dust Proof Strikes: Ives, DCI or approved equal.
 - c. Locks: Schlage or approved equal.
 - d. Cylinder: Schlage or as scheduled or approved equal.
 - e. Kickplates and Armorplates: Ives, Tice, Trimco or approved equal.
 - f. Stops: Ives or approved equal.
 - g. Door Thresholds & Seals: Zero, NGP, Pemko or approved equal.
 - h. Astragals: NGP, Anemostat or approved equal.
 - i. Thresholds: Aluminum, width as required, by NGP or approved equal.

Products shall have the following salient characteristics:

- C. Hardware: Manufactured to conform to published templates, for machine screw installation, using base metal, forming method, and finish specified, and complying with applicable ANSI A156 series standard.
- D. Hinges: Template-Produced, except where both leaves are installed into wood door and frame. Provide three hinges for doors 90 inches and less in height, and one additional hinge for each additional 30 inches of height, or part thereof, unless otherwise indicated. Pairs of doors require a minimum of (3) hinges per door leaf.
 - 1. Size: 4.5 by 4.5 inch up to and including 42 inch wide doors; provide 5 by 4.5 inch hinges for doors wider than 42 inches. Provide wide-throw hinges where trim application or other conditions require for complete range of door movement.
 - 2. All hinges shall be heavy weight type.
 - 3. Pins: Steel in steel hinges, stainless steel elsewhere; non-rising on interior in-swing doors, non-removable elsewhere.
 - 4. Tips: Flat button with matching plug, finished to match leaves.
- E. Cylinders: Interchangeable-core pin tumbler inserts. Furnish temporary inserts for the construction period, install final inserts as directed.
- F. Locks, Latches, and Bolts: Manufacturer's standard wrought box strike with curved lip extended to protect frame, finished to match hardware set. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.
- G. Locksets, Exterior: Schlage ND, Lever Series or approved equal that is BHMA Grade 1

- H. Locksets, Interior: Schlage ELA, Elan Lever or approved equal that is BHMA Grade 2
- I. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by The Contracting Officer. Incorporate decisions made in keying conference
 - 1. Provide keying levels per the Contracting Officer's existing hardware practices and per The Contracting Officer's written direction.
 - 2. Provide key quantities as directed for keying levels but not less than two keys for each cylinder at every keying level.
 - 3. Provide key quantities as directed for keying levels but not less than five each for Master keys, Construction keys and Change keys; two Grand Master keys and 1 Control key.
 - 4. Delivery of Cores, Keys and Cylinders:
 - a. Deliver construction cores, construction master keys, and construction key to Project Site.
 - b. Permanent cores, operating keys, and permanent control keys shall be individually packaged by door, identified by lock.
 - c. After removal of temporary construction cores, ship construction cores, construction keys, and construction control keys to location selected by The Contracting Officer in key conference.
- J. Door Armor and Trim: Kick plates, mop plates, door edging and similar protective components.
 - 1. Fabricate with bevel on four edges (B4E), 2 inches less-than-door-width (LDW) on stop side and 1 LDW on pull side and coordinate with other hardware components to avoid conflict with mounting locations.
- K. Weatherstripping and Gasketing: Type, size, and profile indicated; continuous at head and jambs.
 - 1. Exterior Doors: Weather-strip.
 - 2. Interior Doors: Gasket 20-minute smoke and draft assemblies and other doors as scheduled and indicated.
 - 3. Smoke Gaskets: NFPA 105 tested and labeled per UL 1784.
 - 4. Acoustic Gaskets: ASTM E1408.
- L. Miscellaneous Door Hardware:
 - 1. Silencers: Ives number SR64 for frame material shown or approved equal with the following salient characteristics: Provide three in single door frames, four at double door frames. Omit where prohibited for fire rating, and where continuous bumper-type stripping is provided.
 - 2. Exposed resilient parts of bumpers, stops, gaskets, etc.: Black unless otherwise indicated.
- M. Fasteners: Furnished for each unit of hardware; concealed for hardware exposed when door is closed, and non-corrosive at exterior openings.
 - 1. Finish exposed fasteners to match hardware, and adjacent surfaces.
 - 2. Screws: Unless otherwise indicated, Phillips flat-head screws, self-tapping sheet metal screws are not acceptable.

3. Provide sex-bolts sized for door thickness for closers and exit devices applied to composite wood and mineral core doors.

N. Rescue hardware:

1. Pivot hinges: DAP-3 by Stanley, or approved equal
2. Emergency Door Stop: ES-1 by Stanley, or approved equal
3. Double Lipped Strike: DLS-1 by Stanley, or approved equal

Products shall have the following salient characteristics:

4. Heavy Duty pivot assembly per ANSI 2742
5. Spring action stop per ANSI A1882
6. Strike thickness not less than .075 in, per ANSI A1882

2.3 FINISHING

- A. Provide matching finishes for hardware units at each opening, unless otherwise indicated. Finish Designations are those listed in "Materials and Finishes Standard 1301" by BHMA.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify preparation for items of hardware to be recessed in to floors and other construction.
- B. Verify electrical rough-in is correct and properly coordinate for installation of electrified door hardware with connections to power and sensing or signal systems.

3.2 INSTALLATION

- A. Hardware Mounting Heights: Comply with governing regulations, and Door and Hardware Institute, "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" unless otherwise required.
- B. Install hardware level, plumb, and true to line and location, comply with the manufacturer's instructions and recommendations. Prevent conflicts between mounting heights for each component of hardware.
- C. Adjust and reinforce substrate as necessary for installation and operation, provide backing as wall mounted door stops and other surface mounted hardware; cut and fit as required for installation of hardware, and remove hardware prior to application of final finish; reinstall hardware once finishing is complete.
 1. Where Work cannot be reinforced for fasteners use sleeved through-bolt, or sex screw fastener.

- D. Drill and countersink units not factory-prepared for fasteners. Space fasteners in accordance with industry standards.
- E. Cut and fit threshold and floor covers to profile of door frames with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Permanently anchor thresholds to substrate with No. 10 or larger stainless steel screws. Cut smooth openings for spindles, bolts and similar items as required.
 - 1. Thresholds, Exterior: Set thresholds in sealant, with two beads extending from abutting construction at ends, set in 1-inch from interior side of threshold to permit moisture from draining outward, to exterior.
- F. Push-Pull Units: Fasten using manufacturer's special concealed system, matched pairs can be through-bolted.

3.3 FIELD QUALITY CONTROL

- A. Field Inspection: Provide for inspection of completed installation by manufacturer's field representative and the hardware supplier for components and Hardware Sets required for the Work.
 - 1. Provide certification of proper installation and adjustment of hardware for each opening.

3.4 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate freely and smoothly as intended for the application made
- B. Door Closer Adjustment: After mechanical systems have been balanced, adjust Door Closers operating speed and force to comply with barrier free access and life safety requirements.
- C. Clean adjacent surfaces soiled by hardware installation.
- D. Final Adjustment: Inspect and adjust hardware one week prior to scheduled inspection for final acceptance, and instruct The Contracting Officer's personnel in adjustment and maintenance of hardware.
 - 1. Clean operating items as necessary to restore proper function and finish of hardware and doors.
 - 2. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.5 HARDWARE SCHEDULE

- A. Hardware Groups: As scheduled. Each application of the Groups indicated shall provide the listed components in the quantity required for complete installation and operation. It is the bidder's responsibility to accurately furnish the proper quantities, items, sizes, weights and functions as

required by the plans and specifications. If an opening has, through error, been omitted from the following hardware sets, it shall be the bidder's responsibility to supply hardware of equal quality and quantity, as that which is specified for a comparable opening.

ENTRY SET

Doors 800A & 800B

Hinges

Lockset (Entry)

Closer

Kickplates both side of doors

Weatherstripping

Threshold

Wall Stop

PRIVACY SET 1

Doors 801A, 801B

Deadbolt (Keyed)

Hinges

Lockset (Privacy)

Closer

Rescue Hardware

PRIVACY SET 2

Doors 803A, 806A, 806B, 815A, 815B, 818A, 818B

Hinges

Lockset (Privacy)

Closer

Rescue Hardware

HALF DUMMY SET

Doors 802A, 802B, 804A, 804B, 805A, 805B, 807A, 807B, 814A, 814B, 816A, 816B, 817A, 817B, 819A, 819B

Hinges

Lockset

STORAGE SET 1

Doors 812, 813

Hinges

Lockset (storage)

Closer

Kickplate

PASSAGE SET

Doors 808

Hinges

Lockset (passage)

Closer

Kickplates both side of doors

END OF SECTION 08 71 00.2

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass for windows.
2. Glazing sealants and accessories.
3. Requirements for glazing provided under other sections.

B. Related Requirements:

1. Section 08 50 00 "Windows."
2. Division 08 "Openings" Sections for glass specified for other window systems.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturers of insulating-glass units with sputter-coated, low-E coatings glass testing agency and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For tinted glass, coated glass, insulating glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within the previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by a coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to

avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
 - 1. Obtain tinted glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to

the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic glass lites, properties are based on units with lites 6 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 - 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
- C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- E. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard polyisobutylene and silicone or polyisobutylene and hot-melt butyl primary and secondary sealants.
 - 2. Perimeter Spacer: <As selected from the following>:
 - a. Manufacturer's standard spacer material and construction
 - b. Stainless steel
 - c. Thermally broken aluminum
 - d. Silicone with integral desiccant and vapor barrier.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As scheduled or indicated.

B. Glazing Sealant:

1. Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
 - a. Applications: Where movement is required in glazing.
2. Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non staining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Silicone with a Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended by sealant or glass manufacturer.

- E. Edge Blocks:
 - 1. Silicone with a Shore A durometer hardness per manufacturer's written instructions.
 - 2. Type recommended by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so

that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past the face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove non-permanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before the date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

DIVISION 09 – FINISHES

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Finishing.

B. Related Requirements:

1. Section 09 30 13 "Ceramic Tiling" for tile backing panels for use at tile areas.
2. Section 07 21 00 "Thermal Insulation" for sound attenuation blankets

1.2 SUBMITTALS

A. Product Data: For each product required for installation.

1.3 QUALITY ASSURANCE

1. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
2. Simulate finished lighting conditions for review of mockups.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to,

- discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with the support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board: Type X, ASTM C1396, 5/8 inch.
 1. Long Edges: Tapered.
- B. Mold-Resistant Gypsum Board: Type X, ASTM C1396/ With moisture- and mold-resistant core and paper surfaces.
 1. Core: 5/8" inch
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.

- e. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Section 07 92 00 "Joint Sealants."
- F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."
- G. Vapor Retarders:
 - 1. At Insulation: As specified in Section 07 21 00 "Thermal Insulation."
 - 2. At Tile areas, other than exterior walls: As specified in Section 09 30 13 "Ceramic Tiling."

2.7 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
 - 1. Texture:
 - a. Standard Paint Finish

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF RESILIENT FURRING

- A. Installation Standard: ASTM C754.
- B. Install according to manufacturer's written instructions to framing, with long-leg up, to support framing. Do not fasten through long leg.

3.3 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings,

etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.4 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Type X: AT all walls and ceilings scheduled for gypsum board other than moisture resistant.
 2. Mold-Resistant Type: At all wet areas, including walls and ceilings in bathrooms not scheduled for tile, and walls behind kitchen counters with sinks.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise

indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws with screws; fasten face layers with adhesive and supplementary fasteners.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.5 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings according to ASTM C840 and in specific locations approved by Contracting Officer for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for

decoration. Promptly remove residual joint compound from adjacent surfaces.

- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Where scheduled.
 - 3. Level 3: Where scheduled.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

3.7 INSTALLATION OF TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.9 WASTE MANAGEMENT

- A. Separate clean waste gypsum products from contaminants for recycling in accordance with the Waste Management Plan and place in designated areas for recycling. Do not include wood, plastic, metal, asphalt-impregnated gypsum board, or any gypsum board coated with glass fiber, vinyl, decorative paper, paint or other finish. Place in designated area and protect from moisture and contamination.
- B. Recycle clean waste gypsum products:
 - 1. Return to gypsum board manufacturer.
 - 2. Pulverize and apply on-site as soil amendment in accordance with landscape specifications. Do not use products containing glass fiber. Protect granular material from moisture.
- C. Separate metal waste in accordance with the Waste Management Plan and place in designated areas for recycling.
- D. Close and seal tightly all partly used sealant containers and store protected in well-ventilated, fire-safe area at moderate temperatures.
- E. Place used sealant tubes and containers in areas designated for hazardous materials.

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tile.
2. Tile backing panels.
3. Waterproof membrane for thinset applications.
4. Crack isolation membrane.
5. Metal edge strips.

B. Drawing Designations: FF4.

C. Related Requirements:

1. Section 06 16 00 "Sheathing" for subfloor preparation.
2. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified and contained in its "Specifications for Installation of Ceramic Tile."

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- D. Samples for Verification:
 - 1.5 Full-size units of each type and composition of tile and for each color and finish required.
 - 1.6 Full-size units of each type of trim and accessory for each color and finish required.
 - 1.7 Metal edge strips in 6-inch lengths.
- E. Qualification Data: For Installer.
- F. Product Certificates: For each type of product.
- G. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of grout and tile to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced tile installer, with not less than five consecutive years' experience, specializing in installing tile similar in design and extent to that indicated and required for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.
- D. Store liquid materials in unopened containers and protect them from freezing.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of tile installations that fail in materials or workmanship within specified warranty period.
 - 1. Defective Work includes, but is not limited to, bond failure of any tiling components, crack isolation membrane and waterproofing membrane failure.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Waterproof membrane.
 - 2. Crack isolation membrane.
 - 3. Cementitious backer units.
 - 4. Metal edge strips.

2.2 PRODUCTS, GENERAL

- A. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- B. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

- C. Products, Setting Materials: Subject to compliance with requirements, provide products by the basis-of-design manufacturer or one of the other listed manufacturers:
1. Laticrete International, Inc.; basis-of-design.
 2. Mapei.
 3. Ardex Americas.
 4. Custom Building Products.

Products shall have the following salient characteristics:

- D. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.3 TILE PRODUCTS

A. Tile Type

1. Basis-of-Design Product: DalTile or approved equal with the following salient characteristics:
 2. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated. Provide tile complying with Standard grade requirements unless otherwise indicated.
3. Material:
 - a. Walls: Ceramic.
4. Face Size: As selected.
5. Thickness: Product standard.
6. Dynamic Coefficient of Friction, Floor Tile: Not less than 0.42.
7. Finish: Product standard.
 - a. Walls: Glossy.
8. Tile Color and Pattern: From manufacturer's full range
9. Grout Color: From manufacturer's full range
10. Joint Width: As shown on drawings

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A, in maximum lengths available to minimize end-to-end butt joints.
1. Thickness: 1/2 inch.
 - a. 1/4 inch for wood floor underlayment.

2.5 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Provide one of the following for showers:
 - 1. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
 - 2. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 - 3. Latex-Portland Cement Waterproof Mortar: Flexible, waterproof mortar consisting of cement-based mix and latex additive.

2.6 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch nominal thickness.
 - 1. For use over wood floor assemblies.

2.7 SETTING MATERIALS

- A. General: Provide setting materials required for warranty. Where product standards are not included, refer to manufacturer's recommendations and requirements for applications and conditions shown.
- B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 - 1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
- C. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
 - 4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

- A. High Performance Grout: ANSI A118.7.
- B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.
 - 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metal, designed specifically for applications shown; white zinc alloy or aluminum, exposed-edge material.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.10 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other sub-

stances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Contracting Officer.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 by 8 inches or larger.
 - c. Tile floors consisting of rib-backed tiles.

- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- I. Metal Edge Strips: Install at locations indicated where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- J. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 INSTALLATION OF TILE BACKING PANEL

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 INSTALLATION OF WATERPROOF MEMBRANE

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 INSTALLATION OF CRACK ISOLATION MEMBRANE

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations, Wood Studs or Furring:

1. Ceramic Tile Installation: TCNA W244C; thinset mortar on cementitious backer units.
 - a. Ceramic Tile Type:
 - b. Vapor retarder behind the backer where shown on drawings.
 - c. Thinset Mortar: Modified dry-set mortar; standard dry-set where waterproofing manufacturer recommends use.
 - d. Grout: High-performance unsanded; water-cleanable epoxy grout

3.10 WASTE MANAGEMENT

- A. Separate waste in accordance with the Waste Management Plan and place in designated areas in the following categories for recycling
 1. Half tiles or larger: set aside for reuse by National Park Service.
 2. Broken tile, cutoffs smaller than 1/2 tile, and excess mortar and grout: Crush for use as mosaic, sub-base, or fill.
 3. Separate metal waste and place in designated area for recycling
 4. Separate cardboard waste and place in designated area for recycling.

END OF SECTION 09 30 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.
 - 2. Rubber stair accessories.
 - 3. Resilient molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Tarkett (Johnsonite); Baseworks Thermoset Rubber Base, or approved equal with the following salient characteristics:
- B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
- C. Thicknesses: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths:
 - 1. Coils in manufacturer's standard length.
- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors: As selected by Contracting Officer from full range of industry colors.

2.2 RESILIENT MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Tarkett (Johnsonite) or approved equal with the following salient characteristics:
- B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
- C. Profile and Dimensions: .
 - 1. Reducer Strip between Concrete and VCT: RRS-XX-C by Johnsonite or approved substitute.
- D. Colors and Patterns: As selected by Contracting Officer from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Epoxy Adhesives: Two-part epoxy compound recommended by resilient tread manufacturer to adhere rubber treads and risers to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.
 - 3. At outside corners or bullnose CMU corners with less than 6 inches of length, provide contact or epoxy cement to hold base tight to wall.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
 - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

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. Resilient flooring (RF).
- 2. Luxury Vinyl tile (LVT)'.

- B. Related Requirements:

- 1. Section 03 30 00 "Cast-in-Place Concrete" for substrate coordination.
- 2. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with resilient flooring.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. For adhesives and sealants, paints and coatings, and floor covering materials, provide manufacturers' product data including printed statement of VOC content.
- C. For products having recycled content provide product Data indicating percentages by weight of recycled content and salvaged material content.
- D. For products having biobased content provide product Data indicating products meet Farm Security and Rural Investment Act (FSRIA)Section 9002.
- E. Product-specific declaration or Industry-wide EPD or product-specific EPD for resilient tile flooring, where available.
- F. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples.
 - 1. For heat-welding bead, manufacturer's standard-size Samples
- G. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings

- H. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 2 percent of installed area, of each type, color, pattern, and size of resilient product installed.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 RESILIENT FLOORING (RF)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong Flooring, Inc.; www.armstrongflooring.com.
 - 2. Congoleum Corp.; www.congoleum.com.
 - 3. Mannington Mills, Inc.; www.mannington.com.
 - 4. Schönox; HPS North America, Inc.; www.hpsubfloors.com.
 - 5. Or Approved
- B. Tile Standard: ASTM F1700.
- C. Thickness: 0.100 inch (2.5 mm).
- D. Size: As selected by Contracting Officer from manufacturer's standard range. See drawings finish schedule.
- E. Seamless-Installation Method: Heat welded.
- F. Colors and Patterns: As selected by Contracting Officer from manufacturer's standard range.

2.3 LUXURY VINYL TILE (LVT)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong Flooring, Inc.; www.armstrongflooring.com.
 - 2. Patcraft: www.patcraft.com
 - 3. Congoleum Corp.; www.congoleum.com
 - 4. Johnsonite; a Tarkett company; www.commercial.tarket.com.
- B. Tile Standard: ASTM F1066, Class 1, solid color.
- C. Thickness: 0.125 inch (3.2 mm).
- D. Size: See drawing finish schedule.
- E. Colors and Patterns: As selected by Contracting Officer from manufacturer's standard range. See drawings finish schedule.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Colors: Match floor tile.
 - 2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.
- E. Joint Sealant for Resilient Terrazzo Floor Tile: Silicone sealant of type and grade recommended in writing by floor tile manufacturer to suit resilient terrazzo floor tile.
 - 1. Joint-Sealant Color: Match floor tile.
- F. Sealers and Finish Coats for Resilient Terrazzo Floor Tile: Products recommended by floor tile manufacturer for resilient terrazzo floor tile.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
- C. General: Conduct testing using an independent agency with a minimum of five years' experience in moisture emission testing or as pre-approved by the manufacturer of the flooring material.
- D. Moisture Emission Testing: Conduct moisture emission testing of concrete slabs-on-grade and

elevated slabs to receive floor coverings or coatings by the calcium chloride test method.

Perform tests in accordance with ASTM F-1869.

1. Conduct a minimum of three tests for the first 1,000 sq. ft. and one additional test for each additional 1,000 sq. ft.
 2. Ambient test environment shall conform to ASTM-1869 and be reflective of the building's normal operational environment.
 3. Conduct tests on bare concrete, free of surface contaminants, adhesives, curing compounds or sealers.
 4. Locate test locations a minimum of five feet from exterior walls or interior walls that penetrate the floor. Do not conduct tests over random cracks or within five feet of control or construction joints.
 5. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- E. Internal Relative Humidity Testing: Conduct internal relative humidity testing of concrete slab-on-grade and elevated slabs to receive floor coverings or coatings in accordance with ASTM F-2170.
1. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- F. Surface Alkalinity Testing: Conduct alkalinity testing of the concrete surface at all moisture emission test locations in accordance with ASTM F710 5.3.1.
- G. Submit all test results to the Contracting Officer, flooring installer and manufacturer of the flooring
1. materials before installation of the flooring materials.
- H. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- I. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- J. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- K. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis .
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
 - 1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
 - 2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.

2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
 - D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish per manufacturers recommendations.
 - E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
 - F. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.

END OF SECTION 09 65 19

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface preparation and field painting of exposed items and surfaces on the following substrates:
 - a. Interior Substrates:
 - 1) Gypsum board.
 - 2) Steel.
 - 3) Wood.
 - b. Exterior Substrates:
 - 1) Fiber-Cement.
 - 2) Wood.
 2. Finish and color schedules for painted surfaces.
- B. Drawing Designations: WF1, CF1 and CF2.
- C. Government shall approve all colors prior to procurement and application.
- D. Select products and materials in this Section for indoor chemical and pollutant source control and/or low-VOC emitting characteristics.

1.2 DEFINITIONS

- A. Volatile Organic Compounds (VOCs): Compounds as defined by the U.S. Environmental Protection Agency (EPA) in 40 CFR § 51.100 (s), (1).
- B. Anti-Corrosive Paints: Coatings formulated and recommended for use in preventing the corrosion of ferrous metal substrates.

1.3 SEQUENCING AND SCHEDULING

- A. Perform maintenance repainting in the following sequence, which includes work specified in this and other Sections:
1. Dismantle existing surface-mounted objects and hardware except items indicated to remain in place. Tag items with location identification and protect.

2. Verify that temporary protections have been installed.
3. Examine condition of surfaces to be painted.
4. Remove existing paint to the degree required for each substrate and surface condition of existing paint.
5. Apply paint system.
6. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product List: For each product indicated, include the following:
 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run,] that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. All materials, preparation and painting Work shall comply with the requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI).
 1. All paint manufacturers and products shall be listed under the Approved Product List section of the MPI Painting Manual.
- B. Color Matching: Custom computer-match paint colors to colors scheduled.

1.7 FIELD CONDITIONS

- A. Exterior:
 1. Apply paints, including waterborne paints, only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
 2. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
 3. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

B. Interior:

1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain paint materials for each system indicated from single source and single manufacturer.

1. All interior paint systems shall be institutional, low-odor, low-VOC.
2. Basis-of-Design Paint, Latex: SuperPaint Acrylic Latex by Sherwin Williams or approved equal for interior and exterior, with the following salient characteristics.

B. Gypsum Board Substrates:

1. Acrylic Latex System:
 - a. Prime Coat: Latex, interior.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoat: Acrylic Latex, interior.
2. Moisture Resistant System: Water-based, light industrial system. MPI INT 9.2L.
 - a. Application: Provide at bathrooms and at gypsum backsplashes behind sinks.
 - b. Prime Coat: Acrylic, interior.
 - c. Intermediate Coat: Match topcoat.
 - d. Topcoat: Waterborne epoxy coating, interior.
3. Sheen:
 - a. Walls: Eggshell.
 - b. Ceilings: Flat.
 - c. At Waterborne: Satin for walls and ceilings.

C. Wood Substrates:

1. Acrylic Latex System:
 - a. Prime Coat: Primer, latex, for interior wood.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoat: Acrylic latex, interior, for interior wood.
2. Sheen: Semi-gloss.

D. Fiber Cement:

1. System: Acrylic Latex, Exterior.
 - a. Prime Coat: Acrylic, alkali resistant, water based.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoats: Acrylic latex, exterior.
2. Sheen: As scheduled.

E. Wood: Door frames and other exposed woodwork.

1. Acrylic Latex Enamel over Latex Primer:
 - a. Prime Coat: Primer, latex for exterior wood. Provide where not shop-primed.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoat: Acrylic latex enamel, exterior.
2. Sheen: Semi-gloss.

2.2 PAINT MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards, including gloss levels, and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying the manufacturer's product identification will not be acceptable.
- D. Chemical Components for Paints, General: Provide products containing no material listed on International Living Future Institute's "The Red List."
- E. Chemical Components of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions.
 1. The following chemicals shall not be used as an ingredient in any of the paints or coatings applied indoors and on-site:
 - a. Aromatic Compounds: The product must contain no more than 1.0% by weight of the sum total of aromatic compounds.
 - b. Halomethanes: Methylene Chloride.

- c. Chlorinated Ethanes: 1,1,1-trichloroethane.
 - d. Aromatic Solvents: Benzene, Toluene (methylbenzene), Ethylbenzene.
 - e. Chlorinated Ethylenes: Vinyl Chloride.
 - f. Polynuclear Aromatics: Naphthalene.
 - g. Chlorobenzenes: 1,2-dichlorobenzene.
 - h. Phthalate Esters: di (2-ethylhexyl) phthalate, butyl benzyl phthalate, di-n-butyl phthalate, di-n-octyl phthalate, diethyl phthalate, dimethyl phthalate.
 - i. Miscellaneous Semi-Volatile Organics: Isophorone. Metals and their compounds: Antimony, Cadmium, Hexavalent Chromium, Lead, Mercury.
 - j. Preservatives (Anti-Fouling Agents): Formaldehyde.
 - k. Ketones: Methyl ethyl ketone, Methyl isobutyl Ketone.
 - l. Miscellaneous Volatile Organics: Acrolein, Acrylonitrile.
2. Volatile Organic Compounds: The volatile organic compound (VOC) concentrations (in grams per liter) of the paint or coating shall not exceed those listed below if the paint or coating is applied indoors, on-site. VOCs shall be tested in accordance with the U.S. Environmental Protection Agency (EPA) Test Method 24. The calculation of VOC shall exclude water, exempt solvents, and tinting color added at the point of sale.
- a. Flat Interior Coatings: 50 g/L.
 - b. Non-Flat Interior Coatings: 150 g/L.
 - c. Gloss Anti-Corrosive Interior Coatings: 250 g/L.
 - d. Semi-Gloss Anti-Corrosive Interior Coatings: 250 g/L.
 - e. Flat Anti-Corrosive Interior Coatings: 250 g/L.
 - f. Floor Coatings: 250 g/L.
 - g. Flow Coatings: 420 g/L.
 - h. Pre-Treatment Wash Primers Coatings: 420 g/L.
 - i. Sanding Sealers (Non-Lacquer): 350 g/L.
 - j. Specialty Primers, Sealers, and Undercoats: 350 g/L.
- F. Transition Coat: Paint manufacturer's recommended coating for use where a residual existing coating is incompatible with the paint system.

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. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
 - 4. Cement Plaster: 12 percent.

- C. Exterior Substrates:
 - 1. Portland Cement Plaster: Verify that plaster is fully cured.
 - 2. Exterior Gypsum Board: Verify that finishing compound is sanded smooth.
- D. Interior Substrates:
 - 1. Gypsum Board: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer. Conduct alkali testing with litmus paper on exposed plaster, cementitious, and masonry surfaces.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATORY CLEANING

- A. General: Use the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.
- B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.

3.3 SUBSTRATE REPAIR

- A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.
- B. Gypsum-Plaster and Gypsum-Board Substrates:
 - 1. Repair defects including dents and chips more than 1/16 inch in size and where directed by the Contracting Officer, and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners.
 - 2. Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.
 - a. Finish patch to match adjacent surfaces with no visible transition. Telegraphing patching through finish coats is not acceptable.

3.4 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated, and with procedures specified in PDCA P4 for inspection and acceptance of surfaces to be painted.
- 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 where present.
- C. Clean substrates of substances that could impair the bond of paints, 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 paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - 1. Roughen as required to remove glaze where occurs.
 - 2. Use mechanical methods or surface preparation where hardeners or sealers have been used to improve curing.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 3.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrate, Shop-Primed:
 - 1. Remove stains and other materials that would impede installation of coats over primer specified.
 - 2. Reprime damaged primer.

3.5 REPAINTING, GENERAL

- A. Comply with manufacturers' written instructions for application methods unless otherwise indicated in this Section.

- B. Prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition.
- C. Apply a transition coat over incompatible existing coatings.
- D. Blending Painted Surfaces: When painting new substrates patched into existing surfaces or touching up missing or damaged finishes, apply coating system specified for the specific substrate. Apply the final finish coat over entire surface from edge to edge and corner to corner.
- E. Maintenance Repainting Appearance Standard: Completed work is to have a uniform appearance as viewed by the Contracting Officer from building interior at 5 feet away from painted surface.
- F. Execution of the Work: In repainting surfaces, disturb them as minimally as possible and as follows:
 - 1. Remove failed coatings and corrosion and repaint.
 - 2. Verify that substrate surface conditions are suitable for repainting.
 - 3. Allow other trades to repair items in place before repainting.
- G. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail.
- H. Heat Processes: Do not use torches, heat guns, or heat plates.

3.6 APPLICATION

- A. Material Preparation:
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
- B. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint both sides and edges of doors and entire exposed surface of door frames.
 - 4. Paint the entire exposed surface of window frames and sashes, where scheduled for painting.
 - 5. Paint the front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 6. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 7. Primers specified in painting schedules may be omitted on items that are factory primed or

factory finished if acceptable to topcoat manufacturers.

- C. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- E. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- F. Sand lightly between each succeeding enamel or varnish coats.
- G. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, the Contracting Officer will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- H. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork.
 - b. Acoustical wall panels.
 - c. Finished mechanical and electrical equipment.
 - d. Light fixtures.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Utility tunnels.
 - e. Pipe spaces.
 - f. Duct shafts.
 - 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

3.7 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the project site.
- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by the Contracting Officer.
- C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 1. After the work of other trades is complete, touch up and restore damaged or defaced painted surfaces.
 2. Interior: Comply with procedures specified in PDCA P1.

3.8 COLOR SCHEDULE

- A. All colors shall be reviewed and approved by The Contracting Officer prior to installation.

3.9 WASTE MANAGEMENT

- A. Separate clean waste products from contaminants for recycling in accordance with the Waste Management Plan and place in designated areas for recycling.
- B. Place materials defined as hazardous or toxic waste in designated containers.
- C. Return solvent and oil soaked rags for containment recovery and laundering or for proper disposal.
- D. Do not use kerosene or any such organic solvents to thin or clean up water based paints.
- E. Do not dispose of paints or solvents by pouring on the ground. Place in designated containers for proper disposal.
- F. Where paint recycling is available, collect all waste paint by type and provide for delivery to recycling or collection facility.

- G. Close and seal tightly all partly used sealant containers and store protected in well-ventilated, fire-safe area at moderate temperatures.
- H. Place used sealant tubes and containers in areas designated area for hazardous materials.

END OF SECTION 09 91 00

DIVISION 10 – SPECIALTIES

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes dimensional characters for exterior building signage.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.2 DIMENSIONAL CHARACTERS

A. Dimensional Characters:

1. Fabrication Type:

- a. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles:
- b. Cutout Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows:

- B. Character Height: As indicated on Drawings
- C. Mounting: As indicated on Drawings

D. Thickness: Manufacturer's standard for size of character

2.4 DIMENSIONAL CHARACTER MATERIALS

- i. Aluminum Casting: ASTM B26, alloy recommended by manufacturer and finisher for finish indicated.
- ii. Aluminum Sheet: ASTM B209, alloy recommended by manufacturer and finisher for finish indicated.
- iii. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-level standard of flatness.
- iv. Stainless-Steel Casting: ASTM A743, Grade CF8 or CF 20.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
3. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
 5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
 6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish [to match sign-background color] [to match Project Reference sample] <Insert requirement> color unless otherwise indicated.
 2. Stainless-Steel Brackets: Factory finish brackets

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of signage.

2.8 ALUMINUM FINISHES

- A. Anodic Finish: AAMA 611.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- C. High-Performance Organic Two-Coat Fluoropolymer Finish: AAMA 2605 and containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.9 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
- C. Stainless Steel Sheet and Plate Finishes:
 - 1. Directional Satin Finish: ASTM A480/A480M, No. 4.
 - 2. Dull Satin Finish: ASTM A480/A480M, No. 6.
 - 3. Satin, Reflective, Directional Polish: ASTM A480/A480M, No. 7.
 - 4. Mirrorlike Reflective, Nondirectional Polish: ASTM A480/A480M, No. 8.
 - a. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - b. Sputter-Coated Finish: Titanium nitride coating deposited by magnetic sputter-coating process over indicated mechanical finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

- a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
6. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 10 14 19

SECTION 10 14 53 – TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work consists of constructing permanent traffic control signs, supports, delineators, and object markers, and removing and resetting permanent traffic control devices.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Aluminum Panels. Conform to ASTM B 209, alloy 6061-T6 or 5052-H38.

Fabricate all temporary panels and those permanent panels that are 30 by 30 inches or smaller from 0.080-inch thick aluminum sheets. Fabricate larger permanent panels from 0.125-inch thick aluminum sheets.

The blanks shall be free from laminations, blisters, open seams, pits, holes, or other defects that may affect their appearance or use. The thickness shall be uniform and the blank commercially flat. Perform shearing, cutting, and punching before preparing the blanks for application of reflective material.

Clean, degrease, and chromate the blanks or otherwise properly prepare the panels according to methods recommended by the sheeting manufacturer.

- B. Plastic Panels.

- 1. Plastic. Furnish light, flexible, high-impact, and ultraviolet chemical resistant polycarbonate material that will accept adhesives, coatings, and retroreflective sheeting material as recommended for such material.

Fabricate panels that are 24 by 24 inches or smaller from 0.08-inch thick plastic blanks. Fabricate larger panels from 0.125-inch thick plastic blanks.

The panels shall be flat and free of buckles, warps, and other defects. Where multiple panels adjoin, the gap between adjacent panels shall not be greater than 5/8 inches. Signs larger than 24 by 24 inches shall have reinforcement stiffeners attached on the back for rigidity and for mounting on the supports.

- C. Extruded Aluminum Panels. Furnish panels conforming to ASTM B 221, aluminum alloy 6063-T6. For panel thickness and fabrication, conform to Section 2.1 A. The maximum allowable deviation from flat on the face is 0.05 inches per foot.
- D. Signposts. Furnish wood, steel, or aluminum signposts as specified.

1. Wood posts. Furnish posts from dry no. 1 grade Douglas fir, southern or Ponderosa pine, hemlock, spruce, or western larch conforming to AASHTO M 168. Treat the posts with water-borne preservative ACA, ACZA, or according to AWP Standard C14 except the minimum preservative retention is 0.40 pounds per cubic foot.
 2. Galvanized steel posts. Furnish posts that are straight, smooth, and free from defects affecting strength, durability, or appearance. Conform to the following:
 - a) U-channel steel posts. Furnish flanged, channel, galvanized steel posts conforming to ASTM A 499, grade 60, and dimensions of U cross-section

(1) Width of opened end of U including flanges	3.0 – 3.5 inches
(2) Width of closed end of U	1.0 – 1.6 inches
(3) Depth of U	1.0 – 2.0 inches
(4) Thickness of steel	0.12 – 0.20 inches
 - b) Punching. Starting 1 inch from the top and extending the full length of the post, drill or punch 3/8-inch holes on 1-inch centers along the centerline of the bottom of the U. Remove all burrs and sharp edges.
 - c) Galvanizing after punching AASHTO M 111
 3. Square tubular steel posts. Furnish square tubular galvanized steel posts conforming to ASTM A 1011, grade 55, or ASTM A 715, grade 60, and the following:
 - a) Dimensions

(1) Outside dimensions	1¾ by 1¾ inches or 2 by 2 inches
(2) Wall thickness	0.083 inches
(3) Mass	1.7 – 2.0 pounds per foot
 - b) Punching. Starting 1 inch from the top and extending the full length of the post, drill or punch 7/16-inch holes on 1-inch centers along the centerline of all four sides, in true alignment and opposite each other directly and diagonally. Remove all burrs and sharp edges.
 - c) Galvanizing after punching ASTM A 635, coating
Z275 designation
(inside and outside of post)
 4. Aluminum posts. Furnish approved standard shapes and thicknesses conforming to ASTM B 221, alloy 6061-T6, 6351-T5, 6063-T6, or 6005-T5.
 5. Corrosion resistant steel posts. Furnish posts conforming to ASTM A 588 or ASTM A 242.
- E. Object Marker and Delineator Posts. Furnish wood, steel, or aluminum object marker and delineator posts. Delineator posts may also be fabricated from plastic.
1. Wood posts. Furnish 4- by 4-inch wooden posts conforming to Subsection 2.1.F.
 2. Steel posts. Furnish flanged U-channel steel posts weighing not less than 2 pounds per foot and conforming to ASTM A 36. Galvanize the posts according to AASHTO M 111.
 3. Aluminum posts. Furnish standard shaped 1/8-inch thick aluminum posts conforming to ASTM B 221, alloy 356.0-T6.
 4. Plastic posts. Furnish flexible delineator posts made with high impact resistant polymer material.

- F. Hardware. For lag screws, washers, clip angles, wood screws, shear plates, U-bolts, clamps, bolts, nuts, and other fasteners, use galvanized steel or aluminum alloy.

For high-strength steel bolts, nuts, and washers, conform to AASHTO M 164 or M 253.
Galvanize steel hardware according to AASHTO M 232.

For aluminum alloy bolts, nuts, and washers, conform to *Specifications for Aluminum Structures*.

Furnish oversize bolt heads and oversize neoprene or nylon washers for plastic sign panels.

- G. Letters, Numerals, Arrows, Symbols, and Borders. Colors will be specified in the contract and shall conform to Subsection 2.1.H.

Form letters, numerals, and other units to provide a continuous stroke width with smooth edges. Make the surface flat and free of warp, blisters, wrinkles, burrs, and splinters. Conform to one of the following:

1. Type L-1 (screen process). Apply letters, numerals, arrows, symbols, and borders on the retroreflective sheeting or opaque background of the sign by direct or reverse screen process. Apply messages and borders of a color darker than the background to the paint or the retroreflective sheeting by direct process. Produce messages and borders of a color lighter than sign background by the reverse screen process.

Use opaque or transparent colors, inks, and paints in the screen process of the type and quality recommended by the retroreflective sheeting manufacturer.

Perform the screening in a manner that results in a uniform color and tone, with sharply-defined edges of legends and borders, and without blemishes on the sign background that will affect intended use.

Air dry or bake the signs after screening according to manufacturer's recommendations to provide a smooth hard finish. Any signs with blisters or other blemishes will be rejected.

2. Type L-3 (direct applied characters). Cut letters, numerals, symbols, borders, and other features of the sign message from the type and color of the retroreflective sheeting specified, and apply to the sign background's retroreflective sheeting according to the retroreflective sheeting manufacturer's instructions. For the retroreflective sheeting minimum coefficient of retroreflection (RA), conform to AASHTO M 268.

- H. Delineator and Object Marker Retroreflectors. Furnish type 1 or type 2 retroreflectors that are ready for mounting. Furnish antitheft hardware for mounting as required.

1. Type 1 (acrylic plastic lens). Furnish a 7-square inch minimum acrylic plastic lens with prismatic optical elements and a smooth, clear, transparent face. Fabricate the back from similar material and fuse it to the lens around the entire perimeter to form a homogenous unit. Permanently seal the units against the intrusion of dust, water, or air. Conform to Table 10 14 53-1 regardless of the orientation angle.

Table 10 14 53-1
Minimum Coefficient of (Retroreflective) Luminous Intensity (R_i)⁽¹⁾
Candelas per Footcandle

Observation Angle °	Entrance Angle °	White⁽²⁾	Yellow	Red
0.1	0	115	70	30
0.1	20	45	25	12

(1) See AASHTO T 257.

(2) Crystal, clear, or colorless are acceptable color designations.

Mount the retroreflector unit in a housing fabricated from 0.063-inch aluminum alloy 3003-H-14 or similar, or from cold rolled, hot dip, galvanized steel, having a thickness of 0.064 inches. Provide antitheft attachment hardware.

2. Type 2 (retroreflective sheeting). Furnish a fungus resistant type III, V, VII, VIII, or IX retroreflective sheeting with a class 1 or 2 adhesive backing conforming to ASTM D 4956. Attach the sheeting to an aluminum or plastic support panel (target plate) of the size and dimension specified.
 - I. Sign panels are designated as plywood, aluminum, steel, plastic, or fiberglass reinforced plastic.
 - J. Sign retroreflective sheeting type conforms to ASTM D 4956 Supplemental Requirement S1, Fungus Resistance, if specified. For reboundable retroreflective sheeting, conform to ASTM D 4956 including Supplemental Requirement S2, Reboundable Sheeting Requirements.

When an adhesive is used, use ASTM D 4956, backing class 1, 2, or 3.
 - K. Posts are designated as wood, aluminum, galvanized steel, or corrosion resistant steel.

PART 3 – EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. General

3. Furnish traffic control devices according to the MUTCD and Standard Highway Signs published by FHWA. Submit the sign list for approval before ordering.

B. Supports

1. Sign locations may be changed to fit field conditions as approved by the Contracting Officer (CO). Determine sign support lengths at time of staking. Install supports plumb and according to the manufacturer's instructions. Make all supports within the clear zone crashworthy.
2. Drive posts with a suitable driving head or set posts in drilled or punched holes. Replace all damaged posts.
3. Construct concrete footings according to Specification 03 30 53. Excavate and backfill:

- a) Place backfill in horizontal layers that, when compacted, do not exceed 6 inches in depth. Compact each layer according to (b) below. Bring backfill up evenly on all sides of the structure, and extend each layer to the limits of the excavation or to natural ground. Do not place backfill against concrete less than 7-days-old or until 80 percent of the design strength is achieved.
- b) Compact material placed in all layers to at least 95 percent of the maximum density. Determine the in-place density and moisture content according to AASHTO T 310 or other approved test procedures. Do not apply density requirements as measured by AASHTO T 310 to material that is incapable of being tested or compacted to maximum values determined by AASHTO T 99. For these materials, fill the voids around the rock in each layer with earth or other fine material. Compact each layer, full width, until there is no visible evidence of further consolidation.

C. Panels

1. Use type III, VII, VIII, or IX retroreflective sheeting. For permanent sign panels, use type L-1 letters, numerals, arrows, symbols, and borders. Cut panels to size and shape and drill or punch all holes. Make panels flat and free of buckles, warp, dents, cockles, burrs, and other defects.
2. Clean and degrease the face of metal panels using methods recommended by the retroreflective sheeting manufacturer. Abrade, clean, and degrease the face of the plywood panels using methods recommended by the retroreflective sheeting manufacturer. Treat the edges of the plywood panel with an approved edge sealant. Apply the retroreflective sheeting material to the panels. Package sign panels in protective material and transport them in a vertical position.
3. Mount sign panels with the legend horizontal. Where multiple panels adjoin, limit the gap between adjacent panels to 1/16 inch. To reduce specular glare (mirror reflection), turn the sign panel 3 degrees away from the road in the direction of travel.
4. Use oversized bolt heads and neoprene or nylon washers for fastening plastic sign panels.
5. Do not field drill holes in any part of the panel. Use antitheft fasteners where possible. Paint all bolt heads, screw heads, and washers that are exposed on the sign face. Match the color of the paint to the color of the background or message area at the point where the fitting is exposed.
6. If a sign message is not applicable, completely cover the face of the sign with an opaque material. Maintain the covering in good condition until the message becomes applicable. Do not use adhesive tape on the sign face.
7. Repair or replace damaged parts including sheeting.

D. Delineators and Object Markers

1. Attach delineators and object markers to posts according to the manufacturer's recommendation.

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface preparation and field painting of exposed items and surfaces on the following substrates:
 - a. Interior Substrates:
 - 1) Gypsum board.
 - 2) Steel.
 - 3) Wood.
 - b. Exterior Substrates:
 - 1) Fiber-Cement.
 - 2) Wood.
 2. Finish and color schedules for painted surfaces.
- B. Drawing Designations: WF1, CF1 and CF2.
- C. Government shall approve all colors prior to procurement and application.
- D. Select products and materials in this Section for indoor chemical and pollutant source control and/or low-VOC emitting characteristics.

1.2 DEFINITIONS

- A. Volatile Organic Compounds (VOCs): Compounds as defined by the U.S. Environmental Protection Agency (EPA) in 40 CFR § 51.100 (s), (1).
- B. Anti-Corrosive Paints: Coatings formulated and recommended for use in preventing the corrosion of ferrous metal substrates.

1.3 SEQUENCING AND SCHEDULING

- A. Perform maintenance repainting in the following sequence, which includes work specified in this and other Sections:
1. Dismantle existing surface-mounted objects and hardware except items indicated to remain in place. Tag items with location identification and protect.

2. Verify that temporary protections have been installed.
3. Examine condition of surfaces to be painted.
4. Remove existing paint to the degree required for each substrate and surface condition of existing paint.
5. Apply paint system.
6. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product List: For each product indicated, include the following:
 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run,] that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. All materials, preparation and painting Work shall comply with the requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI).
 1. All paint manufacturers and products shall be listed under the Approved Product List section of the MPI Painting Manual.
- B. Color Matching: Custom computer-match paint colors to colors scheduled.

1.7 FIELD CONDITIONS

- A. Exterior:
 1. Apply paints, including waterborne paints, only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
 2. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
 3. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

B. Interior:

1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain paint materials for each system indicated from single source and single manufacturer.

1. All interior paint systems shall be institutional, low-odor, low-VOC.
2. Basis-of-Design Paint, Latex: SuperPaint Acrylic Latex by Sherwin Williams or approved equal for interior and exterior, with the following salient characteristics.

B. Gypsum Board Substrates:

1. Acrylic Latex System:
 - a. Prime Coat: Latex, interior.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoat: Acrylic Latex, interior.
2. Moisture Resistant System: Water-based, light industrial system. MPI INT 9.2L.
 - a. Application: Provide at bathrooms and at gypsum backsplashes behind sinks.
 - b. Prime Coat: Acrylic, interior.
 - c. Intermediate Coat: Match topcoat.
 - d. Topcoat: Waterborne epoxy coating, interior.
3. Sheen:
 - a. Walls: Eggshell.
 - b. Ceilings: Flat.
 - c. At Waterborne: Satin for walls and ceilings.

C. Wood Substrates:

1. Acrylic Latex System:
 - a. Prime Coat: Primer, latex, for interior wood.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoat: Acrylic latex, interior, for interior wood.
2. Sheen: Semi-gloss.

D. Fiber Cement:

1. System: Acrylic Latex, Exterior.
 - a. Prime Coat: Acrylic, alkali resistant, water based.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoats: Acrylic latex, exterior.
2. Sheen: As scheduled.

E. Wood: Door frames and other exposed woodwork.

1. Acrylic Latex Enamel over Latex Primer:
 - a. Prime Coat: Primer, latex for exterior wood. Provide where not shop-primed.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoat: Acrylic latex enamel, exterior.
2. Sheen: Semi-gloss.

2.2 PAINT MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards, including gloss levels, and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying the manufacturer's product identification will not be acceptable.
- D. Chemical Components for Paints, General: Provide products containing no material listed on International Living Future Institute's "The Red List."
- E. Chemical Components of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions.
 1. The following chemicals shall not be used as an ingredient in any of the paints or coatings applied indoors and on-site:
 - a. Aromatic Compounds: The product must contain no more than 1.0% by weight of the sum total of aromatic compounds.
 - b. Halomethanes: Methylene Chloride.

- c. Chlorinated Ethanes: 1,1,1-trichloroethane.
 - d. Aromatic Solvents: Benzene, Toluene (methylbenzene), Ethylbenzene.
 - e. Chlorinated Ethylenes: Vinyl Chloride.
 - f. Polynuclear Aromatics: Naphthalene.
 - g. Chlorobenzenes: 1,2-dichlorobenzene.
 - h. Phthalate Esters: di (2-ethylhexyl) phthalate, butyl benzyl phthalate, di-n-butyl phthalate, di-n-octyl phthalate, diethyl phthalate, dimethyl phthalate.
 - i. Miscellaneous Semi-Volatile Organics: Isophorone. Metals and their compounds: Antimony, Cadmium, Hexavalent Chromium, Lead, Mercury.
 - j. Preservatives (Anti-Fouling Agents): Formaldehyde.
 - k. Ketones: Methyl ethyl ketone, Methyl isobutyl Ketone.
 - l. Miscellaneous Volatile Organics: Acrolein, Acrylonitrile.
2. Volatile Organic Compounds: The volatile organic compound (VOC) concentrations (in grams per liter) of the paint or coating shall not exceed those listed below if the paint or coating is applied indoors, on-site. VOCs shall be tested in accordance with the U.S. Environmental Protection Agency (EPA) Test Method 24. The calculation of VOC shall exclude water, exempt solvents, and tinting color added at the point of sale.
- a. Flat Interior Coatings: 50 g/L.
 - b. Non-Flat Interior Coatings: 150 g/L.
 - c. Gloss Anti-Corrosive Interior Coatings: 250 g/L.
 - d. Semi-Gloss Anti-Corrosive Interior Coatings: 250 g/L.
 - e. Flat Anti-Corrosive Interior Coatings: 250 g/L.
 - f. Floor Coatings: 250 g/L.
 - g. Flow Coatings: 420 g/L.
 - h. Pre-Treatment Wash Primers Coatings: 420 g/L.
 - i. Sanding Sealers (Non-Lacquer): 350 g/L.
 - j. Specialty Primers, Sealers, and Undercoats: 350 g/L.
- F. Transition Coat: Paint manufacturer's recommended coating for use where a residual existing coating is incompatible with the paint system.

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. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
 - 4. Cement Plaster: 12 percent.

- C. Exterior Substrates:
 - 1. Portland Cement Plaster: Verify that plaster is fully cured.
 - 2. Exterior Gypsum Board: Verify that finishing compound is sanded smooth.
- D. Interior Substrates:
 - 1. Gypsum Board: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer. Conduct alkali testing with litmus paper on exposed plaster, cementitious, and masonry surfaces.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATORY CLEANING

- A. General: Use the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.
- B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.

3.3 SUBSTRATE REPAIR

- A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.
- B. Gypsum-Plaster and Gypsum-Board Substrates:
 - 1. Repair defects including dents and chips more than 1/16 inch in size and where directed by the Contracting Officer, and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners.
 - 2. Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.
 - a. Finish patch to match adjacent surfaces with no visible transition. Telegraphing patching through finish coats is not acceptable.

3.4 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated, and with procedures specified in PDCA P4 for inspection and acceptance of surfaces to be painted.
- 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 where present.
- C. Clean substrates of substances that could impair the bond of paints, 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 paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - 1. Roughen as required to remove glaze where occurs.
 - 2. Use mechanical methods or surface preparation where hardeners or sealers have been used to improve curing.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 3.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrate, Shop-Primed:
 - 1. Remove stains and other materials that would impede installation of coats over primer specified.
 - 2. Reprime damaged primer.

3.5 REPAINTING, GENERAL

- A. Comply with manufacturers' written instructions for application methods unless otherwise indicated in this Section.

- B. Prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition.
- C. Apply a transition coat over incompatible existing coatings.
- D. Blending Painted Surfaces: When painting new substrates patched into existing surfaces or touching up missing or damaged finishes, apply coating system specified for the specific substrate. Apply the final finish coat over entire surface from edge to edge and corner to corner.
- E. Maintenance Repainting Appearance Standard: Completed work is to have a uniform appearance as viewed by the Contracting Officer from building interior at 5 feet away from painted surface.
- F. Execution of the Work: In repainting surfaces, disturb them as minimally as possible and as follows:
 - 1. Remove failed coatings and corrosion and repaint.
 - 2. Verify that substrate surface conditions are suitable for repainting.
 - 3. Allow other trades to repair items in place before repainting.
- G. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail.
- H. Heat Processes: Do not use torches, heat guns, or heat plates.

3.6 APPLICATION

- A. Material Preparation:
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
- B. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint both sides and edges of doors and entire exposed surface of door frames.
 - 4. Paint the entire exposed surface of window frames and sashes, where scheduled for painting.
 - 5. Paint the front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 6. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 7. Primers specified in painting schedules may be omitted on items that are factory primed or

factory finished if acceptable to topcoat manufacturers.

- C. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- E. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- F. Sand lightly between each succeeding enamel or varnish coats.
- G. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, the Contracting Officer will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- H. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork.
 - b. Acoustical wall panels.
 - c. Finished mechanical and electrical equipment.
 - d. Light fixtures.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Utility tunnels.
 - e. Pipe spaces.
 - f. Duct shafts.
 - 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

3.7 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the project site.
- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by the Contracting Officer.
- C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 1. After the work of other trades is complete, touch up and restore damaged or defaced painted surfaces.
 2. Interior: Comply with procedures specified in PDCA P1.

3.8 COLOR SCHEDULE

- A. All colors shall be reviewed and approved by The Contracting Officer prior to installation.

3.9 WASTE MANAGEMENT

- A. Separate clean waste products from contaminants for recycling in accordance with the Waste Management Plan and place in designated areas for recycling.
- B. Place materials defined as hazardous or toxic waste in designated containers.
- C. Return solvent and oil soaked rags for containment recovery and laundering or for proper disposal.
- D. Do not use kerosene or any such organic solvents to thin or clean up water based paints.
- E. Do not dispose of paints or solvents by pouring on the ground. Place in designated containers for proper disposal.
- F. Where paint recycling is available, collect all waste paint by type and provide for delivery to recycling or collection facility.

- G. Close and seal tightly all partly used sealant containers and store protected in well-ventilated, fire-safe area at moderate temperatures.
- H. Place used sealant tubes and containers in areas designated area for hazardous materials.

END OF SECTION 09 91 00

E. Removing and Resetting Permanent Traffic Control Devices

1. Remove and store the existing signs, delineators, and object markers. Replace all devices, posts, and hardware damaged during removal, storage, and raising.

END OF SECTION 10 14 53

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grab bars
2. Towel bars
3. Toilet tissue dispensers
4. Framed mirror units

1.2 COORDINATION

- ##### A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- ##### A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- ##### A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BATHROOM ACCESSORIES

- A. Source Limitations: Obtain each type of bathroom accessory from single source from single manufacturer.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide basis of design product indicated in this section or substitute product by one of the following:
 - 1. Bradley Corporation – basis of design
 - 2. A & J Washroom Accessories, Inc.
 - 3. American Specialties, Inc.
 - 4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

Products shall have the following salient characteristics:

- C. Grab Bars
 - 1. Basis-of-Design Product: Bradley Corp, Model 832
 - 2. Configuration: Style 001
 - 3. Length: As indicated on Drawings
 - 4. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any directions and at any point
- D. Towel Bar
 - 1. Basis-of-Design Product: Bradley Corp, Model 926
 - 2. Length: As indicated on Drawings
- E. Toilet Tissue Dispenser
 - 1. Basis-of-Design Product: Bradley Corp, Model 5102
 - 2. Mounting: Recessed
- F. Mirror Unit
 - 1. Basis-of-Design Product: Bradley Corp, Model 780 Angle-Frame Mirror
 - 2. Corners: Manufacturer's standard welded and ground smooth
 - 3. Hangers: Produce rigid installation, using method indicated below

- a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: 24 inches by 36 inches

G. Shower Curtain Rod

1. Basis-of-Design Product: Bradley Corp, Model 953
2. Length: As indicated on Drawings
3. Mounting Flanges: Exposed

Products shall have the following salient characteristics:

2.2 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- E. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Contracting Officer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 28 00.

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semi-recessed method and relationships of box and trim to surrounding construction.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsens Manufacturing Company.
 - c. Potter Roemer LLC.
 - 2. Available Products: Subject to compliance with requirements, provide one of the following.
 - a. J.L. Industries: Cosmopolitan Series C8137F17.
 - b. Larsen's: Architectural Series SS 2409-6R.
 - c. Potter-Roemer: Alta Series 7062-A-4.
- B. Cabinet Construction: Nonrated.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Cabinet Trim Material: Stainless steel sheet.
- F. Door Material: Stainless steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Tempered float glass (clear).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.

2. Provide continuous hinge, of same material and finish as trim,, permitting door to open 180 degrees.

J. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Decals or pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: White.
2. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: ASTM A480/A480M No. 4 directional satin finish.
3. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:
 1. Fire-Protection Cabinets: 54 inches above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in the manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Drawing Designation: FE

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Warranty: Sample of special warranty.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
 - 1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type: UL-rated 2-A:10:B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled steel or aluminum container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by the Contracting Officer.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 10 57 23 - CLOSET AND UTILITY SHELVING

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. Wire shelving, brackets, and accessories for closets.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including installation instructions.
- B. Shop Drawings: Submit plans, elevations, and perspective drawings as necessary to properly depict the design, fabrication and installation of each product specified.
- C. Research/Evaluation Reports.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain closet and utility shelving and accessories from single source from single manufacturer for each type.
- B. Basis-of-Design Manufacturer: Organized Living, Inc, or approved equal with the following salient characteristics:
- C. Fire Performance: Surface-Burning Characteristics: Comply with ASTM E 84.

- A. General: Provide complete coated wire shelving system as detailed on Drawings consisting of modular components that can be field assembled using simple hand tools.
 - a. Open Slide Hanging Shelf; 16-in depth with end caps
 - b. Sidewall Brackets with Tri-Loc II anchors.
 - c. 12-in Support Braces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and substrate with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install shelving system according to manufacturer's written instructions. All Work requiring wall attachment shall be securely anchored to framing or blocking as required. No work requiring attachment to walls shall be installed where no blocking is provided.
- B. Bracket Spacing: Shelving shall be supported on brackets or standards no more than 8 inches from each end and no more than 30 inches apart throughout the length of the shelf.
- C. Anchors: Shelving brackets shall be securely anchored to the framing and blocking. Shelving shall not be installed where no blocking is provided.
- E. Install shelving level and plumb to a tolerance of 1/8 inch in 6 feet.

END OF SECTION 10 57 23

**DIVISION 11 – COMMERCIAL
EQUIPMENT**

SECTION 11 30 13 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

Items in this section to be National Park Service furnished contractor installed.

- A. Section Includes:
1. Cooking appliances.
 - a. Ranges.
 - b. Microwave ovens.
 2. Kitchen exhaust ventilation.
 - a. Hood.
 3. Refrigeration appliances.
 - a. Refrigerator/Freezer unit.
 4. Cleaning appliances.
 - a. Dishwashers.
 - b. Clothes washer-dryer combination units.
- B. Coordinate installation requirements and operational clearances with casework and counter-tops as applicable.
- C. Related Requirements:
1. Section 12 32 13 "Manufactured Wood-Veneer-Faced Casework" for cabinets.
 2. Section 12 36 23 "Plastic-Laminate-Clad Countertops."
 3. Divisions 22 "Plumbing," 23 "HVAC and 26 "Electrical" for utility connections.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Product Schedule: For appliances. Use same designations indicated on Drawings.
- C. Qualification Data: For manufacturer.

- D. Product Certificates: For each type of appliance.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturers' special warranties.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.4 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.3 RANGES

- A. Electric Range Slide-in range with one oven and complying with AHAM ER-1.
 - 1. Width: 30 inches
 - 2. Electric Burner Elements: 4
 - 3. Coil Type: Manufacturer's standard
 - 4. Oven Features:
 - a. Capacity: 3.3 cu. ft
 - b. Broiler: Located in top of oven
 - c. Oven Door(s): Counterbalanced, removable, with observation window

- d. Electric Power Rating:
 - i. Oven(s): Manufacturer's standard
 - ii. Broiler: Manufacturer's standard
- 5. Anti-Tip Device: Manufacturer's standard.
- 6. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A
- 7.
- 8. Color/Finish: from manufacturers full range

2.4 KITCHEN EXHAUST VENTILATION

A. Overhead Exhaust Hood:

- 1. Basis-of-Design Product: Model PVX7360SJ/FJ by GE or approved equal with the following salient characteristics:
- 2. Type: Soffit- or cabinet under-mounted, exhaust-hood system.
- 3. Dimensions:
 - a. Width: 30 inches, nominal.
 - b. Depth: 20 inches.
- 4. Exhaust Fan: Four-speed fan built into hood and with manufacturer's standard 390-cfm capacity.
 - a. Venting: As indicated.
 - b. Fan Control: As indicated
- 5. Duct Type: Manufacturer's standard.
- 6. Finish: Stainless steel.
- 7. Features:
 - a. Permanent, washable metal mesh filter(s).
 - b. Built-in halogen lighting.
 - c. Warming lamp socket(s).

2.5 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer

- 1. Type: Freestanding.
- 2. Dimensions: As indicated
- 3. Storage Capacity:
 - a. Refrigeration Compartment Volume: 15.6 cu. ft.
 - b. Freezer Volume: 5.13 cu. ft.
 - c. Shelf Area: Three

4. Refrigerator Features:
 - a. Interior light in refrigeration compartment.
 - b. Door Storage: Modular compartments
 - c. Temperature-controlled meat/deli bin.
5. Freezer Features: One freezer compartment
 - a. Interior light in freezer compartment.
6. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
7. Appliance Color/Finish: From Manufacturer's full range

2.6 DISHWASHERS

- A. Dishwasher, Stainless Steel Finish: Complying with AHAM DW-1.
 1. Basis-of-Design Product: Model GLDT690J by GE, with hidden controls or approved equal with the following salient characteristics:
 2. Type: Built-in undercounter.
 3. Dimensions:
 - a. Width: 24 inches.
 - b. Depth: 24 inches.
 - c. Height: 32-11/32 inches.
 4. Sound Level: Maximum 57 dB.
 5. Tub and Door Liner: Manufacturer's standard with sealed detergent and automatic rinsing-aid dispensers.
 6. Rack System: Nylon or PVC-coated sliding dish racks, with removable cutlery basket and utility shelves.
 7. Controls: Touch-pad controls with seven wash cycles and hot-air and heat-off drying cycle options.
 8. Features:
 - a. Waste food disposer.
 - b. Self-cleaning food-filter system.
 - c. Hot-water booster heater for minimum 140 deg F wash water with incoming water at 100 deg F.
 - d. Lock-out feature.
 - e. Half-load option.
 - f. Delay-wash option.
 - g. Digital display panel.
 - h. Water softener.
 - i. Soil-sensing water use control system.

9. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
10. Front Panel: Manufacturer's standard.
11. Appliance Color/Finish: Stainless steel.

2.7. CLOTHES WASHER & DRYER

A. Clothes Washer & Dryer Complying with AHAM HLW-1.

1. Type: Freestanding washer/dryer units with dual-drum design and electric dryer; washer is front loading.
2. Dimensions:
 - a. Width: As indicated on Drawings
 - b. Depth: As indicated on Drawings
 - c. Height: As indicated on Drawings
3. Washer and Dryer Drums: Manufacturer's standard
4. Motor: Manufacturer's standard with built-in overload protector..
5. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.

2.8 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for systems to verify actual locations of piping, venting and electrical connections before appliance installation.
- C. Examine walls, ceilings, and roofs for suitable conditions where exhaust hoods will be installed.

- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
- B. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After installation, start units to confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
 - a. An appliance will be considered defective if it does not pass tests and inspections.
 - b. Prepare test and inspection reports.
 - c. Replace defective units.

END OF SECTION 11 30 13

DIVISION 12 – FURNISHINGS

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

- A. **The items in this section are to be National Park Service furnished and contractor installed.**
- B. Section Includes:
 - 1. Horizontal louver blinds with aluminum slats.
- C. Drawing Designations: FX1 and FX2.
- D. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wood blocking for mounting horizontal louver blinds and accessories.

1.2 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
- B. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Contracting Officer of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

- A. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.
 - 1. Width: 1 inch.
 - 2. Thickness: Not less than 0.008 inch.
 - 3. Spacing: Manufacturer's standard.
 - 4. Finish: Reflective finish on outside-facing surface of slat to enhance reflection of solar energy and as selected by Contracting Officer.
 - 5. Features:
 - 6. Lift-Cord Rout Holes: Minimum size required for lift cord and located near back (outside) edge of slat to maximize slat overlap and minimize light gaps between slats.
- B. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose operating mechanisms on three sides.
 - 1. Capacity: One blind(s) per headrail unless otherwise indicated.
 - 2. Ends: Capped or plugged.
 - 3. Manual Lift Mechanism:
 - a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within blind full operating range.
 - b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.
 - 4. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
 - a. Tilt: Full.
 - b. Operator: Corrosion-resistant steel rod.

- C. Bottom Rail: Formed-steel or extruded-aluminum tube that secures and protects ends of ladders and lift cords and has plastic- or metal-capped ends.
 - 1. Type: Manufacturer's standard.
- D. Lift Cords: Manufacturer's standard braided cord.
- E. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.
 - 1. Type: Braided cord.
- F. Valance: Match slat material in configuration selected or indicated.
- G. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
 - 1. Type: As indicated.
 - 2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
- H. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.
- I. Colors, Textures, Patterns, and Gloss:
 - 1. Slats: As selected by Contracting Officer from manufacturer's full range [As scheduled].
 - 2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.

2.3 HORIZONTAL LOUVER BLIND FABRICATION

- A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - a. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch.
 - b. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - a. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

- D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- F. Color-Coated Finish:
 - a. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds.
 - 2. Install mounting and intermediate brackets to prevent deflection of headrails.
 - 3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

- A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Contracting Officer before time of Substantial Completion.

END OF SECTION 12 21 13

SECTION 12 32 13 - MANUFACTURED WOOD-VENEER-FACED CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-veneer-faced casework.
2. Casework hardware and accessories.

B. Government shall approve all colors prior to procurement and application.

C. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood blocking for anchoring casework.
2. Section 09 65 13 "Resilient Base and Accessories" for resilient base applied to wood- veneer-faced casework.
3. Section 12 36 23 "Plastic-Laminate-Clad Countertops."

1.2 DEFINITIONS

- A. Definitions in the AWI/AWMAC/WI's "Architectural Woodwork Standards" apply to the Work of this Section.

1.3 PREINSTALLATION MEETINGS

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

1.4 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.5 ACTION SUBMITTALS

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

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

- 3 Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
- 4 Chain-of-Custody Qualification Data: For manufacturer and vendor.
- 5 Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

B. Shop Drawings: For wood-veneer-faced casework.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
2. Indicate types and sizes of casework.
3. Indicate manufacturer's catalog numbers for casework.
4. Show fabrication details, including types and locations of hardware.
5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.
6. Apply AWI/WI certification program label to Shop Drawings.

C. Qualification Data: For casework manufacturer and Installer.

D. Sample Warranty: For special warranty.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI's Quality Certification Program or WI's Certified Compliance Program certificates.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program or WI's Certified Compliance Program.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer and licensed participate in AWI's Quality Certification Program or licensed participate in WI's Certified Compliance Program.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during remainder of construction period. Maintain temperature and relative humidity during remainder of construction period in range recommended for Project location by the AWI/AWMAC/WI's "Architectural Woodwork Standards."
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
- C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.
- D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of components or other failures of glue bond.
 - b. Warping of components.
 - c. Failure of operating hardware.
 - d. Deterioration of finishes.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain from single source from single manufacturer.

2.2 WOOD-VENEER-FACED CABINETS

- A. Basis-of-Design: Provide cabinets matching the following design reference product, complying with requirements specified.

1. Cabinet Product: Square Recessed Panel - Solid Square Ginger, No. DRHM6 by Trumbull, available from Kraftmaid or approved equal with the following salient characteristics:
 2. Drawer Style: Flat, flush.
 3. Cabinet Door: Stile and rail with recessed flush center panel. 3-inch width stile and rail, with square edges.
 - a. Stiles continuous from top to bottom.
 4. Finish, Stain: From manufacturer's full range
 5. Pulls: Aluminum, satin.
 - a. Bar Type: Model 3035, 6-5/16-inch center.
 - b. Tab Type: 3042; 2-1/16-inches wide. Mortise drawer or door face for flush installation.
- B. Design: Frameless cabinet construction with the following door and drawer-front style:
1. Flush overlay.
- C. Wood Species: White maple.
1. Wood Stain Colors and Finishes: As indicated by manufacturer's designations.
- D. Face Veneer Cut: Plain sliced or product standard.
- E. Veneer Matching:
1. None required; select and arrange veneers for compatible grain and color.
- F. Grain Direction:
1. Doors: Vertical, for stiles and recessed panel. Horizontal for rails.
 2. Drawer Fronts: Horizontal.
 3. Face Frame Members: Lengthwise.
 4. End Panels: Vertical.
 5. Bottoms and Tops of Units: Side to side.
 6. Knee Space Panels: Vertical.
 7. Aprons: Horizontal.
- G. Exposed Materials:
1. Solid Wood: Clear hardwood lumber of species indicated and selected for grain and color compatible with exposed plywood.
 - a. Application: Door fronts, drawers and exposed frames.
 2. Plywood: Hardwood plywood with face veneer of species indicated, selected for compatible color and grain. Provide backs of same species as faces.
 - a. Application: For shelving; cabinet bottoms and dividers.

3. Edgbanding: Solid wood, minimum 1/8 inch thick and of same species as face veneer.

H. Semiexposed Materials:

1. Wood: Provide solid wood or hardwood plywood for semiexposed surfaces unless otherwise indicated.
 - a. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of same species as exposed wood.
 - b. Plywood: Hardwood plywood of same species as exposed wood. Provide backs of same species as faces.

I. Concealed Materials:

1. Solid Wood: With no defects affecting strength or utility.
2. Plywood: Hardwood plywood. Provide backs of same species as faces.
3. Hardboard.

J. Regional Materials: Products shall be manufactured within 500 miles of Project site.

- 1 Certified Wood: Wood and wood products shall be certified as "FSC Pure" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- 2 Low-Emitting Materials: Adhesives and composite wood product shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

K. Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Grade: Premium.
2. Provide labels and certificates from AWI or WI certification program indicating that casework complies with requirements of grades specified.

L. Certified Wood: Wood products shall be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004.

M. Product Designations: Drawings indicate sizes and configurations, with specifications referencing products and finish materials of manufactured wood-veneer-faced casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered.

2.3 CASEWORK HARDWARE AND ACCESSORIES

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, residential-quality hardware.
 - 1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, Type B01602, self-closing. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.
 - 1. Degrees of Opening: 100 degrees. 135 degrees where required for special access, as determined by the Contracting Officer in shop drawing submittals.
- C. Pulls: Type selected or indicated. Solid aluminum or stainless steel pulls, concealed fastened with minimum two screws.
- D. Door Catches: Magnetic; ANSI/BHMA A156.9, B03141; zinc-plated, or dual, self-aligning, permanent magnet catch. Provide two catches on doors more than 48 inches high.
- E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
 - 1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
 - 2. Drawers: Provide one bumper on back side of drawer front at each corner.
- N. Drawer Slides: ANSI/BHMA A156.9. Grade 1HD-100 and 1HD-200, full-extension type; zinc-plated-steel ball bearing slides. Grade 1 and 2 with polymer rollers not permitted.
 - 1. Duty Side mounted and extending under the bottom edge of drawer.
 - 2. Provide Grade 1HD-100 for all drawers except as follows, provide 1HD-200:
 - a. For drawers more than 6 inches high or more than 24 inches wide.
 - b. For trash bins.
- O. Adjustable Shelf Supports: Mortise-type, powder-coated steel standards and shelf rests complying with ANSI/BHMA A156.9, Type B04071 and Type B04091.
- P. Finish to match cabinet body.

2.4 MATERIALS

- A. Composite Wood Products: Products shall be made without urea formaldehyde.
- B. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

- D. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.
- E. Softwood Plywood: DOC PS 1.
- F. Particleboard: ANSI A208.1, Grade M-2.
- G. Hardboard: ANSI A135.4, Class 1 tempered.
- H. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.5 FABRICATION

- i. Wood-Veneer-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:
 1. Bottoms of Cabinets and Tops of Wall Cabinets: 3/4-inch-thick, veneer-core hardwood plywood.
 2. Ends of Cabinets: 3/4-inch-thick, hardwood plywood.
 3. Shelves: 3/4-inch-thick, veneer-core hardwood plywood.
 4. Base Cabinet Top Frames: 3/4-by-2-inch solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
 5. Base Cabinet Stretchers: 3/4-by-4-1/2-inch plywood, particleboard, or MDF strips or solid-wood boards at front and back of cabinet, glued and pinned or screwed.
 6. Base Cabinet Subtops: 3/4-inch-thick panel product, glued and pinned or screwed.
 7. Backs of Cabinets: 3/4-inch-thick, particleboard-core hardwood plywood where exposed, 1/2-inch-thick hardwood plywood, dadoed into sides, bottoms, and tops where not exposed.
 8. Drawer Fronts: 3/4-inch-thick, solid hardwood.
 9. Drawer Sides and Backs: 1/2-inch-thick, solid-wood or hardwood plywood, with glued dovetail or multiple-dowel joints.
 10. Drawer Bottoms: 1/4-inch-thick, veneer-core hardwood plywood, glued and dadoed into front, back, and sides of drawers. Use 1/2-inch-thick material for drawers more than 24 inches wide.
 11. Doors 48 Inches or Less in Height: 3/4 inch thick hardwood plywood.
 - a. Provide solid-hardwood stiles and rails.
 12. Doors More Than 48 Inches in Height: 1-1/8 inches thick, with particleboard cores and hardwood face veneers and crossbands.
- B. Filler Strips: Provide as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework.

2.6 FINISH

- A. Preparation: Sand lumber and plywood before assembling. Sand edges of doors and drawer fronts and molded shapes with profile-edge sander. Sand casework after assembling for uniform smoothness at least equal to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.

- B. Staining: Remove fibers and dust and apply wash-coat sealer and stain to exposed and semiexposed surfaces as required to provide uniform color and to match approved Samples.
- C. Finishing Closed-Grain Woods: Apply manufacturer's standard two-coat, baked, clear finish consisting of a thermosetting catalyzed sealer and a thermosetting catalyzed conversion varnish. Sand and wipe clean between applications of sealer and topcoat. Topcoat may be omitted on concealed surfaces.

PART 3 - EXECUTION

3.2 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Grade: Install casework to comply with same quality standard grade as item to be installed.
- B. Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten cabinets to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
- E. Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."
- F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- G. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program or WI's Certified Compliance Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

- 1. Inspection entity shall prepare and submit report of inspection.

3.5 CLEANING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Contracting Officer.

END OF SECTION 12 32 13

SECTION 12 36 23 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes plastic-laminate-clad countertops.
 - 1. Plastic-Laminate-Clad Countertops.
- B. Related Requirements:
 - 1. Section 12 32 13 “Manufactured Wood-Veneer-Faced Casework” for cabinets supporting countertops.
 - 2. Division 22 “Plumbing” for sinks, lavatories and associated plumbing fixtures installed in countertops.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: For plastic-laminate-clad countertops.
 - 1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
 - 2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
 - 3. Apply AWI Quality Certification or WI Certified Compliance Program label to Shop Drawings.
- C. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard sizes.
- D. Qualification Data: For Installer and fabricator.
- E. Product Certificates: For the following:
 - 1. Composite wood and agrifiber products.
 - 2. High-pressure decorative laminate.
 - 3. Chemical-resistant, high-pressure decorative laminate.
 - 4. Adhesives.
- F. Quality Standard Compliance Certificates: Applicable AWI Quality Certification Program or WI Certified Compliance Program.
- G. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Shop Certification: AWI's Quality Certification Program accredited participant or WI's Certified Compliance Program licensee.
- B. Installer Qualifications: AWI's Quality Certification Program accredited participant or WI's Certified Compliance Program licensee.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period and as recommended by applicable Quality Assurance program, AWS and product manufacturers.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MATERIAL REQUIREMENTS

- A. Regional Materials: Countertops shall be manufactured within 500 miles of Project site.
- B. Certified Wood: Wood and wood products shall be certified as “FSC Pure” according to FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship,” and to FSC STD-40-004, “FSC Standard for Chain of Custody Certification.”
- C. Low-Emitting Materials: Adhesives and composite wood product shall comply with the testing and product requirements of the California Department of Health Services’ “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”

2.2 PLASTIC-LAMINATE-CLAD COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" (AWS) for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
 - 1. Provide inspections of fabrication and installation together with labels and certificates from AWI or WI certification program indicating that countertops comply with requirements of grades specified.
 - 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Grade: Premium.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGF; Grade HGP where required for post-forming.
 - 1. Products: As scheduled.
 - 2. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - a. Solid colors, [gloss] [matte] finish.
 - b. Solid colors with core same color as surface, [gloss] [matte] finish.
 - c. Wood grains, [gloss] [matte] finish with grain running parallel to length of countertop.
 - d. Patterns, [gloss] [matte] finish.
- D. Edge Treatment: Same as laminate cladding on horizontal surfaces.
 - 1. Profile: Bullnose; as indicated.
- E. Core Material: Exterior-grade plywood.
- F. Core Thickness: 1-1/8 inch.
 - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

G. Backer:

1. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate extending full width of cabinet under sink and lavatories.
2. Paper Backing: Provide paper backing on underside of countertop substrate at all other locations.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent; as recommended by AWS for Project location.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
1. Softwood Plywood: DOC PS 1.

2.4 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: Contact cement, as selected by fabricator to comply with requirements and as recommended by laminate manufacturer for substrates.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets or as indicated. Ease edges to radius indicated for the following:
1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or rough-

ing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.

3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces.
- C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 36 23

**DIVISION 21 – FIRE
SUPPRESSION**

SECTION 21 13 13 - WET-PIPE FIRE-SUPPRESSION SPRINKLER SYSTEM (NFPA 13D)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes fire-suppression sprinklers, piping, and equipment for the following building systems. The intent of the system shall be accordance with NFPA 13D, with coverage areas as shown on the drawings.
 - 1. Wet-pipe, fire-suppression sprinklers, including piping, valves, specialties, and automatic sprinklers.

1.3 DEFINITIONS

Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13D for obtaining approval from authorities having jurisdiction.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design sprinklers and obtain approval from authorities having jurisdiction.
- B. Design sprinkler piping according to the following and obtain approval from authorities having jurisdiction:
 - 1. Include 20% margin of safety for available water flow and pressure.
 - 2. Include losses through water-service piping, valves, and backflow preventers.
- C. Components and Installation: Capable of producing piping systems with 175-psig minimum working-pressure rating, unless otherwise indicated.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe and fitting materials and methods of joining for sprinkler piping.
 - 2. Pipe hangers and supports.
 - 3. Piping seismic restraints.
 - 4. Valves, including specialty valves, accessories, and devices.
 - 5. Alarm devices. Include electrical data.

6. Sprinklers, escutcheons, and guards: Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13D that have been approved by authorities having jurisdiction. Include hydraulic calculations.
- C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements. Include “Contractor’s Material and Test Certificate for any Underground Piping”.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: The installer of the Fire Sprinkler Systems shall be one of the following:
 1. State or Municipal Certified/Licensed sprinkler contractor.
 2. NICET Level II
 3. As approved by the AHJ.
- B. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Base calculations on results of fire-hydrant flow test.
- C. Design Engineer Qualifications: The designer of the Fire Sprinkler Systems shall be one of the following:
 1. A Fire Protection Engineer
 2. A NICET III technician for the type of system designed.
 3. As approved by the AHJ.
- D. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL’s “Fire Protection Equipment Directory”, and FM’s “Fire Protection Approval Guide” and that comply with other requirements indicated.
- E. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:
 1. NFPA 13D, “Installation of Sprinkler Systems”.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. All materials used in the fire sprinkler system shall be listed and approved for their intended use.

2.2 PIPING

Piping and fittings shall be steel or CPVC and shall conform to the requirements of NFPA 13D.

2.3 FIRE-PROTECTION-SERVICE VALVES

- A. General: UL listed and FM approved, with minimum 175-psig (1200-kPa) non-shock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.
- B. Gate Valves, NPS 2 and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y, and rising stem.
- C. Gate Valves, NPS 2-1/2 and larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
- D. Swing Check Valves, NPS 2 and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
- E. Swing Check Valves, NPS 2-1/2 and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.

2.4 BACKFLOW PREVENTER

Provide backflow preventer in accordance with NFPA 13D and means to forward flow test the backflow preventer.

2.5 VALVE TAGS

Engraved black filled numbers and letters not less than ½ inch high for number designation, and not less than ¼ inch for service designation on 19 gage, 1-½ inches round brass disc, attached with brass “S” hook, brass chain, or nylon twist tie.

2.6 SPRINKLERS

- A. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 1767, for early suppression, fast-response applications.

- B. Sprinkler Types and Categories: Nominal 1/2-inch orifice for “Ordinary” temperature classification rating, unless otherwise indicated or required by application.
- C. Sprinkler types, features, and options include the following:
 - 1. Quick-response sprinklers.
 - 2. Semi-recessed sprinklers, including escutcheon.
 - 3. Upright sprinklers.
- D. Sprinkler Finishes: Painted and bronze.
- E. Special Coatings: Wax, lead, and corrosion-resistant paint.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Painted steel, two piece, with 1-inch (25-mm) vertical adjustment.
- G. Sprinkler Guards (where specified): Wire-cage type, including fastening device for attaching to sprinkler.

2.7 SPECIALTY SPRINKLER FITTINGS

- A. Specialty Fittings: UL listed and FM approved made of steel, ductile iron, or other materials compatible with piping.
- B. Sprinkler, Drain and Alarm Test Fittings: UL listed, cast- or ductile-iron body with threaded inlet and outlet, test valve, and orifice and sight glass.
- C. Sprinkler, Branch-Line Test Fittings: UL listed, brass body with threaded inlet and capped drain outlet and threaded outlet for sprinkler.
- D. Sprinkler, Inspector’s Test Fittings: UL listed, cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

2.8 ALARM DEVICES

- A. General: Types matching piping and equipment connections.
- B. Valve Supervisory Switches: UL 753, electrical, single-pole, double throw with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

2.9 PRESSURE GAUGES

- A. Pressure Gauges: UL 393, 3-1/2 to 4-1/2-inch diameter dial with dial range of 0 to 250 psig.

PART 3 – EXECUTION

3.1 PIPING APPLICATIONS

- A. Do not use welded joints with galvanized steel pipe.
- B. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- C. Wet-Pipe Sprinklers: Use the following:
 - 1. NPS 2 and Smaller: Schedule 40 steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - 2. NPS 2-1/2 to NPS 3-1/2: Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.
 - 3. NPS 4: Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.
 - 4. NPS 5 and NPS 6: Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.

3.2 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13D.
 - a. Shutoff Duty: Use gate valves.
 - 2. General-Duty Valves: For applications where UL listed and FM approved valves are not required by NFPA 13D.
 - a. Shutoff Duty: Use gate, ball, or butterfly valves.
 - b. Throttling Duty: Use globe, ball, or butterfly valves.

3.3 JOINT CONSTRUCTION

- A. NFPA 13D approved joint construction for the material utilized.

3.4 WATER-SUPPLY CONNECTION

- A. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water distribution piping.
- B. Install shutoff valve, check valve, pressure gauge, drain, and other accessories at connection to water service.

3.5 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Engineer before deviating from approved working plans.
- B. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- C. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- D. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- E. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13D.
- F. Install sprinkler piping with drains for complete system drainage.
- G. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.
- H. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- I. Install alarm devices in piping systems.
- J. Hangers and Supports: Comply with NFPA 13D for hanger materials. Install according to NFPA 13D for sprinkler piping.
- K. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
- L. Install pressure gauges on riser or feed main and at each sprinkler test connection. Include pressure gauges with connection not less than NPS 1/4 and with soft metal-seated globe valve, arranged for draining pipes between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.

3.6 VALVE INSTALLATION

- A. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13D, manufacturer's written instruction, and authorities having jurisdiction.
- B. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.

- C. Valves for Wall Fire Hydrants: Install gate valve with non-rising stem in supply pipe.
- D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- E. Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain-line connection.

3.7 LABELING AND IDENTIFICATION

Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13D.

3.8 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping according to NFPA 13D, "System Acceptance" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Report test results promptly and in writing to Engineer and authorities having jurisdiction.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

3.10 PROTECTION

Protect sprinklers from damage until Substantial Completion.

3.11 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that specified tests of piping are complete.
- C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.

- E. Verify that potable-water supplies have correct types of backflow preventers.
- F. Verify that hose connections and fire department connections have threads compatible with local fire department equipment.
- G. Fill wet-pipe sprinkler piping with water.
- H. Energize circuits to electrical equipment and devices.
- I. Adjust operating controls and pressure settings.
- J. Coordinate with fire alarm tests. Operate as required.

3.12 DEMONSTRATION

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. Schedule demonstration with Contracting Officer with at least seven days' advance notice.

END OF SECTION 21 13 13

DIVISION 22 – PLUMBING

SECTION 22 00 00 - PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

- A. The Contractor shall furnish all labor, materials, equipment, transportation, permits, inspections, and incidentals required to install and complete all plumbing work as shown on the drawings or specified herein or both.
- B. All work shall be subject to the terms and conditions of the contract and applicable portions of the General Conditions and Special Conditions.
- C. All work and materials shall be in strict accordance with these drawings and specifications even though they may be in excess of the applicable codes, ordinances, and regulations.
- D. Whenever the word "provide" is used, it means furnish and install complete and ready for use.

1.2 DRAWINGS

- A. The general location of the apparatus and the details of the work are shown on the accompanying drawings, which form a part of this specification. Exact locations are to be determined at the building as the work progresses and shall be subject to the Contracting Officer's acceptance.
- B. Anything shown on the drawings and not mentioned in the specifications or vice versa, shall be furnished as if it were both shown and specified.
- C. Due to the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. The Contractor will be required to investigate the structural and finish conditions affecting his work and shall arrange such work accordingly, furnishing such fittings, traps, valves, and accessories as may be required to meet such conditions.
- D. All questions as to the interpretation or extent of the drawings and specifications shall be referred to the Contracting Officer. Failure to do this shall not relieve the Contractor of responsibility to provide all materials and work in accordance with the intent of these plans and specifications at no extra charge.

1.3 RECORD DRAWINGS

- A. The contractor shall maintain at site two separate sets of black line prints of the Plumbing Drawings. As the work progresses, he shall mark neatly and accurately all changes from the original layouts and the work accomplished day by day. Colors shall be used in marking the various services.

- B. These sets of prints will be inspected and considered a guide to determining the amount of work installed. If these drawings are found inaccurate or incomplete, they shall be corrected promptly. This procedure is mandatory and the Contracting Officer will not review requisitions for payment until satisfied that this has been complied with and is up-to-date.
- C. These "As Built" drawings shall be turned over to the Contracting Officer upon completion of the project for preparation of reproducibles by the Contracting Officer.
- D. Final payment will not be made until these "As Built" drawings have been received and accepted.

1.4 GENERAL CONDITIONS

- A. All materials entering into the installation must be new and of the quality specified, otherwise to be of the best commercial quality obtainable for the purpose. All parts of the work and the erection thereof must be performed in the best and most substantial manner in accordance with the standards of the trade and all applicable codes.
- B. The Contractor shall visit the site and building during construction and shall take such measurements as necessary for him to determine that actual conditions follow these plans and specifications such that he may properly install his work without interferences or work hold-ups.
- C. The Contractor shall study all drawings and specifications to determine any conflict with other trades. Any conflicts shall be submitted to the Contracting Officer before starting work. The Architectural, Structural, Mechanical, and Electrical Drawings should be followed and this section of the work fitted thereto.
- D. Submittal of bid shall indicate that this Contractor has examined the site and drawings and has included all required allowances in his bid. No allowances shall be made for error resulting from Contractor's failure to visit job site and to review drawings.
- E. The Contractor shall be responsible for performing all operations in connection with this work and the satisfactory operation and tightness of all water, drainage, and venting systems under this contract.

1.5 CODES, PERMITS, INSPECTIONS

- A. The installation shall comply with all local laws applying to plumbing installations in effect at the site and regulations of any other Governmental body or agency having jurisdiction and with the regulations of the State of Maine Internal Plumbing Code, based on the 2021 Uniform Plumbing Code, where such regulations do not conflict with these laws.
- B. If there are any conflicts between the plans and/or specifications with the laws or local ordinances, the Contractor shall submit these conflicts to the Contracting Officer before starting any work. Any work, done prior to this submittal, that needs to be changed to conform to these laws, ordinances or codes shall be made at the Contractor's expense.
- C. The Contractor shall obtain and pay for all permits, inspections, and licenses required.

- D. After completion of the work, the Contractor shall furnish to the Contracting Officer, a certificate of final inspection and acceptance from the inspector having jurisdiction.

1.6 EXTRA WORK ORDERS - CREDITS

No extra work will be paid for unless authorized by the Contracting Officer in writing. Where extra work is required, the Contractor shall provide an itemized account of the work involved and shall take into consideration any credits due or work omitted for any reason. Estimates shall clearly list such omitted work with proper credit given for same.

1.7 COOPERATION BETWEEN TRADES

- A. The Contractor shall give full information to the General Contractor and other Contractors, sufficiently in advance of this work, so that all necessary work by the other trades may be planned and installed without any delays. The Contractor shall furnish and locate all sleeves, supports, anchors, etc., so that the General Contractor may install the same in place. The Contractor shall locate all necessary work in advance without delay to the other trades. The Contractor shall advise the General Contractor of required partition thickness and furring to conceal cast iron hubs.
- B. In case of failure to give proper information as noted above, the Contractor will be required to do his own cutting and patching, or have same done by the General Contractor, but in no case shall there be any additional expense to the National Park Service.
- C. If Contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make the necessary changes in his work to correct the conditions without extra charge.

1.8 PROTECTION

- A. Contract Materials: The Contractor shall protect all materials and fittings, furnish board enclosures for all water closets, urinals, and lavatories, and protect all enameled surfaces with pasted on paper. No fixtures shall be used prior to acceptance.
- B. Material of Other Trades: The Contractor shall see that care is exercised to prevent injury, discoloration, or defacement of all finished building surfaces. The Plumbers shall do no cutting or fitting of any material other than his own. He shall exercise proper supervision to prevent floods, plumbing torches, and portable fires in the building. Any damage resulting therefrom shall be adjusted under this section to the full satisfaction of the National Park Service at no additional cost or increase in Contract time.
- C. Pipes: All open ends of pipe shall be properly capped or plugged during the construction period to prevent entrance of foreign materials and damage. No piping shall be installed outside of a building or in an exterior wall unless adequate provision is made to protect such pipe from freezing.
- D. No structural members shall be cut without acceptance of the Contracting Officer.

1.9 TEMPORARY WATER

The General Contractor is to provide his own source of water, including storage, in preliminary stages of construction.

1.10 GUARANTEE

- A. The Contractor shall and hereby does guarantee that all work executed under this section will be free from defects of materials and workmanship for a period of one (1) year from the date of the final certificate and agrees to repair, free of expense to National Park Service, any defects that may occur within that time.
- B. The Contractor shall further warrant that all materials furnished and work executed is in accordance with all applicable laws, regulations, etc.
- C. The Contractor will not be responsible for defects which are clearly the result of bad usage of the equipment by persons not under his control.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS AND METHODS

Unless otherwise indicated, the materials to be furnished under this contract shall be standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest standard design that complies with the specification requirements.

2.2 CLEANOUT

- A. Cleanouts shall be installed for soil, waste, and roof drainage piping at base of all risers, at changes in direction, where shown on plans, and as otherwise required.
- B. Basis of design quality shall be Zurn C0-2450 Series or equal with the following salient characteristics:
 - 1. Body shall be PVC or ABS.
 - 2. ABS taper thread plug.
 - 3. Round scoriated nickel bronze adjustable cover with vandal proof screws.
 - 4. 2000 lb load rating.
 - 5. 1 Year Warranty.
- C. Provide clamping collar or membrane flange when required.

2.3 HANGERS

Hangers shall be copper clad steel band for all piping. Wrap band snug around shield and insulation and bolt together at top of insulation. Adjustable ring or clevis type may be used.

Maximum support spacing shall comply with Section 313.0, Hangers and Supports, State of Maine Plumbing Code. Provide wall brackets for hangers on piping running on sidewalls. Provide hangers sized for insulation and galvanized shields for piping up to and including 2". Over 2" see Insulation Section of this Specification. All hangers shall be primer coated and one finish coat after installation.

2.4 HANGER SHIELDS

- A. Insulation protection shields shall be 180°, carbon steel, galvanized. For pipe sizes 1/2" to 2", they shall be 18 gauge and 12" long.
- B. Hangers shall comply with Federal Specification A-A-1192A (Type 40), WW-H-171-E (Type 41), ANSI/MSS SP-69 and MSS SP-58 (Type 40)

2.5 SLEEVES

- A. Sleeves of steel pipe shall be furnished for straight runs of piping through masonry walls, masonry or stud partitions and floors. When piping is not insulated, the sleeves shall be two sizes larger than pipe size. When piping is insulated, the sleeves shall be large enough to allow approximately 1/4" space all around, between sleeves and insulation passing through sleeve. The Contractor will grout sleeve in place. Openings between sleeves and pipes shall be caulked and sealed smoke, fire, and watertight. Sleeves thru floor slabs shall extend 1" above finished floor.
- B. All interior wall sleeves (floor and wall) penetrations that accommodate piping shall be sealed with an approved three-hour rated sealant equal to 3M Fire Barrier 2001 RTV Silicone Foam. Apply as directed by manufacturer.

2.6 PLATES

Chrome-plated, one piece wall, floor and ceiling escutcheon plates shall be provided at all uncovered piping in finished rooms.

2.7 IDENTIFICATION

All new tag valves shall be Seton #M4506 or equal with the following salient characteristics: 1-1/2" square brass tags (20 gauge) and #6 beaded brass chains, stamped with the following identification: "CW", "HW", "RHW", "Air", "Gas", or "Fire". Tags shall be consecutively numbered. DO NOT DUPLICATE EXISTING VALVE IDENTIFICATION NUMBERS. Fixture stops, control valves or valves adjacent to equipment, the use of which is obvious are not to be tagged.

Identify all new domestic cold water, hot water, recirculating hot water, gas, and sprinkler piping with "Set Mark" full snap-around pipe markers by Seton Name Plate Corporation or approved equal by Brady Corp. Markers shall include both identification and direction flow. Markers shall be no less than 10 feet apart except in Boiler Room where they shall be not less than 20 feet apart. Identification shall read "Domestic Cold Water Supply", "Domestic Hot

Water Supply”, “Domestic Recirculating Water”, “Air”, “Gas”, and “Sprinkler” as applicable. Domestic hot and cold water piping shall be labeled differently from heating hot water.

Contractor shall provide Valve Tag Schedule as part of closeout documents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Branch lines from service or main lines shall be taken off the top of the main or bottom of main, using such cross-over fittings as may be required by structural or installation conditions. All service pipes fittings and valves shall be kept a sufficient distance from other work to permit not less than 1/2 inch from finished covering and such other work, and not less than 1/2 inch between finished coverings on different services.
- B. All changes in pipe size and direction of soil, waste and storm lines shall be made with Y's and cleanouts, reducing fittings, or recessed reducers. Y's and 45-degree fittings, or 45-degree combination fittings, shall be used wherever possible. Use long sweep bends at bottom of stacks.
- C. All off-sets shall be made at an angle of not more than 45 degrees. All horizontal runs of soil and waste piping shall have a pitch of 1/4 inch to the foot unless indicated.
- D. Where vertical stacks turn to run horizontally, long sweep 1/4 bends or combination Y and 1/8 bends shall be used. Sanitary T's may be used where horizontal branches connect to vertical stacks. Long sweep fittings shall be used wherever conditions permit. Short radius fittings may be installed where in conformity with the Plumbing Code. Furnish and install cleanouts at bottom of all soil and waste stacks, at every change in direction on soil and waste piping, and where indicated on the drawings.
- E. Buried pipe shall be firmly bedded on a compacted gravel bedding at the required line and grade so that the barrel of the pipe rests on its entire length on the bottom of the trench. The interior of the pipe shall be clean when it is lowered into the trench. In no case shall the spigot end in the pipes chipped to avoid the use of a bend. Backfill for all the pipes shall be placed and compacted in accordance with the best practice of the trade.
- F. All piping shall be supported from the building structure with pipe hangers. All piping over 2-1/2" size shall be supported from top chord of joists.
- G. Cleanouts shall be provided in soil and waste piping in locations such that all portions of the lines shall be readily accessible for cleaning or rodding out. The maximum horizontal distance between cleanouts in piping shall not exceed fifty (50) feet on 4 inch and larger piping, thirty-five (35) feet on 3 inch piping; cleanouts shall be of the same size as the pipe in each case with 4 inch as the maximum size. Traps not integral with fixtures and in accessible locations shall be provided with brass trap screw protected by the water seal, and will be regarded as a cleanout.
- H. Test tees with brass cleanout plugs shall be installed at the foot of all vertical soil and waste lines. Wherever cleanouts on vertical lines occur concealed behind finished walls, they shall be

extended to back of finish wall and a stainless steel or brass wall plate shall be provided flush with finished wall.

- I. When cleanouts occur on lines under floor slabs, they shall be brought up to underside of finished floor and shall have a floor cleanout with a rim at finish floor level.
- J. Exposed waste piping, traps and supplies to any fixture shall be chromium plated pipe or tubing and fittings.
- K. Any fixture or drain not having an integral trap shall have a separate trap provided adjacent to it.
- L. Cleanouts shall be provided at the base of all vent stacks.

3.3 TESTS

- A. All water piping shall be tested to a pressure of 125 lbs. per square inch for at least 30 minutes. Pressure drop in this period shall not exceed two lbs.
- B. Before each test is made on domestic water piping, the Contractor shall flush clean the system ready for test. After final test, all mixing valves, flush valves, check valves, strainers, storage tanks, circulating pumps, etc., shall be opened and all foreign material flushed or wiped clean. The Contractor shall submit a statement in writing to the Contracting Officer that all flushing has been completed and that the fixtures are free from foreign material.
- C. All drainage systems shall be tested in accordance with any laws or ordinances that apply. Each entire drainage system shall be tested with water and proved tight before any of the work is covered up.
- D. The Contracting Officer and/or Engineer shall be advised 48 hours in advance of all tests and the Contractor shall submit a statement in writing to the Contracting Officer that all tests have been completed in accordance with specification and codes, and shall include a written acceptance from the local Plumbing Inspector.
- E. Contractor shall provide report indicating hot water temperatures at all lavatories, sinks, showers, and mixing valve locations. The report shall be part of the closeout documents.

3.4 FINAL CLEANING

The Contractor, on completion of the work and building, is to clean all fixtures and his work, to the satisfaction of the Contracting Officer, and instruct the proper person in the use and control of the entire plumbing system. The Contractor shall remove all oil and debris, clean and polish all fixtures and metal to be exposed, clean out and flush all piping systems, traps, and cleanouts.

3.5 FINAL ACCEPTANCE

Before final acceptance of the work under this section, all damaged or imperfect materials shall be refinished or replaced. All debris, scaffolding, and tools shall be removed and premises shall be "broom clean" to the satisfaction of the Contracting Officer.

END OF SECTION 22 00 00

SECTION 22 07 00 PLUMBING INSULATION

PART 1 - GENERAL

1.1 SCOPE

- A. Insulate all new cold water, hot water, and recirculating hot water piping.
- B. Insulate all new roof drain piping above the slab.

1.2 GENERAL CONDITIONS

- A. Refer to General Provisions Section 22 00 00 for provisions affecting work in this section.
- B. Heating piping and ductwork insulation specified in Section 23 00 00.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

- A. Piping insulation shall be glass fiber pipe insulation with a reinforced kraft-aluminum foil jacket. Equal to Certainteed™ 500° Snap* On Pipe Insulation. Pipe insulation shall have a minimum wall thickness of not less than 1.0" for hot water pipe diameter of up to 1"; 1-1/2" for hot water pipe over 1-1/4"; and 1/2" for all cold water and condensate drain piping.
- B. Fittings and joints shall be insulated and finished with a one-piece premolded high impact PVC fitting covers with fiberglass inserts and accessories, 25/50 rated, equal to Proto LoSmoke brand.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All pipe surfaces to be covered shall be thoroughly cleaned before applying any insulation.
- B. All testing of systems shall be completed before applying insulation.

3.2 INSULATION

- A. All laps, joints and seams must be sealed for a vapor barrier, using manufacturer's recommended adhesive.
- B. All insulation shall be applied in accordance with the manufacturer's recommendations and applied in a first class manner.
- C. All fittings and valve bodies (concealed and exposed) on all piping shall be insulated to equal thickness. (Concealed shall be finished same as exposed.)

- D. Insulate with same material as piping or apply fiberglass molded or segmental insulation to fittings equal in thickness to that of the insulation to be applied to adjoining pipe and securely fasten in place, using wire.

END OF SECTION 22 07 00

SECTION 22 11 00 - WATER SYSTEM

PART 1 - GENERAL

1.1 SCOPE

The work under this section shall include all labor and material to install a domestic water system as shown on the drawings or specified herein or both.

1.2 GENERAL CONDITIONS

Refer to General Provisions Section 22 00 00 for provisions affecting work in this section.

1.3 CROSS CONNECTIONS

- A. No piping shall be installed to permit any back siphonage or flow of any polluted liquid into water distribution system.
- B. Vacuum breakers, air gaps or funnel type drains shall be used as required by local and State Plumbing Codes. All piping to faucets with hose threaded outlets and all fixtures with their outlets below the overflow shall have vacuum breakers.

1.4 WORK INCLUDED

- A. The work shall include, but shall not be limited to the following:
 - 1. Fixtures connected (whether supplied or not).
 - 2. Hot and cold water systems.
 - 3. Piping, hangers, sleeves, fittings, valves, gauges, controls, etc., required to complete the system.
 - 4. Provide electric water heaters and all controls.
 - 5. Building water mains, to 5'-0" outside walls.

1.5 WORK BY OTHERS

- A. The following work, which is incidental to the installation, will be executed by others under the direction of the Contractor:
 - 1. Execute all required masonry and carpentry work, cutting, patching, furring's, plastering, etc., except as herein noted.
 - 2. Execute all required excavation work, backfilling, grading, etc. for water.
 - 3. Finished painting of piping, supports except as herein noted.
 - 4. Access panels in ceilings and walls for access to valves.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS AND METHODS

- A. Unless otherwise indicated, the materials to be furnished under this contract shall be standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest standard design that complies with the specification requirements.
- B. All copper tubing shall be cut through and the ends shall be reamed out to the full inside diameter of the pipe.

2.2 DOMESTIC HOT AND COLD WATER SYSTEM

- A. Copper tubing shall be Type "L" for above ground, ASTM B-88.
- B. Copper tubing shall be Type "K" for underground, ASTM B-88.
- C. Types "K" and "L" copper tubing shall have joints of either wrought-copper or case brass solder joint fittings.

2.3 SOLDER

Solder for all accessible joints shall be equal to Engelhard Silver Brite 100, with the following salient characteristics, "Lead Free" made up of 95.5 percent tin, and 4 percent copper and .5% silver. Flux shall be non-corrosive. All joints shall be wiped clean of solder and flux. Piping underground or slab on grade shall have silver solder joints of at least 1000° degrees solder. All piping shall utilize soldered joints, unless otherwise noted.

2.4 VALVES

- A. All valves shall be Nibco, Apollo, Hammond, Wolverine Brass, or equal with the following salient characteristics. They shall be installed where indicated and otherwise required to provide for complete operation and drainage of the system. Ball valves shall be used for shut-offs and drains; globe valves shall be used for throttling and plug type for balancing. Solder or screw type may be used up to 2" size, screw type only for 2-1/2" size and over. All above ground valves shall be of one manufacture.
- B. Bronze Ball Valves: (Up to 3" size), chromium-plated ball, full port design, 600 psi, W.O.G. rated threaded ends. Federal Specification WWV-35B, Type II, Class A, Style 3, and MSS Sp-72.
- C. Bronze Globe Valves: Class 150, conforming to Federal Specification WW-V-51, Class B, Type I and MSS SP-80.
- D. Plug Valves: Lubricated Plug, Semi-steel construction, 175 psi. W.O.G., maximum temperature limitations are 200°F.

2.5 WATER HAMMER ELIMINATORS

Furnish and install water hammer eliminators for fixtures in accordance with PDI Standards.

2.6 EXPANSION JOINTS, LOOPS AND ANCHORS

Provide expansion joints and loops on hot water supply and circulating returns where required to control expansion. Provide rigid anchors where required. Anchors shall be bolted collars held by angular braces in direction of piping. Provide guides on each side of all expansion joints.

2.7 HOSE BIBBS (H.B.)

Provide in locations as shown on drawings Woodford B65CH Frostproof Chrome Finish Concealed Wall Hydrant or equal.

2.8 ELECTRIC HOT WATER HEATER

- A. Furnish and install 80-gallon hot water heater for the 3 Bedroom Unit. Verify location with Contracting Officer. Water heater shall be equal to Bradford White ElectriFLEX HD with 3" non-cfc insulation, T & P relief valve, 15 kw electric element, surface mounted thermostat, high limit control and overheat protection, adjustable temperature range. Five year residential (tank) warranty and 1 year parts warranty or equal.
- B. Furnish and install 119-gallon hot water heater for the 5 Bedroom Unit. Verify location with Contracting Officer. Water heater shall be equal to Bradford White ElectriFLEX HD with 3" non-cfc insulation, T & P relief valve, 15 kw electric element, surface mounted thermostat, high limit control and overheat protection, adjustable temperature range. Five year residential (tank) warranty and 1 year parts warranty or equal.

2.9 THERMAL EXPANSION TANKS

Furnish and install where shown on drawings thermal expansion tanks. Units shall be rated for 150 psig working pressure, steel shell, butyl diaphragm, and polypropylene liner. Equal to Amtrol, sizing shown on plans.

PART 3 - EXECUTION

3.1 BASIC WATER PIPING SYSTEM

- A. Furnish and install the complete domestic hot water and cold water systems essentially as indicated on the drawings connecting to all fixtures and equipment requiring these services.
- B. Piping shall be new, run parallel, and graded evenly to draining points.

- C. Provide 1/2-inch drain valves at each low point in each piping system so that all parts of each system can be drained.
- D. No plumbing fixtures, devices, or piping shall be installed which will provide a cross or inter-connection between a distributing supply for a drinking water system or domestic water system and a polluted supply or drainage system or plant water system.
- E. Changes in pipe sizes shall be made with reducing fittings.
- F. Piping shall run as high and as close as possible and parallel to the walls, or as shown.
- G. Escutcheons shall be used for all insulated pipes passing through walls and finished spaces.
- H. No water pipe shall be installed outside of the building or in an exterior wall unless adequate provision is made to protect such pipe from freezing.
- I. The Contractor under this section shall make all final water connections to all equipment requiring these services that are furnished under other sections of this specification or furnished by the Contracting Officer, all as shown on the drawings. Connections shall include shut-off valves, flow restrictors, vacuum breakers, unions, and such other trim as hereinafter specified.
- J. Exposed water piping in toilets shall be chromium plated I.P.S. copper or brass pipe or tubing and fittings. Valves on exposed water piping in toilets shall be chromium plated brass or bronze.
- K. Provide ball valve at base of all domestic water risers and stop and check valves on all supplies to thermostatic mixing and shower valves, and ball and check valves on all circulating hot water return branches to main.
- L. Provide shock absorbers, chains, anchors, guides and expansion loops or joints as indicated or otherwise required to control pipe movement and any water hammer noise.
- M. Provide all required anchors, supports, stands, etc.

3.2 DOMESTIC COLD WATER

- A. The building cold water system shall begin 8' outside the building wall.
- B. The cold water system includes furnishing cold water main with risers, drops and branches to all fixtures and equipment.
- C. Provide suitable means to protect all water piping from water hammer.

3.3 DOMESTIC HOT WATER SYSTEM

- A. The main hot water system shall include connecting hot water and cold water piping to hot water heaters as shown on plans, hot water supply mains with risers and branches to all fixtures and equipment.

- B. Hot water piping shall be kept at least 6 inches away from cold water lines.
- C. Provide suitable means for thermal expansion for all hot water piping, using swing joints, expansion loops and long offsets, as required.
- D. Vent all high points in the hot water system. All hot water piping shall be pitched up toward fixtures and risers for proper air relief. (Fixture supplies shall be considered vents.)
- E. Provide a suitable means to protect all water piping from water hammer.

END OF SECTION 22 11 00

SECTION 22 13 00 - SANITARY SYSTEM

PART 1 - GENERAL

1.1 SCOPE

The work under this section shall include all labor and material to install a sanitary soil, waste, and drainage system as shown on the drawings or specified herein or both.

1.2 GENERAL CONDITIONS

Refer to General Provisions, Section 22 00 00 for provisions affecting work in this section.

1.3 WORK INCLUDED

- A. The work covered by this section of the specifications shall include, but is not limited to, the following:
1. Fixtures connected (whether supplied or not).
 2. Piping, hangers, sleeves, cleanouts, vents, fittings, traps, controls, etc., required completing the system.
 3. Floor waste system including traps.
 4. Sanitary drainage and venting system to 5'-0" outside wall.
- B. The following work, which is incidental to the installation will be executed by the Contractor:
1. Execute all required masonry and carpentry work, cutting, patching, furrings, plastering, etc., except as herein noted.
 2. Execute all required excavation work, backfilling, grading, etc. for water, drains, sewers, storm water, etc.
 3. Finished painting of piping supports and insulation, except as herein noted.
 4. Sanitary drainage system from 5'-0" outside wall to town system.
 5. Fixture ventilation.
 6. Access panels in ceiling and walls for access to cleanouts valves, etc.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS AND METHODS

Unless otherwise indicated, the materials to be furnished under this contract shall be standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest standard design that complies with the specification requirements.

2.2 SANITARY SYSTEM

- A. All sanitary soil, waste and vent piping and fittings below lowest floor, in earth or concrete, shall be PVC or no-hub cast iron. All pipe and fittings used for drain, waste and vent piping shall conform to requirements of Maine State Plumbing Code for material and gauge.
- B. All joints for PVC pipe shall be secured only with solvent cement that is recommended by the pipe manufacturer.
- C. Sanitary soil, waste and vent piping systems above lowest floor may be PVC or Tyler cast iron, no-hub, CISPT standard 301-72, bitumastic coated.
- D. Acid-resisting pipe and fittings shall be G.S.P. Fuseal F.R. polypropylene.

2.3 FLOOR DRAINS

- A. Drains shall be provided and installed with all waste and vent connections. All floor drains shall be provided in accordance with the drawings. Each floor drain shall have deep seal trap.
- B. All of the floor drains shall be installed in an approved manner, finished surfaces protected during construction and set level and installed as recommended by manufacturer.
- C. All surfaces, grates, buckets, etc., shall be cleaned and all construction dirt and stains removed at completion of project.
- D. All floor drains not installed in slab on grade shall be furnished with clamping collars.
- E. Floor drains shall be PVC with 6" dia. equal to Zurn #Z400 Type B with the following salient characteristics; round adjustable Nickel-Bronze strainer top, square heel proof opening and secured grate, unless otherwise specified on the drawings.
- F. Floor drain or similar traps directly connected to the drainage system and subject to infrequent use shall be protected with a trap seal primer. Trap seal primers shall be accessible for maintenance.

PART 3 - EXECUTION

3.1 SOIL AND WASTE SYSTEM

- A. Furnish and install complete drainage system inside the buildings essentially as indicated on the drawings, connecting to all fixtures, drain and equipment.
- B. Soil, waste, and vent conductor piping inside the building shall be run as indicated on the drawings, properly secured to the building structure with iron hangers. Extend to roof all lines of soil, waste and vent piping in stacks with all branches and fittings required and with extension through roofs as required by the Plumbing Code, a minimum of 36 inches above the finished roof level. Where an end circuit vent pipe from any fixture or line is connected to a

vent line serving other fixtures, the connection shall be at least three feet above the highest fixture branch or high enough above the floor to prevent the use of the vent line as a waste line.

- C. All fixtures and drains on the sanitary system shall be separately trapped and all traps shall be vented, unless otherwise indicated on the drawings for fixtures or drains in battery ventilation systems.
- D. All traps and running traps where buried in or under floors or serving floor drains shall have top clean-outs and extensions, with brass covers.

3.2 INSTALLATION AND WORKMANSHIP

- A. All plumbing work must be installed in accordance with plans and specifications except as otherwise required by local and State requirements. This Contractor shall obtain and pay for all necessary permits, licenses, and fees in accordance with installation of services.
- B. All piping shall be located approximately as shown. Slight relocations will be permitted to improve function, clearance, and appearance.
- C. Pitch sanitary, waste and vent piping 1/4" per foot or as indicated. Conceal all piping where possible.

END OF SECTION 22 13 00

SECTION 22 40 00 -PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SCOPE

The work under this section shall include all labor and material to install all fixtures as shown on the drawings or specified herein or both.

1.2 GENERAL CONDITIONS

Refer to General Provisions Section 22 00 00 for provisions affecting work in this section.

1.3 PROTECTION

The Plumbing Contractor shall protect all fixtures from damage during construction, furnish board enclosures for all water closets, urinals, lavatories and sinks and protect all enameled surfaces with pasted on paper. No fixtures shall be used prior to acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS

Fittings and Trim shall be chrome-plated brass and unless otherwise specified and shall be of same manufacture as fixtures, including traps, flow restrictors, supplies, stops, and union connections. Any chrome trim with wrench marks shall be removed and new trim installed.

2.2 FIXTURES

- A. All fixtures shall be free from all imperfections, smooth watertight and complete in every respect.
- B. Where specified fixtures shall be furnished and installed complete with all wall hangers, stops, fittings and connections. See Fixture Schedule on Plans.

2.3 FIXTURE SUPPORTS

- A. Provide acceptable foot supported carriers for all wall-hung fixtures except where noted on plans. Carriers shall be as noted on the drawings.
- B. No fixture shall be supported off the wall except where noted on plans.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES

Inspection of Roughing-In: Inspect roughing-in to see that it is in the exact position to allow fixtures to be at locations and heights indicated. Do not proceed until all positions are verified or any adjustment in fixture location is accepted by Contracting Officer.

3.2 INSTALLATION

- A. Traps: Provide traps for all fixtures and equipment whether supplied or not, chrome-plated brass non-siphon traps shall be provided where required by the law in lieu of traps.
- B. Fixture Hangers and Stops: All fixtures supplied under this contract shall have key stops on supplies and mounting hangers or brackets for wall hung types. Also, provide key stops on supplies to all fixtures not supplied but connected under this contract.
- C. Fixture Mounting Heights: Verify all mounting heights with the Contracting Officer.

3.3 CLEANING

Clean fixtures and trim just prior to final inspection. Clean out all strainers and aerators and adjust or replace washers to prevent leaks at faucets and stops

END OF SECTION 22 40 00

DIVISION 23 – HVAC

SECTION 23 00 00 - HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 GENERAL CONDITIONS OF THE CONTRACT

All of the provisions of the General Conditions, Information for Bidders, Special Provisions of the General Contract are a part of this section. The Contractor should be familiar with these sections of the project.

1.2 SCOPE OF WORK

The Contractor shall furnish all labor and materials to complete all heating and ventilating work as shown on the drawings or herein specified, or both. The drawings do not show all the details for the pipes, valves, fittings, hangers, ductwork, and equipment to be used for complete installation, but show general arrangement and extent of the work to be performed. Included in this Contractor's work (but not limited to) are:

- A. Grilles, Diffusers, and Ductwork.
- B. Insulation of ductwork.
- C. Ventilation Fans, Air Handlers, and Ductwork.
- D. Cut all holes for ductwork in walls, floors, and ceilings.

1.3 RECORD DRAWINGS

- A. This Contractor shall maintain at site two separate sets of black line prints of the Mechanical Drawings. As the work progresses, he shall mark neatly and accurately all changes from the original layouts and the work accomplished day by day. Colors shall be used in marking the various services.
- B. These sets of prints will be inspected and considered a guide to determining the amount of work installed. If these drawings are found inaccurate or incomplete, they shall be corrected promptly. This procedure is mandatory, and the Contracting Officer will not review requisitions for payment until satisfied that this has been complied with and is up-to-date.
- C. These "As Built" drawings shall be turned over to the Contracting Officer upon completion of the project for preparation of reproducibles by the Contracting Officer for the National Park Service.
- D. Final payment will not be made until these "As Built" drawings have been received and accepted.

1.4 SPECIAL CONDITIONS

- A. All materials shall be new and of the latest design of the respective manufacturers. All materials and equipment of the same classification shall be of the same manufacture unless otherwise specified.
- B. Codes constitute minimum requirements. If a higher standard is specified, the higher standard shall supersede the code requirements. Any conflicts shall be resolved to the satisfaction of the Contracting Officer before proceeding with construction. The latest edition of the Standards for the Installation of Oil Burning Equipment, State of Maine Department of Insurance and all other applicable codes shall be the standard for this project. Interpretations of these codes must be acceptable to the Contracting Officer.
- C. Specification by brand name, manufacturer, or type is to establish standards of quality and style. Under the contract these materials shall be furnished as specified unless a change has been approved by the Project Contracting Officer. Where two or more designations are listed, the Contractor may select at his option.
- D. Drawings shall be considered as though part of the specifications. All information contained on the drawings supplied by the Contracting Officer shall be as though it were written in these specifications, subject to the following:
 - 1. Drawings are not to be scaled for dimensions.
 - 2. Layouts are not absolute. It is subject to minor changes to facilitate installation.
 - 3. Locations are not exact but are as close as clear drafting practice will allow. Field verification with the Contracting Officer or his designated representative shall be the responsibility of this Contractor.
 - 4. This Contractor shall keep fully informed on the space and position requirements of his work and shall give information to the Contractor to allow coordination with other trades. Particular attention shall be paid to proper clearance from other pipes, electrical conduit, etc., as well as any other structural components.
 - 5. A set of AS-BUILT DRAWINGS, clean and clearly marked in red, shall be kept on the job at all times and turned over to the Contracting Officer upon completion of the project.

1.5 SUBSTITUTIONS

- A. Any proposal for substitution shall be made in writing by the Contractor who shall submit full details for consideration and obtain written approval of the Contracting Officer. The Contracting Officer's decision as to acceptability of the substitute material or equipment shall be final. Approval by the Contracting Officer for such substitutions shall not relieve the Contractor from responsibility regarding a satisfactory installation of such work in accordance with the intent of the plans and specifications and shall not affect his guarantee covering all parts of the work.
- B. Any additional cost resulting from the substitution of equipment shall be paid by this Contractor.

1.6 CO-ORDINATION WITH OTHER TRADES

This Contractor shall be responsible for the co-ordination of his work with the electrical and plumbing contractors and shall make the necessary adjustments and changes to facilitate installation of all ducts, conduits, and piping in the spaces available.

1.7 PROTECTION OF WORK

This Contractor shall assume full responsibility for the care and protection of all materials and mechanical work until the project is accepted by the National Park Service. Any material damaged or destroyed shall be immediately removed from the premises and replaced with equipment in full compliance with the specification without expense to the National Park Service.

1.8 OBJECTIONABLE NOISE AND VIBRATION

Mechanical equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping, or ducts, as determined by the Contracting Officer, the necessary changes eliminating the noise or vibration shall be made by the Contractor at no extra cost to the National Park Service.

1.9 ORDINANCES, PERMITS AND FEES

The Contractor shall obtain all licenses or permits, pay all fees, and comply with all local and state rules and regulations as well as those of the National Board of Fire Underwriters.

1.10 INSURANCE: See General Conditions and Special Provisions of the General Contract.

1.11 STATEMENT OF INTENT

It is the intent of the drawings and specifications to provide for the installation of an H.V.A.C. system that is safe, quiet, and economical in operation and complete in all respects.

1.12 ALTERNATES

Several alternate prices are required in these bidding documents. The Contractor is responsible for separating the work called for in the various alternates and be prepared to undertake any part or all of the work called for in the alternate(s) which are accepted by the National Park Service.

See Drawings for the various alternates and the extent of work.

PART 2 - PRODUCTS AND MATERIALS

2.1 PIPING

- A. Hot Water - Schedule 40, standard weight black steel ASTM 120 or Type L hard drawn copper tubing, above grade, and Type K copper below grade.
- B. Cold Water - Type- L hard drawn copper tubing.
- C. Condensate Drain Piping Schedule 40 PVC plastic pipe and fittings with solvent-welded joints.
- D. Drains and Vents - Type-L hard drawn copper tubing.
- E. Pipe Sleeves - Schedule 40 black iron through masonry. 18 Gage galvanized steel or heavier in stud wall construction.
- F. Refrigerant – Type-L (ACR) hard drawn copper tubing, washed and capped.

2.2 VALVES AND RELATED MATERIALS

- A. Fittings:
 - 1. Screwed - 125# cast iron screwed pattern ASTM A126, ASA B16.1
 - 2. Unions - 250# malleable iron with brass to iron ground seats.
 - 3. Flanges - 150# forged steel slip-on ASTM A234.
 - 4. Sweat - Cast bronze or wrought copper.
 - 5. Connections to equipment - Screwed unions.
- B. Acceptable Manufacturers - Valves:
 - 1. Nibco
 - 2. Apollo
 - 3. Jenkins
 - 4. Stockham
 - 5. Hammond
 - 6. Armstrong
 - 7. Watts
 - 8. Or Equal
- C. Valve Connections:
 - 1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves.
 - 2. Thread pipe sizes 2 inches and smaller.
 - 3. Flange pipe sizes 2-1/2 inches and larger.
 - 4. Solder or screw to solder adaptors for copper tubing.
 - 5. Use grooved body valves with mechanical grooved jointed piping.
- D. Valves Characteristics/Performance:

1. OS and Y Gate Valves: Flanged, iron body, 125-lb. S.W.P., 200 lb. W.O.G., solid wedge. Federal Specification WW-V-58 Class I, Type I and MSS SP-70.
2. N.R.S. Gate Valves: Flanged, iron body, 125-lb. S.W.P., 200 lb. W.O.G., solid wedge, bronze-mounted. Federal Specification WW-V-58, Class I, Type I and MSS SP-70.
3. Bronze Gate Valves (Rising Stem): Solid wedge, 125 lb. S.W.P., 200 lb. W.O.G. Federal Specification WW-V-54, Class Q, Type II and MSS SP-80.
4. Butterfly Valves: Lug-type body (2" through 24" sizes). Seat material shall be E.P.T. or Buna-N. Pressure rating shall be 150 psi at 225°F.
5. Plug Valves: Lubricated plug, semi-steel construction, 175 psi, W.O.G., maximum temperature limitations are 200°F.
6. Bronze Globe Valves: Class 150, conforming to Federal Specification WW-V-51, Class B, Type I and MSS SP-80.
7. Bronze Ball Valves: (Up to 3" size), chromium-plated ball, full-port design, 600 psi, W.O.G. rated threaded ends. Federal Specification WWV-35B, Type II, Class A, Style 3, and MMS SP-72.
8. Silent Check Valves: Globe-style bronze check valve (sizes 2" through 30"), 150 psig rated.

- E. Balancing Fittings - Balance fittings shall have 125# bronze bodies equal to Sarco Balance Master, unless otherwise noted on drawings.

2.3 BALANCING VALVES

- A. Bronze Calibrated-Orifice, Balancing Valves with the following salient characteristics:

1. Basis-of-Design Quality shall be Taco: Accu-Flo or equal.
2. Body: Bronze, ball or plug type with calibrated orifice.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. Performance:
 - a. CWP Rating: Minimum 125 psig.
 - b. Maximum Operating Temperature: 250°F.

- B. Automatic Flow-Control Valves with the following salient characteristics:

1. Manufacturers: Subject to compliance with requirements, provide products equal to one of the following:
 - a. Flow Design Inc.
 - b. Griswold Controls.
 - c. Hays Fluid Controls
2. Body: Brass or ferrous metal
3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance:

- a. Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
- b. Minimum CWP Rating: 175 psig.
- c. Maximum Operating Temperature: 200°F.

2.4 WATER PRESSURE REDUCING VALVES

Equal to Bell and Gossett No. 12, unless otherwise noted.

2.5 AIR VENTS

- A. Air vents shall be equal to Armstrong air vent traps No. 1 – AV ½” with the following salient characteristics:

- 1. Stainless steel trim.
- 2. Manual air vents shall consist of air chamber with ¾” pipe off the top, with ¾” gate valve.

2.6 VENTILATION FANS

Furnish and install ventilation exhaust fans sized and located as called for in the schedules on the drawings.

2.7 FIRE DAMPERS

- A. Fire dampers shall be equal to Ruskins Mfg. Type CR or C, with the following salient characteristics:

- 1. Fusible links rated at 212°F.
- 2. UL approved for use in fire assemblies with ratings up to 2 hours.
- 3. Provided with access panels.

2.8 VENTILATION DUCTWORK

Ductwork shall be of galvanized sheet metal and shall be new copper-bearing sheets of lock-forming quality. Zinc coating that will flake or peel under any forming operation, or laminated sheets will not be allowed. Thickness of metal for rectangular ducts, including elbows and other details, shall be as follows:

Longest Rectangular Dimension of Duct Inches	Thickness Galv. Steel USS Gauge
Up thru 12	26
13 thru 30	24
31 thru 54	22
55 thru 84	20

Ductwork shall be reinforced in accordance with the latest SMACNA Duct Construction Standards – Metal and Flexible. All dampers and deflectors shall be #22 gauge and stiffened as required.

2.9 FLEXIBLE INSULATED DUCT WORK

- A. Flexible Insulated Duct Work shall be used for termination of round supply duct not to exceed 6 feet in length with the following salient characteristics:
1. Formed with a resilient core of continuous air barrier.
 2. Insulated with fiberglass flexible insulation.
 3. Jacketed with a tough reinforced vapor barrier jacket.
 4. Equal to Owens-Corning fiberglass INL-25 fiberglass duct, C = 0.23, 1-1/4" minimum thickness.

2.10 DAMPERS AND ACTUATORS

- A. Intake air and exhaust air control dampers shall be installed where required and as shown on the drawings, with the following salient characteristics:
1. 16 gauge galvanized steel blades.
 2. Parallel blades with neoprene seals.
 3. Compressible metal jambe seals.
 4. Concealed linkage.
 5. Equal to Ruskin #CD36, Belino #LF24-S, direct coupled damper actuator.

PART 3 - EXECUTION

3.1 PIPING - GENERAL

- A. Provide and install the piping shown on the plans and as required to complete the intended installation. The Contractor shall make such off-sets as are shown or required to place all piping in proper position to avoid other work (especially other piping and electrical).
- B. The size and general arrangements, as well as the methods of connecting all piping, valves, equipment, etc., shall be as indicated, or as approved by the Contracting Officer.
- C. All piping shall be erected to provide for the easy and noiseless passage of water under all working conditions. Inverted eccentric reducing fittings shall be used wherever hot water pipes reduce in size. Provide 1/2" ball valves with hose couplings for drains at all low points in the piping system.
- D. All water mains shall be run level or pitch slightly upward so that no air pockets are formed in the piping. The mains shall be set at elevations such that the runouts feeding heating equipment shall have no pockets where air can collect or where vents are provided.

- E. In the erection of water piping care must be taken to make proper allowances for expansion and contraction; piping shall be anchored as necessary to control the expansion. Runouts to radiation shall be the size indicated on the plans and shall come off the top of the mains at a 45° angle for upfeed radiators and downward at a 45° angle for downfeed radiators.
- F. Install a sufficient number of flanged fittings and/or unions to facilitate assembly and disassembly of piping and removal of equipment. Install ball valves on each side of unit heaters, cabinet heaters and circulation pumps.
- G. All water mains 3" and larger shall have welded connections using standard factory-fabricated tees, elbows, reducers, caps, etc. Branch outlets in welded sizes shall be made with tees for full size or one size reduction and with either "weldolets" or factory shaped nipples for all other sizes. All welds shall be made by qualified welders capable of welding in any position "in the field". All welds shall conform with the rules set forth in the Standard Manual of Pipe Welding of the Heating, Piping and Air-Conditioning Contractors National Association.
- H. Water piping 2½" and smaller shall have screwed connections in the case of black iron pipe and sweat fittings in the case of hard drawn copper. Copper fittings shall be joined with 50/50 solder above grade and silver solder below grade.
- I. Pipe Hangers: Shall be provided at maximum intervals of ten feet, for horizontal pipes. Hangers shall be as shown on plans or equal, with Contracting Officer's approval. Vertical pipes shall be supported by adjustable malleable iron brackets.
- J. Pipe Sleeves: Furnish and install pipe sleeves for heating pipes passing through walls and ceilings. All pipe sleeves shall be sized to permit continuous pipe insulation to pass through.
- K. Escutcheons: Furnish and install chrome steel escutcheons plates in all finished areas where piping passes through walls or ceiling.

3.2 SHEET METAL AND DUCTWORK

- A. General - Furnish and install all required sheet metal work and duct systems including: intake ducts, back-draft dampers, weatherhoods, turning vanes, deflectors, operators, louvers and screens, grilles, registers, diffusers, collars, sleeves, stop-offs, baffles, acoustic linings, access doors, flexible connections, supports, etc., for the complete installation as shown on the drawings or noted herein, or required to make the installation complete in accordance with the intent of the drawings and specifications.
- B. Installation: Fabricate and install in accordance with applicable requirements of the ASHRAE Guide and Data Book. Ductwork shall be neat, accurate, rigidly constructed and mechanically tight, as well as substantially airtight and shall provide quiet system of air transportation. Offsets of exposed ductwork shall be made on sides opposite to walls, and ceilings, unless otherwise shown on the drawings or specified. Sizes, as marked on the plans, shall be adhered to as closely as possible. The right is reserved to vary the size of ducts and flues to accommodate structural conditions during the progress of the work, without additional cost to the National Park Service.
- C. All Joints in sheet metal ducts shall be sealed and made airtight and all branches, turns, etc., shall be made with long radius elbows and fittings or shall be provided with fixed air foil turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius

elbow with a throat radius of not less than duct width. Turning vanes shall be Tuttle & Bailey's Ducturns or approved equal with salient characteristics.

- D. All ducts shall be installed with necessary offsets, changes in cross sections, etc., and shall be constructed with approved joints and be substantially supported in an approved manner. Ductwork shall have no standing seams.
- E. Access Doors: Shall be installed in building construction, casings, plenum chambers and ducts where shown and wherever else required for ready access to operating parts of any kind.
- F. Registers, Grilles, Diffusers and Louvers: Each air outlet and inlet shall be provided with finished terminal fitting as indicated and in accordance with the drawings and schedule. All items shall be as specified or an approved equal with salient characteristics.
- G. Cleaning: Before the duct system is tested and balanced, the interior of all ducts shall be cleaned thoroughly by blowing through the system with the system fan. Cheesecloth shall be secured over each air outlet to entrain dirt and dust during this operation.
- H. Testing and Adjusting: The Contractor shall perform all testing and adjusting necessary to conform to these plans and specifications. Qualified personnel with suitable air-measuring instruments shall adjust all dampers, etc., in the duct systems, and the Contractor shall furnish a written report, in triplicate, stating the volume and velocity of air from each central air handling unit and through each diffuser, grille and register.
- I. Adjustments: After completion of the installation work called for in this specification, the Contractor and his subcontractors shall furnish necessary mechanics or engineers for the adjustment and operation of the plant, to the end that the plant may be perfectly adjusted and turned over to the National Park Service in perfect working order. The Contractor shall further instruct the Contracting Officer in the care and operation of the installation providing all required framed instruction charts, directions, etc.

3.3 ELECTRICAL

Furnish and install all low voltage (less than 120 v.) wiring associated with the H.V.A.C. system and its control. All wiring shall be done by licensed electricians and be installed in accordance with the National Electric Code.

3.4 VALVE AND PIPE IDENTIFICATION

Identify all piping and valves according to the following marking system:

- A. Nameplates: Provide and install "Seton" or nameplates with the following salient characteristics, embossed vinyl-plastic nametags with white letters on black background to identify equipment, controls, etc.
- B. Tags and Charts: Attach to each valve a 1-1/2" round or octagonal brass tag with 1/2" indented numerals filled with a durable black compound. In addition to the valve numbers, each tag shall identify the system it controls. Tags shall be securely attached to stems of valves with copper or brass "S" hooks, or chain`. Valve charts shall be provided for each piping system and shall consist of schematic drawings of piping layouts, showing, and identifying each valve and

describing its function. Upon completion of the work, one copy of each chart, sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung where directed. Two additional unmounted copies shall be delivered to the Contracting Officer.

3.5 MAINTENANCE MANUALS AND OPERATING INSTRUCTION

- A. At completion of the work, the Contractor shall provide the Contracting Officer two complete sets of operation and maintenance instructions for all heating and ventilating equipment. These shall be bound together in two notebooks for the National Park Service.
- B. The National Park Service or Contracting Officer shall be completely instructed in the operation of the heating and ventilating system and all its components and advised of good and correct operating and maintenance procedures.

3.6 SYSTEM BALANCE

- A. System balancing work shall be performed by personnel, experienced in HVAC balancing techniques, using state of the art and properly calibrated instrumentation. The Contractor must obtain approval from the Contracting Officer for the balancing program. Three (3) bound, typewritten copies of the balancing report shall be delivered to the Contracting Officer for approval at the completion of the work. If the report is found to be incomplete or inaccurate, the affected portions shall be repeated at no additional cost.
- B. Air Balancing: Adjust the mixing damper linkages as required to provide the correct percentages of outside air.

Adjust all dampers to deliver the air quantities specified throughout the systems. Review design volume with Contracting Officer prior to proceeding with balance. The balancing contractor shall balance to the design flow rate in each zone with all zone dampers open.

END OF SECTION 23 00 00

SECTION 23 01 65 -VARIABLE REFRIGERANT FLOW

PART 1 – GENERAL

1.1 SUMMARY

- A. Bidders shall provide the minimum system as indicated on drawing, including Heat Recovery or Heat Pump systems as defined by model and family numbers. All systems shall be capable of providing the scheduled capacity at the location of the indoor unit regardless of pipe length. Nominal or catalog capacities will not be accepted.
- B. Heat Recovery systems shall be capable of simultaneous cooling and heating. The Heat Recovery system shall consist of Heat Recovery unit(s), MCU(s) (Mode Change Unit), indoor units and VRF System Controls.
- D. The Heat Recovery system shall be capable of transferring heat between individual indoor units, and between individual Mode Control Units.
- E. To ensure maximum occupant comfort, Heat Recovery systems may have a space temperature controller for each connected indoor unit. Each individual space temperature controller shall be capable of automatically satisfying heating or cooling regardless of time of day, occupancy, or season without inhibiting or affecting other space temperature controllers.
- F. The Heat Pump system shall consist of Heat Pump unit(s), indoor units, and VRF System Controls. Heat Pump systems shall not be used for systems requiring simultaneous heating and cooling.
- G. If the application calls for simultaneous heating and cooling with multiple zones and multiple controllers, and the installing contractor submits a Heat Pump system, the submittal shall be summarily rejected. The contractor shall then be required to resubmit and install a simultaneous heating and cooling system. The contractor shall bear all additional costs required to provide a simultaneous heating and cooling system, with no additional cost to the National Park Service.
- H. System Controls, installation, and integration shall be provided by the manufacturer of the VRF system. This is to ensure sole source responsibility for the control system including non-VRF systems. Graphics shall include floor plan layout.

1.2 QUALITY ASSURANCE

- A. System efficiencies (SEER and HSPF) for units less than 65,000 BTUH shall be certified by AHRI standard 210-240, and shall be published for public review at www.ahrinet.org. Equipment that is “rated” in accordance with AHRI Standard 210-240, but not published for public review by AHRI shall not be accepted.
- B. System efficiencies (IEER and SCHE) for units greater than 65,000 BTUH shall be certified by AHRI standard 1230, and shall be published for public review at www.ahrinet.org. Equipment

that is “rated” in accordance with AHRI Standard 1230, but not published for public review by AHRI shall not be accepted.

- C. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
- D. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- E. Project shall comply with the applicable version of ASHRAE standard 15.
- F. Project shall comply with the applicable version of ASHRAE 90.1
- G. The VRF manufacturing facility shall be registered to ISO 9001 and ISO14001.
- H. All components shall be provided by one manufacturer including but not limited to:
 - 1. Outdoor Units
 - 2. Indoor Units
 - 3. Mode Control Units as required
 - 4. All necessary and applicable controls for the VRF System
 - 5. Factory refrigerant charge for outdoor unit(s) only
 - 6. Factory Y and or T-Branch(s) as required
 - 7. Condensate Lift Pump(s) as shown on the contract documents
 - 8. Refrigerant Ball Valves as shown on the contract documents
 - 9. Service Software

1.3 DELIVERY, STORAGE AND HANDLING

- A. Installing contractor will take all reasonable and appropriate care to store and handle equipment per the manufacturer’s recommendation.

1.4 SUBMITTALS

- A. Installing contractor shall provide the following:
 - 1. VRF Guide Specification
 - 2. VRF Dimensional Data for all products submitted
 - 3. VRF Product Data for all products submitted.
 - 4. VRF Select report showing design conditions, total load profile, and actual capacity at actual Indoor Unit location,
 - 5. VRF Select Piping and Wiring layout showing estimated piping, wiring sizes, equipment quantities, piping length estimate, and additional refrigerant charge.
 - 6. VRF Select Schedule showing the performance for all pieces of equipment.

1.5 INSTALLATION AND OPERATION MANUALS

- A. National Park Service shall be provided with a complete and comprehensive electronic set of Installation and Operation Manuals.

1.6 QUALIFICATIONS

- A. Manufacturer shall have a minimum of twenty-five (25) years of HVAC experience in the North America market.
- B. Manufacturer to have Local Factory Service within seventy-five (75) miles of jobsite.
- C. The VRF system shall be installed by a certified installer with extensive VRF installation and service training. The mandatory contractor service and install training shall be performed by the manufacturer.

1.7 WARRANTY

- A. The units shall be covered by the manufacturer's standard limited warranty for a period of 12 months from date of installation. If during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.
- B. The units shall carry an extended manufacturer's parts and compressor warranty for a period of 10 years from date of installation. The following steps shall be taken by the contractor to ensure systems are eligible for extended warranty.
 - 1. System is designed and submitted using the approved application tool.
 - 2. System installed by a contractor who has successfully completed the factory training classes.
 - 3. Upon completion of installation and prior to final commissioning, contractor shall provide revised piping layout reflecting actual installation conditions.
 - 4. Provide a verified and submitted commissioning report.
- C. The contractor shall provide labor warranty as specified in the general conditions for this project.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers shall be considered an equal, provided they meet the scheduled performance indicated on the drawings:
 - 1. Daikin
 - 2. Mitsubishi

2.2 MCU (Mode Change Unit)

- A. The MCU (Mode Change Unit) shall be used for applications requiring simultaneous heating and cooling. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
- B. MCUs require they be used in conjunction with VRF Heat Recovery water source or air source units. These units shall be equipped with a circuit board that shall perform all functions necessary for operation.
- C. The MCU (Mode Change Unit) shall be completely factory assembled, internally piped and wired. Unit shall be run tested. This unit shall be mounted indoors.
- D. Each MCU shall be capable of transferring heat to connected associated indoor units, and to the connected water source or air source unit. This shall allow simultaneous heating and cooling without the need for reheat.
- E. Isolation valves with access ports shall be installed by the contractor on the entering and leaving refrigerant circuits as shown on the drawings.
- F. Additional subcooling shall be provided at the MCU. The additional subcooling is shall mitigate losses due to pipe length and heat gain, and ensure scheduled capacity at the indoor unit.
- G. MCU (Mode Change Units) shall be available in three sizes, 4-port, 6-port, and dedicated 2-port. The heat recovery water source or air source unit shall be capable of connecting to multiple MCUs (Mode Change Units).
- H. The 4-port MCU shall connect up to 4 indoor units when the sum of the indoor unit's capacity is less than 120 MBH. Optionally, the 6-port MCUs shall connect up to 6 indoor units where the sum of indoor unit's capacity is less than 180 MBH.
- I. The dedicated 2-port MCU shall be used to connect individual Indoor units whose capacity greater than or equal to 36 MBH, and where the sum of the MCUs capacity is less than 192 MBH.
- J. When connecting indoor units with capacities greater than 36 MBH to a 4-port, 6-port, or dedicated 2-port MCU, two ports shall be twinned together at the MCU to deliver the required refrigerant. The two MCU refrigerant valves shall operate simultaneously.
- K. IDUs with capacity in excess of 48MBH shall not be connected to 4-port or 6-port MCUs. They should be used exclusively with a dedicated 2-port MCUs.
- L. IDUS with capacity less than 36MBH indoor unit shall not be connected to a dedicated 2-port MCUs.
- M. The MCU casing shall be fabricated of galvanized steel. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves. The unit shall house two tube-in-tube heat exchangers (sub cooling) to ensure heating and cooling capacity at the indoor unit.
- N. The MCU shall be furnished with multiple two position refrigerant valves. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

- O. An integral MCU condensate pan and drain connection shall be provided.
- P. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.

2.3 4-WAY MINI/ 4-WAY CEILING CASSETTE INDOOR UNITS

- A. The four-way cassette style indoor units that recess into the ceiling grid with an exposed ceiling grille and an integral 2000 step modulating expansion device. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
- B. The indoor unit shall be a factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function. The unit shall be provided with a face mounted infrared receiver for use with a handheld wireless remote controller. The unit shall have an integral return air sensor.
- C. The unit cabinet shall be a space-saving ceiling-recessed cassette.
- D. The indoor fan shall consist of a turbo fan with a single direct drive motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. The indoor fan shall have high, medium, and low fan speeds. The fan speed shall be adjustable by an optional remote controller. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution. If required, the cassette shall be capable of closing off one or more vanes to prevent “stray airflow”.
- E. Return air shall be filtered by means of a long-life washable permanent filter.
- F. The indoor coil shall be constructed as follows:
 - 1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
 - 2. The tubing shall have inner grooves for high efficiency heat exchange.
 - 3. All tube joints shall be brazed with phos-copper or silver alloy.
 - 4. The coils shall be pressure tested at the factory.
 - 5. A condensate pan and drain shall be provided under the coil.
 - 6. The coil fins shall be coated with hydrophilic paints.
 - 7. The factory installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan.
 - 8. Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.4 WALL MOUNTED INDOOR UNITS

- A. Wall-mounted indoor unit section with a slim silhouette. The wall mounted indoor unit electrical power shall be 208-230 volts, 1-phase, 60 hertz and a 2000 step modulating expansion device.
- B. The indoor unit shall be factory assembled, wired, and run tested. Contained within the unit shall be all factory wiring, internal piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function. The unit shall be provided with a face mounted infrared receiver for use with a handheld wireless remote controller. The unit shall have an integral return air sensor.
- C. The unit casing shall have a white finish, with multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and four (4) directions for condensate drainage. The unit shall be secured firmly to the wall with factory mounting plate.
- D. The indoor fan shall consist of a cross-flow fan with a single direct drive motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. A manual adjustable guide vane shall be provided to change the airflow from side to side (left to right) as desired. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution. The indoor fan shall have multiple speeds.
- E. Return air shall be filtered by means of an easily removable, washable filter.
- F. The indoor coil shall be constructed as follows:
 - 1. The indoor coil shall be of nonferrous construction with Slit fins on copper tubing.
 - 2. The tubing shall have inner grooves for high efficiency heat exchange.
 - 3. All tube joints shall be brazed with phos-copper or silver alloy.
 - 4. The coils shall be pressure tested at the factory.
 - 5. A condensate pan and drain shall be provided under the coil.
 - 6. The coil fins shall be coated with hydrophilic paints.
 - 7. The optional field installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan.
 - 8. Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.5 ACCESSORIES

- A. Y-Joint Kits- are a required component for VRF-Systems with multiple evaporators or MCU's on the same system. Y-joints shall be provided for liquid, suction, and hot gas fittings as required. Y-joints shall be provided with polystyrene insulation. Y-branches shall facilitate

different pipe sizes without having to braze additional fittings. Kits shall be installed per manufacturer guidelines. Requires field installation.

- B. T-Joint Kits – are a required component for VRF systems capable of operating multiple outdoor modules on a single system, (check catalog(s) for factory approved combinations). The T-Joint shall be provided for liquid, suction, and hot gas fittings as required. T-Joints shall be provided with polystyrene insulation. T-Branches shall facilitate different pipe sizes without having to braze additional fittings. Kits shall be installed per manufacturer guidelines. Requires field installation.
- C. EEV KITs- the EEV (Electronic Expansion Valve) provides refrigerant management of indoor units. The EEV shall be required for field installation on ceiling suspended (floor) indoor units. Heat Recovery systems shall use the one unit EEV kit. Heat Pump systems may utilize the one, two, or three unit EEV kits. Kits shall be installed per manufacturer guidelines. Requires field installation.
- D. Condensate Drain Pumps shall be provided for field installation as required for efficient condensate management. Condensate pumps shall be capable of 29.5” of lift to allow condensate to reach the closest gravity drain line. Condensate pumps shall include a check valve to prevent water from flowing back into the indoor unit. Pump shall be mounted in the chassis of the indoor unit. Pump shall draw on required power from the associated indoor unit. Requires field installation (Standard factory installed for all ceiling cassettes).
- E. Refrigerant Isolation Ball Valves - shall be provided for field installation as specified by the contract documents. Valves shall utilize a uni-body full port design to minimize leaks and internal pressure drops. Valves shall be rated for 700PSIG, and are offered with an optional factory insulation package. Valves shall be factory tested under pressure. Valves shall require polytetrafluoroethylene (PTFE) seals and gaskets. No synthetic O-rings are allowed. Design shall permit valve operation without removal of seal cap. Valves shall have a temperature operation range of -40°F to 300°F. Valves 5/8” and smaller shall be flare fittings. Valves larger than 5/8” shall be sweat fittings. Valves shall be provided with formed and fitted insulated jacket. Requires field installation.
- F. Wireless remote temperature controller can be used with all VRF Indoor Units. Remote shall utilize a multi-function LCD display and shall possess the following functionality:
 - 1. Power on/off setting
 - 2. Infrared control of IDU
 - 3. Battery operated
 - 4. Utilizes indoor unit mounted temperature sensor for temperature control.
 - 5. ON/OFF Control
 - 6. Mode Selection
 - 7. Temperature Set-point
 - 8. Fan Speed Setting
 - 9. Adjustment of individual airflow blade control (cassette units).
 - 10. Dirty Filter Alert
 - 11. 4 transmission channel options can separate control to specific IDU.
 - 12. Requires VRF Duct Signal receiver for ducted units.
- G. Simple wired remote controller can be used with all VRF Indoor Units. Remote shall utilize a multi-function LCD display and shall possess the following functionality:

1. Power on/off setting
2. Mode selection
3. Temperature set point control
4. Fan speed setting
5. On/off timer
6. Controls up to 16 idus
7. Up to 2 simple remotes may be configured as Master Slave for 1 IDU
8. Child lock
9. Filter timer

H. Simple Touch Remote Controller can be used with all VRF Indoor Units. Remote shall utilize an intuitive touchscreen multi-function LCD display and shall possess the following functionality:

1. Power on/off setting
2. Intuitive touch pad
3. Integral space temperature thermistor
4. Temperature set point control
5. Fahrenheit or Centigrade
6. Mode control settings (auto/cool/dry/fan/heat)
7. Fan control settings (auto/high/medium/low)
8. Sleep function
9. Filter timer
10. Access restriction settings
11. Occupied/unoccupied (manual function)
12. IDU vane position control (cassette units)
13. Integrated IR receiver
14. Controls up to 16 idus
15. Up to 2 simple remotes may be configured as Master Slave for 1 IDU

I. Wired Remote Temperature Controller can be used with all VRF Indoor Units. Remote shall utilize a multi-function LCD display and shall possess the following functionality:

1. Power on/off setting
2. Temperature set point control
3. Built-in room temperature sensor
4. Operation mode: Auto-Cool-Dry-Fan-Heat
5. Fan speed: Auto-Low-Med-High
6. Filter alarm reset (timer)
7. Individual airflow blade control on cassette units
8. Controls up to 16 IDUs
9. Real-time clock includes current time, day display
10. Daylight savings time adjustment (program in the date)
11. Weekly operating scheduling
12. Motion Detection/Away function (applies to enabled IDUs)
13. Upper/Lower temperature limit settings
14. Up to 2 remotes may be averaged as single controller for 1 IDU
15. Error display
16. Service Mode provides configuration settings
17. Security lock code

- J. External Room Temperature Sensor is wall-mounted to provide accurate room temperature sensing for an associated VRF cooling and heating unit. It is used in place of the unit-mounted return air sensor provided with VRF indoor units. It may also be used when there is a desire to prohibit direct occupant control. Requires field installation.
- K. Motion Detector is an optional component for the Mini 4-Way cassette that offers a smart solution to saving energy and costs. It works by turning off the air conditioning system once it detects the absence of any users in the vicinity. Energy efficiency is further maximized through its ability to automatically identify and set operation patterns. The Motion Detector Sensor prevents air flow from blowing directly onto a person by adjusting the blade direction when motion is detected. This creates a more constant and comfortable environment. The motion sensor must be used with the wired remote controller, (TVCTRLTWRWD01T). Requires field installation.
- L. External Contact Interface shall permit the on/off control of indoor units through an external input. The device will also allow the indoor unit to interlock control of external devices. This will allow the external devices to operate in sequence with the interlocked indoor unit.
- M. Auxiliary heat contact shall enable the operation of external auxiliary supplemental heat.
- N. Standard Cassette Panels shall be required with as indicated for all 1-way, Mini 4-way, and 4-way ceiling cassettes.
- O. Mode Select Switch shall enable the manually override mode control for the HP system. The switch shall set the operating mode as Cool, Heat, or Auto. (For use on heat pump systems only.) Requires field installation.
- P. Hail guards shall protect the air source condenser coil(s) from damaging hail. Requires field installation.
- Q. Wind/Snow Prevention Duct. The kits are used in windy or snowy regions to prevent cold gusts of air from interfering with stable operation of the units. They are also for use in snowy regions to prevent snow from accumulating on the units. The kit is recommended when low ambient heating is required. The Wind/Snow prevention kit may require the additional use of the Duct Discharge Kit. Requires field installation.
- R. Snow Hood/Duct Discharge Kit protects the Air Source VRF Outdoor unit from heavy snowfall. The kit also allows the Air Source VRF unit to be located inside a structure, and duct the condenser discharge air to the exterior of the structure. Requires field installation.

2.6 CONTROLS

- A. The VRF System Network Controls shall be capable of supporting remote controllers, system controllers, centralized controllers, an integrated web-based interface, graphical user workstation, and system integration to Building Management Systems via BACnet®.

B. ELECTRICAL CHARACTERISTICS

1. The VRF System Network Controls shall operate at 12VDC. Controller power and communications shall be via a common non-polar communications bus.
2. Control wiring shall be installed in a system daisy chain configuration from the wired remote controller to the indoor unit, to the and to outdoor unit. Control wiring to wired remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
3. Control wiring for system controllers, and centralized controllers shall be installed in a daisy chain configuration from interface module to interface module, to system controllers, to the power supply.
4. For communication wiring between ODUs, IDUs, MCU, system controller, and remote controllers use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire. Splicing of communication wiring shall not be permitted.
5. The VRF Web UI shall be capable of being networked with the VRF System Controller, and system controllers for web-based control.
6. Network wiring shall be CAT-6 with RJ-45 connection.

C. SYSTEM NETWORK CONTROLS

1. The VRF System Network Controls consists of individual controllers, system controllers, and integrated management system. The VRF System Network Controls shall support operation monitoring, scheduling, error monitor, power distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using BACnet® interfaces.

D. VRF-SYSTEM TOUCHSCREEN CONTROLLER

1. The VRF System Touchscreen shall provide an intuitive, fast, and convenient method of centrally operating a VRF system. The VRF System Touchscreen shall communicate with associated VRF components through a dedicated control network. It can control many comfort and energy-saving settings, including temperature, fan speeds, and operating schedules for up to 128 indoor units, and up to 16 outdoor units. The unit shall be housed in an attractive enclosure suitable for wall-mounting in an office, corridor, or utility room.
2. The System Touchscreen shall feature a 7" Color Capacitive Touch Screen. The User interface shall display operating equipment icons indicating mode status at a glance. All units within a zone shall be managed with one-button control. Unique zone description icons shall make it easy to recognize a zone.
3. Control shall include but not be limited to the following; On/Off control, temperature set-point, mode settings Auto/Heat/Cool/Auto/Dry/Fan, air-direction adjustment, and local temperature set-point restrictions.

4. The System Touchscreen shall be capable of setting up to up to 10 unique schedules including exception day setting for holidays, and Daylight-Saving Time adjustment.
5. The System Touchscreen shall be capable of grouping indoor unit in common zones. There may be up to 12 zones. Zones may be individually named.
6. The System Touchscreen shall provide management of multiple indoor units as 1 unit (Group control). Additionally, the controller shall provide monitoring and control points for interlocking of external equipment via 2 Binary Inputs and 1 Binary Output.
7. The System Touchscreen shall provide an alarm/error display, and alarm history.
8. Security shall be provided by a secure password.
9. The System Touchscreen shall connect via R1/R2 VRF communications link for monitoring and control of up to 128-total Indoor Units and MCUs, associated with up to 16-outdoor units. Alternately, the system shall connect via F1/F2 VRF communications link for monitoring and control of up to 64-indoor units plus up to 16-MCUs, associated with 1-Outdoor Unit.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. System shall be installed in accordance with manufacturer's guidelines.
- B. Installing contractor shall attend and successfully complete the factory training classes. Contractor shall submit certificate of completion as part of project closeout documents.
- C. Installing contractor shall install units to comply with all applicable building codes.
- D. VRF systems shall be installed in such a way as to permit access for routine maintenance.

3.2 COMMISSIONING

- A. Upon completion of installation and prior to final commissioning, contractor shall provide revised piping layout reflecting actual installation conditions to VRF technician.
- B. The system shall then be reviewed and commissioned by a Factory VRF Technician. Contractor shall provide a verified and submitted commissioning report to Factory Service Department, and to the Contracting Officer verifying the system has met the requirements for proper installation, and function.
- C. Engage a Factory Certified VRF Technician to train National Park Service's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 01 65

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

1.3 DEFINITIONS

MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Equipment:
 - a. All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment shall be properly supported to resist a horizontal force of 20 percent of the weight of the equipment furnished.

- b. All mechanical equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting a horizontal force of 50 percent of the weight of the equipment furnished.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 – PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of fiberglass.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 - g. Wesanco, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Vinyl.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International; a subsidiary of Mueller Water Products Inc.
 - b. Empire Industries, Inc.
 - c. ERICO International Corporation.
 - d. Haydon Corporation; H-Strut Division.
 - e. NIBCO INC.
 - f. PHD Manufacturing, Inc.
 - g. PHS Industries, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Paint.

2.5 FIBERGLASS STRUT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Allied Tube & Conduit.
 2. Champion Fiberglass, Inc.
 3. Cooper B-Line, Inc.
 4. SEASAFE, INC.; a Gibraltar Industries Company.
- B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.
 1. Channels: Continuous slotted fiberglass or other plastic channel with inturned lips.
 2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass.

2.6 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.8 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 2. Base: Plastic.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 – EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
 - 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal to match base paint type.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 50), from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1- GENERAL

1.1 SUMMARY

Section includes testing, adjusting, and balancing of air systems, testing, adjusting, and balancing of hydronic systems, measurement of final operating condition of HVAC systems, sound measurement of equipment operating conditions, vibration measurement of equipment operating conditions.

1.2 REFERENCES

- A. AABC (Associated Air Balance Council) - National Standards for Total System Balance.
- B. ASHRAE 111 (American Society of Heating, Refrigerating and Air-Conditioning Engineers) - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- C. NEBB (National Environmental Balancing Bureau) - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

- A. Test Reports: Indicate data on AABC National Standards for Total System Balance forms, forms prepared following ASHRAE 111, or NEBB Report forms.
- B. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- C. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- D. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Contracting Officer and for inclusion in operating and maintenance manuals.
- E. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets and indicating thermostat locations.
- F. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty or Copy of NEBB Certificate of Conformance Certification.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance, ASHRAE 111 or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems
- B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience certified by AABC or Certified by NEBB.
- B. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor, or registered professional engineer experienced in performance of this Work and licensed in the State of Maine.

1.6 PRE-INSTALLATION MEETING

Convene minimum one week prior to commencing Work of this section.

1.7 SEQUENCING

Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.8 SCHEDULING

Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

PART 2 – PRODUCTS Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.

6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed, and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place or in normal position.
15. Service and balance valves are open.

- B. Submit field reports. Report defects and deficiencies noted during performance of services, which prevent system balance.

3.2 PREPARATION

Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Contracting Officer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus 5 percent or minus 0 percent of design.
- B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 0 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Contracting Officer.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

- B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross-sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.
- E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes as required to vary fan speed. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure.

3.6 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing
 - 1. HVAC Pumps
 - 2. Energy Recovery Ventilator (ERV)
 - 3. Air Inlets and Outlets
- B. Report Forms
 - 1. Title Page:
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency
 - c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
 - d. Project name
 - e. Project location
 - f. Project Architect
 - g. Project Engineer
 - h. Project Contractor
 - i. Project altitude
 - j. Report date

2. Summary Comments:
 - a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
 - e. Nomenclature used throughout report
 - f. Test conditions
3. Instrument List:
 - a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
4. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP and kW
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore
5. V-Belt Drive:
 - a. Identification/location
 - b. Required driven RPM
 - c. Driven sheave, diameter, and RPM
 - d. Belt, size, and quantity
 - e. Motor sheave diameter and RPM
 - f. Center to center distance, maximum, minimum, and actual
6. Air Moving Equipment(ERV)
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Arrangement/Class/Discharge
 - f. Air flow, specified and actual
 - g. Return air flow, specified and actual
 - h. Outside air flow, specified and actual
 - i. Total static pressure (total external), specified and actual
 - j. Inlet pressure
 - k. Discharge pressure
 - l. Sheave Make/Size/Bore
 - m. Number of Belts/Make/Size
 - n. Fan RPM
7. Return Air/Outside Air Data:
 - a. Identification/location
 - b. Design air flow
 - c. Actual air flow
 - d. Design return air flow

- e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
 - h. Return air temperature
 - i. Outside air temperature
 - j. Required mixed air temperature
 - k. Actual mixed air temperature
 - l. Design outside/return air ratio
 - m. Actual outside/return air ratio
8. Exhaust Fan Data:
- a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Air flow, specified and actual
 - f. Total static pressure (total external), specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM
9. Duct Traverse:
- a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature
 - j. Air correction factor
10. Duct Leak Test:
- a. Description of ductwork under test
 - b. Duct design operating pressure
 - c. Duct design test static pressure
 - d. Duct capacity, air flow
 - e. Maximum allowable leakage duct capacity times leak factor
 - f. Test apparatus
 - 1. Blower
 - 2. Orifice, tube size
 - 3. Orifice size
 - 4. Calibrated
 - g. Test static pressure
 - h. Test orifice differential pressure
 - i. Leakage
11. Flow Measuring Station:
- a. Identification/number
 - b. Location
 - c. Size
 - d. Manufacturer

- e. Model number
 - f. Serial number
 - g. Design Flow rate
 - h. Design pressure drop
 - i. Actual/final pressure drop
 - j. Actual/final flow rate
 - k. Station calibrated setting
12. Air Distribution Test Sheet:
- a. Air terminal number
 - b. Room number/location
 - c. Terminal size
 - d. Design velocity
 - e. Design air flow
 - f. Test (final) velocity
 - g. Test (final) air flow
 - h. Percent of design air flow
13. Sound Level Report:
- a. Location
 - b. Octave bands - equipment off
 - c. Octave bands - equipment on
 - d. RC level – equipment on
14. Normally acceptable readings, velocity, and acceleration.

END OF SECTION 23 05 93

SECTION 23 07 00 - HVAC INSULATION

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. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Insulating cements.
 - 3. Adhesives.
 - 4. Lagging adhesives.
 - 5. Sealants.
 - 6. Factory-applied jackets.
 - 7. Field-applied jackets.
 - 8. Tapes.
 - 9. Securements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets.
- B. Qualification Data: For qualified Installer.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed a program or another craft training program.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material

containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. If utilized, coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, available products that may be

incorporated into the Work include, but are not limited to, the following:

- a. Aeroflex USA Inc.; Aerocel.
- b. Armacell LLC; AP Armaflex.
- c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Owens Corning; All-Service Duct Wrap.

E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory- Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Johns Manville; 800 Series Spin-Glas.
 - c. Knauf Insulation; Insulation Board.
 - d. Owens Corning; Fiberglas 700 Series.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
 - 2. Service Temperature Range: Minus 50 to plus 180 deg F.
 - 3. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: Aluminum.
- C. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: White.

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

- A. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.

- b. P.I.C. Plastics, Inc.; FG Series.
- c. Proto PVC Corporation; LoSmoke.
- d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

2.9 SECUREMENTS

- A. Bands:
 1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
- B. Insulation Pins and Hangers:
 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Wire: 0.062-inch soft-annealed, galvanized steel.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints, and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation less than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at

fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

D. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies.

3.5 MINERAL-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints.

- At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor- discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor ducts.
2. Outdoor-air supply ducts.
3. Exhaust air ducts.
4. Energy Recovery Unit exhaust duct between unit outlet and penetration of building exterior.
5. General Exhaust ducts between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply, return air, outdoor air, and exhaust air duct insulation shall be the following:

1. Mineral-Fiber: 3 inches thick and 0.75-lb/cu. ft. nominal density. Equal to R-12.

B. General Exhaust-air from range hood/dryer exhaust duct insulation within 10 ft of penetration of building exterior shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

3.9 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

- C. Insulate cold surfaces on chillers, including, but not limited to, evaporator bundles, suction piping, compressor inlets, tube sheets, water boxes, and nozzles with the following:
 - 1. Mineral-Fiber Pipe and Tank: 1 inch thick.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate Roof Drains and Equipment Drain Water below 60 Deg F:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1-1/2 inches thick.

END OF SECTION 23 07 00

SECTION 23 09 00 - AUTOMATIC TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS OF THE CONTRACT

All of the provisions of the General Conditions, Information for Bidders, Special Provisions of the General Contract are a part of this section. The Contractor should be familiar with these sections of the project. Refer to Division 01 General Requirements.

1.2 DESCRIPTION

- A. General: This section includes control equipment for HVAC systems and components, together with control components for terminal heating and cooling units not supplied with factory wired controls. The control system shall be direct digital control (D.D.C.) with equipment furnished, installed, and guaranteed by the Contractor.
- B. The ATC Contractor shall provide and install a complete system of micro processor based direct digital automatic temperature control as herein specified, including all required micro processors, controllers, monitoring, I/O devices, software, sensors, transducers, wiring, thermostats, valves, relays, switches, etc. as indicated and required.
 - 1. Work includes, but is not limited to, the following:
 - a. Thermostats and Sensors
 - b. Control Valves and Actuators
 - c. Control Dampers and Actuators
 - d. Software (both Application and Programming)
 - e. Wiring of Control Devices
 - f. Control Devices
 - g. Sequence of Operation
 - h. Variable Frequency Drives (VFD's)
 - i. I/O Devices, Transducers
 - j. Relays and Switches
 - k. Control Panels and Cabinets
 - l. Application Specific Controllers
 - m. Hardware, Microprocessors, Controllers
 - 2. Work Related and Specified Elsewhere:
 - a. Section 23 00 00 – Heating, Ventilation and Air Conditioning

1.3 DEFINITIONS

- A. DDC: Direct Digital Control
- B. GUI: Graphical User Interface.
- C. I/O: Input/Output.

- D. BACnet: Building Automation and Control Network.
- E. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
- F. MS/TP: Master Slave/Token Passing.
- G. PC: Personal Computer.
- H. RTD: Resistance Temperature Detector.
- I. FMCS: Facilities Management Control System.
- J. VFD: Variable Frequency Drive.
- K. ATC: Automatic Temperature Controls.

1.4 QUALITY ASSURANCE

A SPECIFICATION COMPLIANCE REVIEW

1. The Contractor shall supply, at the time of bid opening, a paragraph by paragraph specification compliance report. The report shall indicate for each numbered paragraph, how the contractor meets the criteria of the paragraph. The following format must be utilized in completing the compliance report:
 - a. Comply - without exception.
 - b. Qualify - meet the functional intent. For each paragraph, the contractor shall identify all differences in specific functions stated in the given paragraph and provide a description of what is excluded or how the qualifying system will meet the function specified.
 - c. Does not comply – cannot meet specified function.
2. The control systems shall be installed under the direct supervision of the control manufacturer. The manufacturer shall provide instruction and direct work in progress and shall assume complete responsibility for the final installation. The control manufacturer shall perform all tests and make the necessary adjustments, and provide free service of the installation for one year from the date of acceptance by the National Park Service.

1.5 SUBMITTALS

- A. Refer to Division 01 General Requirements for submittal requirements.
- B. Submit the following for approval:
 1. Automatic temperature control system components.
 2. Written descriptive sequence of operation for all equipment.
 3. System configuration diagrams in simplified block format.
 4. Input/Output point and alarm point summary listing.
 5. Electrical drawings/wiring diagrams showing all system internal and external connection points, terminal block layouts and terminal identification.

6. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
7. Overall system operation and maintenance data/instructions, including preventive maintenance and troubleshooting instructions.
8. Complete recommended spare parts list.
9. Provide failure analysis report to Contracting Officer for review.
10. Schedule of dampers including size, leakage, and flow characteristics.
11. Schedule of valves including flow characteristics.

C. Drawings shall be standard sizes (22 inches x 34 inches) or (11 inches x 17 inches).

PART 2 – PRODUCTS

2.1 DIRECT DIGITAL CONTROLS (D.D.C.)

A. Main Components and Features:

1. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system. The FMCS requires the incorporation of LonWorks Technologies using Free Topology Transceivers (FTT-10), and specific conformance to the LONMARK Interoperability Association's v3.0 Physical and logical Layer guidelines in all unitary, terminal unit and other devices.
2. LonTalk communications protocol will be used on the communication network between FMCS controllers and other LonWorks devices to assure interoperability between all devices within the network.
3. The FMCS shall support the direct integration of standard and non-standard communicating systems. At a minimum, the FMCS shall deliver connectivity at the Lon, IP, and HMI levels through standard offerings. The FMCS shall offer as a standard available solution, a minimum of 300 individual communicating interfaces to 3rd party products.
4. The FMCS shall provide a standard available test kit for development of additional interfaces by others, in addition to the FMCS manufacturer.
5. The FMCS shall provide compliance with the ASHRAE standard 135-P for BACnet interoperability with all devices within the FMCS.
6. The FMCS shall provide a high-speed Network Interface that shall plug directly into the controller node which supports one of the following types of communication standards between controller nodes:

Ethernet: The intent for this project is to utilize the facility Ethernet LAN as the FMCS communications backbone between the area controllers and the thin clients.

The Network Interface shall employ Carrier Sense Multiple Access/Collision Detect (CSMA/CD) contention type protocol, which adheres to the industry standard format IEEE 802.3. The content of messages shall be the manufacturer's standard. The Network Interface shall be fully Internet Protocol (IP) compliant allowing connection to currently installed IEEE 802.3 compliant Ethernet Networks.

The Network Interface shall directly support connectivity to a variety of cabling types. As a minimum provide the following connectivity: 10Base2 (ThinNet RG-58 A/U Coaxial cabling with BNC connectors), 10BaseT (Twisted-Pair RJ-45 terminated UTP cabling).

Echelon: The FMCS shall employ LonTalk communications utilizing the LonWorks Neuron chip on the device bus, which conforms to the International Standards Organization's (ISO) seven layer Open Systems Interconnect (OSI) network protocol model. The content of messages shall be the manufacturer's standard. The Neuron chip and a transformer-isolated transceiver shall provide for 78.8kbps communications over Category 4 Unshielded Twisted Pair (UTP) cabling.

To facilitate facility expansion or to support large Wide Area Networks (WANs) the Network Interface shall directly support a minimum of 4 logical networks using the same physical network (Ethernet or Echelon). Each logical network shall support a minimum of 126 controller nodes.

The ability to support bi-directional access to remote controller nodes shall be supported by a single point of connection. The ability to monitor and edit system data shall be provided via the controller node remote communications connection. Connection via the HMI, the GP as well as a standard VT-100 terminal interface shall be provided. Support for solicited as well as unsolicited communications is a requirement.

Other Requirements:

Each stand-alone digital control cabinet shall be programmable through the hand held operator terminal or C.P.I. terminal. Software architecture shall allow both standard setups of point types, EMS Programs, loops of related parameters as well as custom program linking with math and logic. In addition, the network shall allow the building operations a means of interrogating input/output sensor conditions, such as interrogating the values of analog sensor input upon request, or the status of control via the standard keyboard and display unit, or the P.C.I. terminal unit.

All programming shall allow a minimum of three levels of entry with code requirements; level one for general data entry; level two for overall system entry; level three for programming.

B. DDC Sensor (for all DDC controllers)

1. The DDC Sensor shall connect directly to the DDC Controller and shall not utilize any of the I/O points of the controller. The DDC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The DDC Sensor shall provide a communications jack for connection to the LON communication trunk to which the DDC controller is connected. The DDC Sensor, the connected controller, and all other devices on the LON bus shall be accessible by the Graphical Programming tool. The DDC Sensor shall be supplied in the following variations:
 - a. Tamper-resistant (no display)
 - b. Tamper-resistant with tenant override
 - c. Basic user functions (LCD display and setpoint adjustment and tenant override)
 - d. Full user functions (LCD display and network-variable access and tenant override)
 - e. ASHRAE 95 compliance (LCD display and sub-base functionality)
2. The DDC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering. The DDC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering. User interface with the DDC Sensor shall be provided as a configurable function by the FMCS, and shall offer password protection for access to

network variable editing. Multiple network variables shall be accessible and editable by the DDC Sensor. Icons shall be utilized to represent sensor and controller function status, affording independence from a single language for use interface.

C. INTEROPERABLE LONMARK CONTROLLERS (ILC)

1. Controls shall be microprocessor based Interoperable LONMARK Controllers (ILC), bearing the applicable LONMARK interoperability logo on each product delivered. ILCs shall be provided for Heat Recovery Ventilators, Fan Coils, and other applications as shown on the drawings. ILCs shall be based on the Echelon Neuron 3150 microprocessor working from software program memory which is physically located in the ILC. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals.
2. To simplify controls and mechanical service troubleshooting, the ILC shall be mounted directly in the control compartment of the unitary system. The ILC shall be provided with a sheet metal or polymeric enclosure that is constructed of material allowing for the direct mounting within the primary air stream, as defined by UL-465. The direct mounting shall allow all controls maintenance and troubleshooting to be made while at the unitary equipment.
3. The ILCs shall communicate with the GUI at a baud rate of not less than 78.8K baud. The ILC shall provide LED indication of communication and controller performance to the technician, without cover removal.
4. The ILCs shall be fully supported and communicate with any and all GUI(s) on the bus.
5. The ILC shall provide a -40 to 140 degree Fahrenheit ambient operating temperature range. The ILC shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of any of the ILC electronics. ILC devices that require the electronics to be present at the time of wiring, will require an additional controller to be provided for every 10 devices on the drawings, to allow for the preconfiguration and storing for service purposes.
6. All input/output signals shall be directly hardwired to the ILC. For all non-VAV terminal applications, a minimum of two input points of the ILC shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If universal points are not available, a minimum of two input points (each) of the dry contact, resistive and analog voltage/current types must be provided on every controller. The outputs of the ILC shall be of the relay and universal analog form. All digital outputs shall be relay type. ILC devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices. Configuration of all I/O points shall be accomplished without physical hardware jumpers, switches or settings. Troubleshooting of input/output signals shall be easily executed with the Graphical Programming tool (GP) or a volt-ohm meter (VOM). All I/O points shall be utilized by the local ILC or shall be available as I/O points for other controllers throughout the network.
7. All ILCs shall be fully application programmable and shall at all times maintain their LONMARK certification. All control sequences within or programmed into the ILC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
8. The Contractor shall be provided with the ability to interface with the Graphical Programming tool. The interface port shall be provided at the wall sensor or within the unitary equipment, as specified on the plans. The interface port shall allow the GP to have full functionality as described in GP section of this specification. Through the connected

controller all ILC devices on the LON bus shall be accessible by the Graphical Programming tool.

9. Mechanical equipment manufacturers desiring to provide ILC type controls as factory mounted equipment shall provide a separate bid for their products less all controls, actuators, valve assemblies and sensors, which are specified to be provided by the FMCS contractor.

D. INTEROPERABLE DIGITAL CONTROLLERS (IDC)

1. Controls shall be microprocessor based Interoperable LonWorks Digital Controllers (IDC), providing interoperability with all LONMARK and LonWorks devices. IDCs shall be provided for any equipment applications as required, as shown on the drawings. IDCs shall be based on the Echelon Neuron Hosted microprocessor architecture, working from software program memory that is physically located in the IDC. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals.
2. All IDCs shall be fully application programmable utilizing graphical objects. All control sequences programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained. Systems that only allow selection of sequences from a library or table are not acceptable.
3. The IDC shall be provided with the ability to interface with the Graphical Programming tool. The interface port shall allow the GP to have full functionality as described in GP section of this specification. Through the interface port all IDC devices on the LON bus shall be accessible by the Graphical Programming tool.
4. The IDCs shall communicate with the SDC at a baud rate of not less than 78.8K baud. The IDC shall have as a minimum ambient operating temperature range of 32 to 122°F.
5. The IDC shall be fully supported by the Graphical User Interface (GUI).
6. All input/output signals shall be directly hardwired to the IDC. All controllers shall employ a universal input configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current-sourced inputs. If universal points are not available, a minimum of one spare input point (each) of the dry contact, resistive and analog voltage/current types must be provided for each input point utilized. IDC devices shall provide digital and analog output types and quantities consistent with the requirements of the application requirements. Troubleshooting of input/output signals shall be easily executed with the Graphical Programming tool or a volt-ohm meter (VOM). All I/O points shall be utilized by the local ILC or shall be available as I/O points for other controllers throughout the network.
7. To simplify controls and mechanical service troubleshooting, the IDC shall be mounted directly in or on the control compartment of the air handling system. The IDC shall be provided in a NEMA 1 enclosure to accommodate direct mounting on the equipment to be controlled. The IDC shall be constructed in a modular orientation such that service of the failed components can be done quickly and easily. The modular construction should limit the quantities of printed circuit boards to a maximum of two. All logic, control system, power supply and input/output circuitry shall be contained on a single plug-in circuit board. All wiring terminations shall be made to serviceable connections allowing controller reconfiguration without the removal of any terminated wires. This shall allow all controls maintenance and troubleshooting to be made while at the air handling unit. The IDC shall be directly wired to sensory devices, staging relays or modulating valves for heating and cooling.
8. The Contractor shall provide and field install all IDCs specified under this section. Mechanical equipment manufacturers desiring to provide IDC type controls as factory

mounted equipment shall provide a separate bid for their products less all controls, actuators, valve assemblies and sensors, which are specified to be provided by the BAS/Temperature control contractor.

2.2 GRAPHICAL USER INTERFACE SOFTWARE

A. OPEN ARCHITECTURE, BROWSER BASED GUI

1. A graphical user interface shall be included with the host computer system software. This user interface shall allow, with proper password access, full interaction with the system including, but not limited to, viewing, and modifying data, database administration, configuration of communications parameters, password and security administration, programming and configuration of objects, receipt, routing and acknowledgement of alarms, and development of graphic screens.
2. The user interface shall employ browser-like functionality for ease of navigation. It shall include a tree view for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation techniques similar to those in a commercially available Web Browser. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
3. Graphic screens shall be developed using any drawing package capable of generating a .GIF, .BMP, or .JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of, a graphic background, the user interface shall support the use of scanned pictures.
4. Graphics developed for the user interface shall be capable of being used by a standard Web Browser client, without the need to develop additional graphic screens specifically for the Web Browser. Graphics used by the Web Browser client(s) shall be capable of being edited using a standard HTML document editor.
5. Graphic screens shall have the capability to be overlaid with text, real-time values, command and adjust, animation, color spectrum, logs, graphs, HTML document links, and schedule graphic objects, as well as links to other graphic screens.
6. Modifying common application objects, such as schedules, calendars, and setpoints shall be accomplished in a graphical manner.
7. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
8. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.
9. Commands issued to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
10. Adjustments to analog objects, such as setpoints, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
11. The graphic screens shall be three dimensional and contain all of the points associated with the equipment being controlled. Provide the ability to change setpoint and monitor equipment running status. Provide a sample of graphic screens to the Contracting Officer for his review before final design of the graphic screens. Modification of the graphic screen, if required by the Contracting Officer, shall be done at no cost.

B. ALARM CONSOLE

1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm.
2. A separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

C. WEB BROWSER CLIENTS

1. The system shall be capable of supporting an unlimited number of clients using a standard Web Browser such as Internet Explorer™. Systems requiring additional software resident on the client machine or manufacture-specific browsers shall not be acceptable.
2. The Web Browser client shall support at a minimum, the following functions: User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed.

Graphical screens developed for the GUI shall be the same screens used for the Web Browser client. Storage of the graphical screens shall be in the system, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

Depending on user access privileges, the user shall be able to view data, modify and command objects such as start/stop, and adjust setpoints. In addition, users can be provided with the ability to view logs and view and acknowledge alarms.

3. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. The capability to limit the user to just their home page shall be provided. From the home page, links to other views, or pages in the system shall be possible.
4. Graphic screens on the Web Browser client shall support hypertext links to other Web pages on other Internet or Intranet sites.

D. OBJECT LIBRARIES

1. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
2. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
3. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
4. The library shall include applications or objects for the following functions:
Scheduling Object: Provide a BACnet compliant, 7-day plus holiday & temporary scheduling object to allow for a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on/off events.

Calendar Object: Provide a BACnet compliant 12-month calendar object to allow for holiday or special event data entry. Data entry to be by graphical “point-and-click” selection. This object must be “linkable” to any or all scheduling-objects for effective event control.

Duty Cycling Object: Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals

Temperature Override Object: Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.

Start-Stop Time Optimization Object: Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building’s “flywheel” effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day’s performance.

Demand Limiting Object: Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment setpoints to affect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the setpoint, a message shall be displayed on the users’ screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

5. At a minimum, the library shall include services to support LonWorks and BACnet networks.
6. The library shall include control objects for the following functions at a minimum: Analog Input Object: Minimum requirement is to meet the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.

Analog Output Object: Minimum requirement is to meet the BACnet standard for data sharing.

Binary Input Object: Minimum requirement is to meet the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of

time the hardware input is in an “on” condition. The user must be able to specify either input condition as the “on” condition.

Binary Output Object: Minimum requirement is to meet the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme must also be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing this contention resolution shall not be acceptable.

PID Control Loop Object: Minimum requirement is to meet the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral, and derivative control.

Comparison Object: Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.

Math Object: Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.

Custom Programming Objects: Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.

Interlock Object: Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

Temperature Override Object: Provide an object whose purpose is to provide the capability of overriding a binary output to an “On” state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.

Composite Object: Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the “contained” application that are represented on the graphical shell of this container.

7. The object library shall include objects to support common LonMark devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering.

2.3 MONITORING AND TREND LOGGING

- A. Provide hardware, software, and programming for monitoring and trend logging of mechanical and electrical systems necessary for facility operators and commissioning entities to easily diagnose problems and verify that systems are operating according to design intent.
 1. Sensor to monitor and trend (create trend logs) at the operator interface controlled variables (i.e., air flow, water flow, temperature, pressure, CO₂, pump speed, and fan speed).
 2. Sensors to trend outdoor air temperatures.
 3. Sensors to monitor and trend equipment status for all equipment with motors greater than ½ HP.
 4. Indication and trending of damper and valve command position.
 5. Sensors to monitor building electrical and fuel demand and consumption.
 6. Sensors to monitor indoor and outdoor CO₂.
- B. Provide point’s matrix including all hardwired input and output devices connected to the automation system, all setpoints, upper and lower control limits.
- C. Trend requirements to include a trend point list and a preprogrammed sample of points, sample rate, storage interval, upload interval, custom trend capabilities, alarms, and automated trend data review and notification.
- D. System architecture shall be capable of allowing sampling of these points to facilitate building commissioning and diagnostics without significantly affecting system performance.
- E. Data storage shall be provided with adequate capacity to record trend data for use by building operators. Data export requirements must facilitate user-friendly data access and manipulation.
- F. Operator interface shall be designed for remote web access, monitoring requirements, trend-log reporting, and diagnosing building problems through a user-friendly interface. Provide visual (non-text based) operations and reporting interface to facilitate rapid system assessment that utilizes color coding, diagrams of floor plans and graphing capabilities.

2.4 CONTROL PANELS

Wherever three or more manual switches, relays, controllers, or other control devices (not including room thermostats or duct-mounted instruments) are required for a ventilating unit or system, such devices shall be grouped and mounted in a control panel. Panels shall be made of enameled steel. Panels shall be secured to walls or unit casings with sufficient space in the rear for access to wiring, etc.

2.5 AUTOMATIC DAMPERS

All automatic dampers shall be furnished under this paragraph. Automatic dampers shall be constructed and installed in accordance with the following specifications:

- A. Damper Blades: All automatic dampers shall be of the balanced type, factory-fabricated, with galvanized steel blades fully gasketed, mounted horizontally in welded steel frames. Damper blades shall be not lighter than 16 gauge steel, no more than eight inches wide, and shall have interlocking edges.
- B. Modulating Dampers: All modulating dampers shall be of the opposed blade type.
- C. Damper Size and Bearings: Damper blades shall have steel trunnions mounted in oil-impregnated bearings. Dampers shall be not more than 48" in length between bearings.
- D. Frames: Damper frames shall be of welded channel or angle-iron, with heavy steel corner gussets and braces or stiffened with steel tie-rods where necessary. Frames shall be painted with aluminum paint to insure against rusting.
- E. All dampers shall be guaranteed to close tight, and shall provide substantially the full area of the opening when open. All outdoor air intakes and all exhaust ducts to outside shall have damper blades with gasketed seats of low leakage design.
- F. Damper Linkages: Damper-operating links shall be steel or brass rods, adjustable in length with ball and socket joints and of such proportions that they will withstand without appreciable deflection, a load equal to not less than twice the maximum operating force of the damper motor.

2.6 DIRECT DIGITAL CONTROL (D.D.C.) OF OPERATORS

- A. General: Direct control capability using a custom control program, manual command, or time program initiated commands shall be provided as standard features of this system. It shall be possible to input a sensor or group of sensors to the D.C.C. unit, process the data using the features of a Custom Control Program, and output an analog control signal or setpoint directly to a controlled valve or damper. It shall not be necessary to provide intermediate controllers to condition the signal for the valve or damper actuator. The output signal shall be scaled in software to be compatible with industry standard control signal variables, such as three (3) to six (6) volts, six (6) to nine (9) volts.
- B. Main Components and Features:
 - 1. Motors: For each automatically-controlled damper or valve, a suitable damper motor or motors shall be provided in accordance with the following specifications:
 - a. Operator: Motors shall be of the fully proportioning type, non-hydraulic. The motor shall have a rating of not less than twice the thrust needed for actual operation of the damper or valve.
 - b. Adjustments: Motor shall have adjustable stops to adjust the open and closed positions and adjustable return spring on damper motor.
 - c. Mounting: Damper motor shall be provided with suitable mounting base and frame. The damper motor and mounting base shall not be mounted directly on cold or insulated ducts and casings, but shall be mounted outside the insulated covering in such a manner as to prevent sweating and interference with the insulation.

2. Sensors: Linear precision resistance elements and resistance averaging elements shall be provided for temperature sensing. Their range shall be -50 to 250 degrees Fahrenheit with an accuracy of +/- 0.5 degrees Fahrenheit.

2.7 AUTOMATIC CONTROL VALVES

- A. Automatic control valves shall be furnished as follows:
 1. Valves shall have removable composition discs and with Monel stem. Bodies 2" or smaller shall be bronze with screwed ends. Bodies 2-1/2" and larger shall be cast iron with flanged ends. Valve bodies, trim, and stuffing boxes shall be designed for not less than 125 psi working pressure. Valve packing shall be non-lubricated Teflon packing.
 2. Shall be fully proportioning as herein before described under operators.
 3. Water valves shall be sized for approximately 2 psi drop.

2.8 ROOM CONTROLLERS

- A. The Contractor shall provide and install room controllers that perform the following functions:
 1. Room temperature sensing with display.
 2. Setpoint temperature with display.
 3. Unoccupied override button.
- B. Thermostats/sensors shall be securely attached to a suitable base mounted on the wall or other building surface. Each sensor shall be located where shown or, if not shown, where it will respond to the average temperature in the room. Sensors generally shall be mounted 4 feet above floor and shall not be mounted on outside walls or partitions between offices if other locations are possible. If located on outside wall, it shall have an insulated base.
- C. Provide guards for all thermostats/sensors with approved security fastening system where subject to abuse such as classrooms, corridors, etc.
- D. Thermostats/sensors without displays and/or override may be used in unoccupied spaces only as approved by the Contracting Officer.

2.9 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
 1. Accuracy: Plus or minus 0.5°F at calibration point.
 2. Wire: Twisted, shielded-pair cable
 3. Insertion Elements in Ducts: Single point, 8" long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
 4. Averaging Elements in Ducts: 18" long, rigid; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
 5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2".

6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- C. Equipment operation sensors as follows:
1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5" wg.
 2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
 3. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
- D. Electronic Valve/Damper Position Indication: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- E. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vapor-proof type.
- F. Humidistats: Humidity Sensors: Bulk polymer sensor element.
1. Accuracy: 5 percent full range with linear output.
 2. Room Sensor Range: 20 to 80 percent relative humidity.
- G. Occupancy Sensors: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180° field of view with vertical sensing adjustment, for flush mounting.
- H. CO2 Sensors: Carbon-Dioxide Sensor and Transmitter: Single detectors, using solid-state infrared sensors, suitable over a temperature range of 23 to 130°F, calibrated for 0 to 2 percent, with continuous or averaged reading, 4 to 20 mA output, and wall mounted.

2.10 THERMOSTATS

- A. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable setpoint.
- B. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type, with adjustable setpoint in middle of range and adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- C. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12" of bulb length is equal to or below setpoint.
1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- D. Electric High-Limit Duct Sensor/Discharge Sensor.
- E. DDC Thermostat with LED/LCD readout, setpoint, and manual override.

2.11 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment".
 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 3. Nonspring-Return Motors for Valves Larger than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 4. Spring-Return Motors for Valves Larger than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
 5. Nonspring-Return Motors for Dampers Larger than 25 sq. ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 6. Spring-Return Motors for Dampers Larger than 25 sq. ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 2. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 in.-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 in.-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 in.-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3in.-sq. ft. of damper.
 - e. Dampers with 2- to 3-inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 3. Coupling: V-bolt and V-shaped, toothed cradle.
 4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 6. Power Requirements (Two-Position Spring Return): 24-Vac.
 7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
 8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2-0 to 10-V dc position feedback signal.
 9. Temperature Rating: Minus 22 to plus 122°F.
 10. Temperature Rating (Smoke Dampers): Minus 22 to plus 250°F.
 11. Run Time: 30 seconds.

2.12 CONTROL VALVES

Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

2.13 VARIABLE FREQUENCY CONTROLLERS (VFD's)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
1. Cerrus Industrial.
 2. Eaton Corp.: Cutler-Hammer Products.
 3. Emerson Industrial Automation.
 4. General Electric Distribution & Control.
 5. Yaskawa Electric America, Inc. (MagneTek Drives and Systems).
 6. Square D Co.
- B. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of a NEMA MG 1, Design B, 3-phase, premium-efficiency induction motor by adjusting output voltage and frequency. Units shall be provided with main power disconnect.
- C. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power transmission connection.
- D. Output Rating: 3-phase, 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
- E. Unit Operating Requirements:
1. Input ac voltage tolerance of 380 to 500 V, plus or minus 10 percent.
 2. Input frequency tolerance of 50/60 Hz, plus or minus 5 percent.
 3. Capable of driving full load, under the following conditions, without derating:
 - a. Ambient Temperature: Minus 10 to 40°C.
 - b. Humidity: Less than 95 percent (non-condensing).
 - c. Altitude: 3300 feet.
 4. Minimum Efficiency: 96 percent at 60 Hz, full load.
 5. Minimum Displacement Primary-Side Power Factor: 98 percent.
 6. Overload Capability: 1.5 times the base load current for 60 seconds.
 7. Starting Torque: 150 percent of rated torque or as indicated.
 8. Speed Regulation: Plus or minus 1 percent.
 9. Isolated control interface to allow controller to follow control signal over a 40:1 speed range.
- F. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 3. Acceleration: 2 to a minimum of 1 second.
 4. Deceleration: 2 to a minimum of 1 second.
 5. Current Limit: 50 to a minimum of 100 percent of maximum rating.
- G. Self-Protection and Reliability Features:
1. Under- and overvoltage trips; inverter to overtemperature, overload, and overcurrent trips.

2. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 20 performance.
 3. Instantaneous line-to-line and line-to-ground overcurrent trips.
 4. Reverse-phase protection.
 5. Short-circuit protection.
 6. Motor overtemperature fault.
- H. Automatic Reset and Restart: To attempt ten restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
- I. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
- J. Torque Boost: Automatically vary starting and continuous torque to at least 1.5 times the minimum torque to insure high-starting torque and increased torque at slow speeds.
- K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled fan-ventilated motors at slow speeds.
- L. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
1. Power on.
 2. Line fault.
- M. Alphanumeric Display: Liquid-crystal type, 16 characters, minimum.
- N. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- O. Indicating Devices: Digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
1. Output frequency (Hz).
 2. Motor speed (rpm).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Fault or alarming status (code).
 7. PID feedback signal (percent).
 8. DC-link voltage (VDC).
 9. Setpoint frequency (Hz).
 10. Motor output voltage (V).
- P. Control Signal Interface: Provide from VFC Lon interface communications module, with the following:
1. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from other controls systems:
 - a. 0 to 10-V dc.

- b. 4 to 20 mA.
- c. Keypad display for local hand operation.
- 2. Output Signal Interface:
 - a. A minimum of 1 analog output signal (4-20 mA), which can be programmed to either of the following:
 - 1) DC-link voltage (VDC).
 - 2) Setpoint frequency (Hz).
- 3. Remote Indication Interface: A minimum of 2 dry circuit relay output (120-V ac, 1 A) for remote indication of the following:
 - a. Motor running.
 - b. Setpoint speed reached.
 - c. Fault and warning indication (overtemperature or overcurrent)
 - d. PID high or low speed limits reached.

Q. Communications: Provide a LON communications card allowing VFC to be used with an external system within a multidrop LAN configuration. Provide capability for VFC to retain these settings within the nonvolatile memory. LON communications module connected directly with LON communications bus for information and programming.

R. Accessories:

- 1. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- 2. Control Relays: Auxiliary and adjustable time-delay relays.
- 3. Standard Displays:
 - a. Output frequency (Hz).
 - b. Setpoint frequency (Hz).
- 4. Motor current (amperes).
 - a. Motor full-load current (amperes).
 - b. DC-link voltage (VDC).
 - c. Motor torque (percent).
 - d. Motor speed (rpm).
 - e. Motor output voltage (V).
 - f. Motor output power (kW).
 - g. Status: Forward or reverse.
- 5. Historical Logging Information and Displays.
- 6. Total run time.
- 7. Fault log, maintaining last four faults.

2.14 TRAINING

- A. Provide 8 hours of training for the building operators. This training shall be "hands- on" type at the site. A mutual agreement on the scheduling of this training class will be made between the National Park Service and the ATC contractor. The intent of this training is that four (4) hours of training will occur before the National Park Service accepts the system; the rest is to follow after the National Park Service has accepted beneficial use.
- B. The training classes will use the actual Operator manual that will be submitted for this project.

PART 3 – EXECUTION

3.1 SYSTEM INSTALLATION

General: The control equipment and connecting wiring shall be installed in a neat and workmanlike manner by trained mechanics under direct supervision of the control contractor, conforming to all applicable state and local codes.

3.2 LABELING

- A. All inputs and outputs, devices, panels, gauges, wires and bus cables shall be labeled with the device being controlled, function, range, and device destination. Orange tags shall be tied to all cable adequately spaced to facilitate recognition of cables.
- B. The EMS Contractor shall provide system block diagram showing all major components including identification numbers and location.
- C. Provide laminated wiring diagrams affixed in all DDC control panels.

3.3 CALIBRATION AND ADJUSTMENTS

After completion of the installation, perform final calibrations and adjustments of the equipment provided under this contract and supply services incidental to the proper performance of the EMS.

3.4. WIRING

- A. Under this section provide and install all wiring associated with the temperature control system. Equipment and wiring not provided under electric sections shall be furnished and mounted under this section.
 - 1. Low voltage control wiring (24V) shall be Type THHN stranded No. 16 or multiconductor No. 18 or better.
 - 2. Communication wiring shall be Lon compliant Category 4 or 5 twisted unshielded pair.
 - 3. Line voltage wiring (120V or higher) shall be No. 12 minimum and run in conduit.
 - 4. All wiring shall be in accordance to Division 16 - Electrical.
 - 5. Exposed wire in mechanical rooms shall be in conduit. Concealed wire shall be plenum grade, run together and supported every 4 feet. All wiring shall be run at right angles to the building. Drops down walls shall be in conduit.

3.5 SEQUENCE OF OPERATION

A. GENERAL

- 1. Ventilation system shall be comprised of air-to-air heat recovery air handler(s) and exhaust fans.

2. Room/Area cooling systems shall be ductless split system type with operating controls independent of the ERV system.

B. OCCUPIED-UNOCCUPIED CONTROL

1. Occupied-Unoccupied control shall be a function of the DDC software in the Building Management System (BMS). Provide scheduling from front end graphics with full 365 day calendar functions and holiday scheduling. Coordinate with Contracting Officer for all holidays prior to final acceptance.
2. Front end graphics shall provide separate schedules for each piece of equipment accessible from the respective system graphics with the option of selecting an individual schedule for that system, or the master schedule for the building. Occupied/unoccupied network variables shall be sent to the respective controller on the Lon network.

C. ENERGY RECOVERY UNIT AND ELECTRICAL DUCT COIL (ERV-1 AND ERV-2)

1. Energy Recovery Unit shall operate from the DDC System in conjunction with its own internal controls. Unit shall be provided with a control panel. The contractor shall be responsible to mount panels and provide ATC wiring.
2. Occupied:
Energy Recovery Unit to be enabled by BMS. Intake and exhaust air duct M.O.D.s (Motor Operated Dampers) shall open. The ERV shall ramp up to high speed as required to maintain a maximum CO₂ level (CO₂ level adjustable by the BMS) in the spaces with wall mounted CO₂ sensors. Refer to drawings for sensor locations.
3. Unoccupied:
Energy Recovery Unit to be disabled by BMS. Intake and exhaust air duct M.O.D.s shall close.

Override shall be interlocked through the BMS to return the HRV to occupied mode for a three-hour time period, at which time the systems shall return to unoccupied mode unless the timer is indexed again. The BMS shall be able to select which Room Controllers have the ability to override ERV operation as determined by the National Park Service.

4. Control points to be provided and shown at the BMS include:
 - a. Enable, Disable, and Override.
 - b. Discharge Temperatures (before and after duct coil).
5. The ERV Air Handling Unit Duct Coil will be energized by a signal from the BMS. The coil shall maintain a 70° discharge temperature (adjustable through the BMS). Control and monitoring of the coil position and discharge air temperature will require a separate communication to the BMS (not part of the ERV Controls System). Control Points to be provided and shown at the BMS are as follows:
 - a. Discharge air temperature.
 - b. Duct coil status.
 - c. Unoccupied Override.
 - d. Mode (Occupied/Unoccupied)

D. EXHAUST FANS

1. Exhaust fans to be controlled by DDC system.
2. Occupied, exhaust fans to be enabled by BMS.
3. Unoccupied, exhaust fans to be disabled by BMS.

3.6 COMPLETION

- A. Guarantee: The entire system shall be complete in every respect and guaranteed by the Contractor against original defects in workmanship or materials for a period of one year from date of final certificate, to control all valves so as to maintain temperature within one degree above or below any desired point. The Contractor shall maintain the equipment in perfect working order for the guarantee period without additional charge.
- B. Instruction and Adjustment: On completion of the job, the Contractor shall completely adjust, ready for use, all sensors, valves, and relays provided under his contract. The Contractor shall provide a complete instruction manual covering the function and operation of all control components on the job and a schematic control diagram. This manual shall be furnished to the National Park Service operating personnel, and a competent technician shall be provided for instruction purposes for one (1) day minimum. Submit shop drawing for approval before start of installation.
- C. Testing: A minimum of two technicians for at least two (2) days minimum for testing procedures. Prior to the final inspection, perform required tests and submit the reports and records along with final readings with technicians signed certification of compliance. The following shall be done as a minimum:
1. Verify every point in the system and record findings with one technician at a DCC panel to operate a point command and the other to observe the point and ensure function has been carried out.
 2. Confirm and record all temperatures being correctly read within acceptable tolerance.

END OF SECTION 23 09 00

SECTION 23 23 00 - REFRIGERANT PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. General: Provide and install refrigerant piping system shown on drawings and specified in this Section. Work in this Section includes complete operating charge of refrigerant for each system.

1.3 QUALITY OF COMPLIANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of refrigerant piping products of types, materials, and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with refrigerant piping work similar to that required for project.
- C. Codes and Standards:
 - 1. ANSI Compliance: Fabricate and install refrigerant piping in accordance with ANSI B31.5, "Refrigeration Piping" and extend applicable lower pressure limits to pressures below 15 psig.
 - 2. ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration".
- D. Submittals: Product Data: Submit Manufacturer's Technical Product Data and Installation Instructions for Refrigerant Piping Materials and Products. See Section 22 00 00, "Plumbing General Provisions" and 23 00 00 "Heating, Ventilation, and Air Conditioning".

PART 2 – PRODUCTS

2.1 PIPING

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigerant piping system and maximum design pressures. Provide sizes and types matching piping and equipment connections. Provide fittings of materials that match pipe materials used in refrigerant piping systems. Where more than one type of materials or products is indicated, selection is Installer's opinion.

- B. Tube Size 4-1/8" and Smaller: Copper tube, Type ACR, hard-drawn temper, wrought-copper, solder-joint fitting, and soldered joints.
- C. Soldered Joints: Solder Joints using silver-lead solder, ASTM B 32, Grade 96 TS.
- D. Brazed Joints: Braze joints using American Welding Society (AWS) classification for brazing filler metal.

2.2 PIPE SUPPORTS

- A. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.
- B. Two-bolt riser clamps for vertical piping supports.
- C. Concrete inserts, C-clamps, and steel brackets for building attachment.
- D. Protection shields for insulated piping support in hangers.
- E. Copper flashings for piping penetrations.

2.3 REFRIGERANT SPECIALTIES

- A. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300°F (149°C) temperature rating, 500 psi working pressure.
- B. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-Listed, 200°F (93°C) temperature rating, 500 psi working pressure.
- C. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
- D. Acceptable Manufacturers:
 1. ALCO
 2. Henry Valve Company
 3. Sporlan Valve Company
- E. Refrigerant piping shall be insulated with closed cell elastomeric foam insulation. Material shall be 1-1/2" wall thickness and be UV resistant. Equal to AP/Armaflex™ by Armacell.

PART 3 – EXECUTION

3.1 GENERAL

Examine areas and conditions under which refrigerant piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLING REFRIGERANT PIPING

Install refrigerant piping with ¼" per foot (1%) downward slope in direction of coil return to compressor. Provide oil traps and double risers where indicated and where required to provide oil return.

3.3 CLEANING REFRIGERANT PIPING

Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil-soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.

3.4 BLEED DRY REFRIGERANT PIPING

Bleed dry nitrogen through refrigerant piping during brazing operations.

3.5 VALVES

Install refrigerant valves where indicated and in accordance with manufacturer's instructions. Remove accessible internal parts before soldering or brazing and replace after joints are completed.

3.6 SOLENOID VALVES

Install in refrigerant piping as indicated with stem pointing upwards.

3.7 CONNECTIONS

Connect refrigerant piping to mechanical equipment as indicated and comply with equipment manufacturer's instructions where not otherwise indicated.

3.8 LEAK TESTING

- A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5, "Refrigeration Piping".

Perform initial test with dry nitrogen using soap solution to test all joints. Perform final test with 27" vacuum and then 200 psi using halide torch. System must be entirely leak-free.

- B. Repair or replace refrigerant piping as required to eliminate leaks and retest as specified to demonstrate compliance.

3.9 DEHYDRATION AND CHARGING SYSTEM

- A. Install core in filter dryer after leak test but before evacuation.

- B. Evacuate refrigerant system with vacuum pump until temperature of 35°F (2°C) is indicated on vacuum dehydration indicator.
- C. During evacuation, apply heat to pockets, elbows, and low spots in piping.
- D. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
- E. Break vacuum with refrigerant gas and allow pressure to build up to 2 psi.
- F. Complete charging of system using new filter dryer core in charging line. Provide full operating charge.

END OF SECTION 23 23 00

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes back-draft dampers, duct access doors, volume control dampers, fire dampers, flexible duct connections and duct test holes.

1.2 REFERENCES

- A. NFPA 90A (National Fire Protection Association) - Installation of Air Conditioning and Ventilating Systems.
- B. NFPA 92A (National Fire Protection Association) - Smoke Control Systems.
- C. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.
- D. UL 33 (Underwriters Laboratories, Inc.) - Heat Responsive Links for Fire-Protection Service.
- E. UL 555 (Underwriters Laboratories, Inc.) - Fire Dampers and Ceiling Dampers.
- F. UL 555S (Underwriters Laboratories, Inc.) - Leakage Rated Dampers for Use in Smoke Control Systems.

1.3 SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit data for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of access doors test holes.
- B. Operation and Maintenance Data: Submit for Fire Dampers.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect dampers from damage to operating linkages and blades.

1.6 FIELD MEASUREMENTS

Verify field measurements prior to fabrication.

1.7 COORDINATION

Coordinate Work where appropriate with building control Work.

PART 2 - PRODUCTS

2.1 BACKDRAFT DAMPERS

- A. Product Description: Gravity Back-draft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturers standard construction.
- B. Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel, or extruded aluminum. Blades, maximum 6-inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Provide dampers with adjustment device to permit setting for varying differential static pressure.

2.2 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1-inch thick insulation with sheet metal cover.
 - 1. Less Than 12 inches square, secure with sash locks.
 - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.

2.3 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Splitter Dampers:
 - 1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
 - 2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.

3. Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch.
4. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware;
5. End Bearings: Except in round ductwork 2 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings. Provide closed end bearings on all ducts having a pressure classification over 2 inches wg.

C. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.4 FIRE DAMPERS

Shall have fusible links rated at 212°F. The dampers shall be UL approved for use in fire assemblies with ratings up to 2 hours. Equal to Ruskin Type CR or C. Provide access panels to all fire dampers. (Ruskin ADH-1)

2.5 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and SMACNA for Round Industrial Ductwork.
- B. Connector: Fabric crimped into metal edging strip.
 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 2. Net Fabric Width: Approximately 6 inches wide.
 3. Metal: 3 inch wide, 18 gage galvanized steel.
- C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
- D. On discharge: - for +2 WG static pressure.
On suction side: -for - 2 WG static pressure.
On suction side: - for - 8 WG static pressure (for exhaust tile piping).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify rated walls are ready for fire damper installation.
- B. Verify ducts and equipment installation are ready for accessories.

3.2 INSTALLATION

- A. Provide back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

3.3 CLEANING

- A. Vacuum clean coils and inside of unit cabinet.
- B. Install new throwaway filters in units at Substantial Completion.
- C. Ventilation units shall run two weeks before final cleaning to flush out all construction dust as required. Change all filters after final cleaning. Cleaning and unit flush out shall comply with ASHRAE Standard 62-2016 Ventilation for Acceptable Indoor Air Quality.

END OF SECTION 23 33 00

SECTION 23 72 00 AIR TO AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

Section Includes:

1. Fixed-plate total heat exchangers.

1.3 PERFORMANCE REQUIREMENTS

Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.
 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ARI Compliance: Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Rating Air-to-Air Energy Recovery Equipment."

- C. ASHRAE Compliance:
 - 1. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."
- D. NRCA Compliance: Roof curbs for roof-mounted equipment shall be constructed according to recommendations of NRCA.
- E. UL Compliance: Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators".

1.6 COORDINATION

- A. Coordinate layout and installation of air-to-air energy recovery equipment and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 WARRANTY

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

1.8 EXTRA MATERIALS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Filters: One set(s) of each type of filter specified.
- 2. Fan Belts: One set(s) of belts for each belt-driven fan in energy recovery units.

PART 2 - PRODUCTS

2.1 FIXED-PLATE TOTAL HEAT EXCHANGERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mitsubishi Electric Inc.

2. RenewAire LLC (Basis of Design).
 3. Nu-Air.
- B. Performance and Configuration: As Scheduled on the Drawings.
- C. Casing: Galvanized steel.
- D. Plates: Evenly spaced and sealed and arranged for counter airflow.
1. Plate Material: Chemically treated paper with selective hydroscopicity and moisture permeability, and gas barrier properties.
- E. Bypass Plenum: Within casing, with gasketed face-and-bypass dampers having operating rods extended outside casing.
- F. Supply and Exhaust Fans: Forward-curved, centrifugal fan with spring isolators and flexible duct connections.
1. Motor and Drive: Belt driven with adjustable sheaves, motor mounted on adjustable base.
 2. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
 5. Spring isolators on each fan having 1-inch static deflection.
- G. Extended-Surface, Disposable Panel Filters: (Outdoor Air and Exhaust Air streams)
1. Comply with NFPA 90A.
 2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 4. Factory-fabricated, dry, extended-surface type.
 5. Thickness: 2 inches.
 6. Arrestance (ASHRAE 52.1): 90.
 7. Merv (ASHRAE 52.2): 8.
 8. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid
- H. Indoor and Wiring: Fabricate units with space within housing for piping and electrical conduits. Wire motors and controls so only single point external connections are required during installation rip.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for electrical services to verify actual locations of connections before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install floor-mounted units on 4-inch- high concrete base.
- B. Install units with clearances for service and maintenance.
- C. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 CONNECTIONS

- A. Comply with requirements for ductwork specified in Division 23 Section "Metal Ducts."
- B. Install piping adjacent to machine to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Adjust seals and purge.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 4. Set initial temperature and humidity set points.
 - 5. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

- C. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 DEMONSTRATION

Engage a factory-authorized service representative to train National Park Service maintenance personnel to adjust, operate, and maintain air-to-air energy recovery units.

END OF SECTION 23 72 00

SECTION 23 83 33.1 - ELECTRIC RADIANT HEATERS - COMMERCIAL

PART 1 - GENERAL

1.1 SCOPE

- A. The Contractor shall furnish and install all electric heaters, and their controls as shown on the plans.
- B. The Contractor will submit shop drawings of all items furnished as described in this section.

PART 2 - PRODUCTS

2.1 BASEBOARD HEAT

- A. The electric baseboard heaters shall be 208/230 volt, 250 watts per foot, commercial type, UL listed, as scheduled on the plans, Stelpro Model ABA or better.
 - 1. Finish shall be Epoxy-Polyester Powdercoat.
 - 2. 22-gauge steel cabinet
 - 3. 11-gauge extruded aluminum with molded and curved end-caps.
 - 4. Thermal protection with automatic reset.
 - 5. Full length wireway.
- B. Element – single tubular, stainless steel sheathed element with boxed aluminum fins.
- C. Control – electronic wall thermostat, unless otherwise noted or scheduled.
 - 1. Built-in mechanical single pole or double pole thermostat.
 - 2. Low-voltage relay kit with transformer.
 - 3. Disconnect switch.
- D. Warranty – Five years. Lifetime on heating element.

2.2 ELECTRIC UNIT HEATER

- A. The electric unit heater shall be 208/230 volt, commercial type, as scheduled on the plans, Stelpro Model Oxford ASHU or better.
 - 1. Finish shall be Epoxy-Polyester Powdercoat.
 - 2. 18-gauge steel cabinet
 - 3. Adjustable louvers and protective screens
 - 4. Thermal protection with automatic reset
- B. Nichrome Element
- C. Control – electronic wall thermostat, unless otherwise noted or scheduled.
 - 1. Built-in mechanical single pole or double pole thermostat.

2. Low-voltage relay kit with transformer.
3. Disconnect switch.

D. Warranty – 3 Years

PART 3 - EXECUTION

3.1 HEATER INSTALLATION

- A. Surface mount electric heating units per manufacturer's instructions.
- B. Install wall mounted thermostats in outlet box 60" above finished floor, 48" in ADA spaces.
- C. Do not install baseboard units under wall receptacles.
- D. Coordinate controls with VRF controls.

END OF SECTION 23 83 33.1

DIVISION 26 – ELECTRICAL

SECTION 26 05 00 ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

- A. The work covered by this section includes the furnishing of all labor, material, equipment, and incidentals and the performing of all operations in connection with "electrical work" as indicated on the drawings and/or herein specified and including all incidental items to affect a finished and complete job even though such items are not shown or particularly mentioned herein. All work shall be subject to terms and conditions of the contract and applicable portions of the General Conditions and Special Conditions of the Specifications.
- B. All work and material shall be in strict accordance with those plans and specifications, even though they may be in excess of minimum requirements of applicable codes and regulations. The electrical work will include service entrances, metering, telephone, and power panels, lighting, cable TV systems, communications, etc.
- C. The work under this Division is divided into sections for convenience only, and it is not the intent to define or establish the limits of the work or responsibility of the Contractor to provide a complete workable job.
- D. The Contractor shall assume all responsibility to have thoroughly examined the drawings and design criteria including all addenda, facilities and conditions, taken all field measurements of related and connected work, and to have determined the entire scope of the work required for a finished and completed project, in accordance with the drawings and design criteria and as approved by the Contracting Officer. Any questions over conflicting information shown on the drawings and specifications shall be referred to the Contracting Officer for clarification. Any item or object omitted but clearly needed to make a system operate shall be furnished complete.

1.2 COLOR CODING

- A. All wiring except bare equipment grounding conductors shall be color-coded.
- B. The power wiring shall be color-coded with tape, red, blue, and black, for insulated conductors. The neutral shall be white or gray. Comply with National Electrical Code (NEC), Article 210. Use green or green with yellow stripe for equipment ground.

1.3 INCIDENTAL WORK

- A. Excavation, trenching, backfill, outdoor pole bases, cutting and patching by Contractor.
- B. Cost of Electric power during construction to be paid by Contractor.
- C. Finish painting by Contractor.

1.4 CODES, PERMITS, INSPECTIONS

- A. The installation shall comply with all laws applying to the electrical installation in effect at the site with regulations of any other governmental body or agency having jurisdiction, and with the regulations of the NEC where such regulations do not conflict with those laws.
- B. The communications conduits, panelboards and outlets shall be installed to conform with the requirements of the National Park Service and Communications Company. The Contractor shall verify work (as shown on plans and specified) with the Contracting Officer before installation.
- C. The Contractor shall obtain and pay for all permits required by the ordinances at the site. After completion of the work, the Contractor shall furnish to the Contracting Officer, a certificate of final inspection and approval from the authority having jurisdiction.

1.5 EXTRA WORK ORDERS - CREDITS

- A. No extra work will be paid unless authorized by the Contracting Officer in writing. Where extra work is required, the Contractor shall provide an itemized account for the work or materials involved and shall take into consideration any credits due or work omitted for any reasons. Estimates shall clearly list such omitted work with proper credit given for same.
- B. Amounts of credits for work omitted and/or substitutions shall be approved by the Contracting Officer. All credit submittals and approvals shall be in writing.

1.6 STANDARDS

- A. All materials, equipment and installation shall comply with the following:
 - 1. The NEC, latest approved edition.
 - 2. Any and all Federal, State and/or local codes, applicable ordinances, and regulations.
 - 3. Latest approved standards of IEEE, ANSI, NEMA, and NFPA.
 - 4. Local utility and telephone company regulations.
 - 5. All equipment shall be new and U.L. listed where listing is available.

1.7 GUARANTEE - WARRANTY

- A. This Contractor shall and hereby does warrant and the General Contractor shall and hereby does guarantee that all work executed under this section will be free from defects of materials and workmanship for a period of one (1) year from the date of the final certificate.
- B. This Contractor shall further warrant that all materials furnished are new and that the work executed is in accordance with all applicable laws, regulations, etc.

1.8 MATERIALS

Material specifications are included hereinafter under each specific section.

1.9 EQUIPMENT

Equipment specifications are included hereinafter under each specific section.

1.10 TEMPORARY POWER

- A. Temporary power for all trades will be provided by the Contractor, and the cost of electrical power shall be borne by the General Contractor.
- B. The Contractor shall furnish at least a 200-amp single-phase service, 115/230 volts with a 200-watt lamp connection for each 1000 square feet. (No lamp shall be furnished by the Contractor.)

Furnish grounded duplex outlets as required. Outlets shall be located so that 50' extension (fbo) will reach any point. Power to outlets shall be limited to 1/2 HP motors 115/240 volts. If additional power is required it shall be furnished by others.

1.11 SITE VISITATION

Due to the nature of the work, certain details of the site may not be shown or specified. The Contractor should visit the site and failure to do this shall not relieve the responsibility of the Contractor, as no additional payments or extras will be allowed for conditions encountered in the execution of the work in accordance with the intent of the plans and specifications.

1.12 WORK PROGRESS

- A. The Contractor shall coordinate his work with the progress of the building and other trades such that he shall complete his work as soon as conditions permit. Any overtime or additional costs incurred by a lack of improper coordination with other trades shall be borne by the Contractor without any additional costs to the National Park Service.
- B. Waste material shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion and protected from exposure and the weather.

1.13 TESTS

- A. After the interior wiring system installation is completed and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The tests shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests, and the National Park Service will furnish the necessary electric power.
- B. Special tests required for certain systems may be detailed elsewhere in this specification.

1.14 AS BUILT DRAWINGS

The Contractor shall submit a neatly marked up set of Electrical Drawings to the Contracting Officer for record of final installation as actually installed. This copy will be returned to the National Park Service after records are made.

1.15 UTILITY EXCESS COSTS

The contractor shall carry in his bid and **allowance of \$25,000.00** for work necessary to be completed by the utility, including connections, shutdowns, metering, etc. The cost of this work by the utility will be reimbursed with proof of utility invoice. All other work is included in the base bid.

1.16 UNUSED ELECTRICAL WORK

Remove all unused electrical work that will be exposed on completion of the work. All existing unused electrical equipment shall become the property of the contractor and be removed from the premises.

END OF SECTION 26 05 00

SECTION 26 05 19 -POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SCOPE

- A. All conductor material, insulation and fittings shall meet National Electrical Code (NEC) requirements. All conductors and fittings shall be U.L. listed. All conductors shall be listed for 600 volt A.C. All conductors shall be sized to meet the NEC ampacity and voltage drop requirements.
- B. Minimum size power wiring shall be #12 AWG. Minimum size control wiring shall be #16 AWG. Branch circuit conductor #8 and larger must be stranded.
- C. Branch wiring over 90 feet long must not be smaller than #10 AWG at 120 volts and over 150 feet at 208 volts.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conductors shall be THWN/THHN. Larger sizes shall be THW. All wire #8 and larger must be stranded. All conductors shall be copper.
- B. Ground wire for use above ground shall be bare annealed copper or shall be insulated green or green with yellow stripes.
- C. Lugs for power conductor termination in switchgear, panelboards, etc., shall be compression type. Lugs shall be U.L. listed for cu.
- D. Connectors for #6 AWG and larger shall be compression type, U.L. listed for cu.
- E. Splices of wire sizes up through #8 may be wire nuts similar to U.L. listed wing nuts.
- F. Underground conductors shall be THWN/XHHW.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Splices for #6 and larger shall be by compression connectors.
- B. Follow the NEC Rules when homeruns are combined in a single conduit.
- C. Tape all bare surfaces of conductors with a minimum of 2 half lapped layers of electrical tape.

- D. Torque all electrical connections at panels per manufacturer's recommendations.
- E. Sleeve all direct burial cable in galvanized rigid steel or Schedule 40 PVC under paving and through masonry walls and footings.

END OF SECTION 26 05 19

SECTION 26 05 22 - ELECTRIC SERVICE

PART 1 - GENERAL

1.1 SCOPE

- A. Electrical Services:
 - 1. The electrical services will be 120/208 volt, three phase, 4 wire grounded at the 8 BR Dormitory buildings. The secondary shall be run underground to the building.
 - 2. The electrical services will be 120/240 volt, single phase, 3 wire for the 6 BR Apartment Unit buildings. The secondary shall be run underground to the building.
- B. All work shall comply with the National Electrical Code (NEC) and local Utility Company regulations and requirements.
- C. The General Contractor shall provide all trenching and backfill.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conduit shall be galvanized rigid steel and Schedule 40 PVC per Section 26 05 33.
- B. The meter (s) will be by the local Utility Company.
- C. Meter trim and Cabinets will be by the Electrical Contractor. Meter trim shall be as shown on the plans.
- D. Ground rods per Section 26 05 26.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Electrical Contractor shall meet all the requirements of the local Utility Company and determine the extent of the utilities work.
- B. The Electrical Contractor shall install the meter trim.

END OF SECTION 26 05 22

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SCOPE

- A. The grounded conductor and equipment grounding conductors shall be connected from the service entrance equipment to the building ground electrode by the grounding electrode conductor in accordance to National Electrical Code (NEC) regulations, Article 250, and Utility requirements.
- B. Metal conduit shall be grounded in accordance to NEC requirements; but in addition to this, equipment-grounding conductors shall be furnished and installed and sized per plans.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Grounding electrode and equipment ground conductors shall be copper and sized per plans.
- B. Ground rods shall be copper clad steel, 3/4" dia. 10' long.

2.2 CONDUCTORS

- A. Insulated Conductors shall be copper wire or cable insulated 600 V unless otherwise required.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Cable: 28kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus shall be predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32 inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and impulse tested at 5000 V.

2.3 CONNECTORS

- A. Connectors shall be listed and labeled by an authorized testing lab.
- B. Bolted Connectors for Conductors and pipes shall be copper or copper alloy pressure type with at least two bolts properly sized.

- C. Welded Connectors shall be with exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors shall be mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; $\frac{3}{4}$ dia, 10' long.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All grounding shall be in strict compliance with the NEC and these specifications.
- B. All equipment grounding conductors shall be bare copper or insulated copper with green jacket or green with yellow stripe or green tape as covered by the code.
- C. The bonding/grounding jumpers shall be sized by NEC Table 250.66. All grounding and bonding in the building must comply with the latest issue of the NEC.
- D. All metallic conduit used with power wiring shall be bonded to provide an effective ground. Use PVC conduit for service grounding conductors.
- E. Install ground rods as indicated with approved connectors.

3.2 APPLICATIONS

- A. Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Install bare copper conductor, No 2/0 AWG minimum for underground conductors.
 - 1. Bury at least 24 inches below grade.
 - 2. Bury duct bank grounding conductor 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors shall have green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
 - 1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

D. Conductor Terminations and Connections

1. Pipe and Equipment Grounding Conductor Terminations shall be bolted connectors.
2. Underground Connections shall be welded connectors except at test walls and as otherwise indicated.
3. Connections to Ground Rods at Test Wells shall be bolted connectors.
4. Connections to Structural Steel shall be Welded connectors.

3.3 GROUNDING OVERHEAD LINES

- A. Comply with grounding requirements.
- B. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.
- C. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.
- D. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- C. In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A for signal and communication equipment.
 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in race way from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a ¼-by-4-by-12-inch grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- D. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Install Bonding Straps and Jumpers in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Install a driven ground rod at base of each building corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- G. All grounding shall be in strict compliance with the NEC and these specifications.
- H. All equipment grounding conductors shall be bare copper or insulated copper with green jacket or green with yellow stripe or green tape as covered by the code.
- I. The bonding jumpers shall be sized by NEC Table 250-95. All grounding and bonding in the building must comply with the latest issue of the NEC.

- J. All metallic conduit used with power wiring shall be bonded to provide an effective ground. Use PVC conduit for service grounding conductors.
- K. Install ground rods as indicated with approved connectors.

3.6 FIELD QUALITY CONTROL

- A. Perform Tests and Inspections.
 - 1. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Report Measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment of System with Capacity of 500 kVA and Less: 10 ohms.
- C. If resistance to ground exceeds specified values, notify Contracting Officer promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 28 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SCOPE

- A. All inserts and anchors and hardware necessary for the support of electrical equipment shall be furnished under this section of the specifications.
- B. Apparatus shall be mounted to walls, columns, or machine frames (with 1/4" separation from same) and all necessary spacers, brackets, structural pieces, inserts, anchors and bolts necessary for this purpose shall be provided.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wooden plugs inserted in masonry or concrete shall not be used as a base to fasten conduit supports. Conduit shall be supported on approved types of galvanized wall brackets, ceiling trapeze, strap hangers, or pipe straps, secured by means of toggle bolts, on hollow masonry units or expansion bolts in concrete or brick, machine screws on metal surfaces and wood construction.
- B. Where indicated, 3/4" plywood panels shall be wall mounted to support electrical and telephone equipment. Plywood shall be fire-rated and painted black.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Conduit systems shall be installed in accordance with the applicable provisions of the National Electrical Code (NEC).
- B. Conduit shall be installed in such manner as to insure against trouble from the collection of trapped condensation, and all runs of conduit shall be arranged so as to be devoid of traps wherever possible. The Contractor shall exercise the necessary precautions to prevent the lodgment of dirt, plaster or trash in conduit, fittings and boxes during the course of installation. A run of conduit which has become clogged shall be entirely freed of this accumulation, or shall be replaced.
- C. Conduit shall be securely fastened to all cast or sheet metal equipment, junction, or pull boxes with galvanized locknuts and bushings care being observed to see that the full number of threads project through which the locknut shall be made up sufficiently tight to draw the bushing into firm electrical contact with the box.

- D. Plywood panels shall be attached with hardware sized to support the weight of the equipment and the panels shall be painted gray with two coats of paint.
- E. Install exposed surface mounted devices or equipment less than 8' AFF with anchors to masonry walls, with appropriate anchors as required.

END OF SECTION 26 05 28

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

Provide all hangers and supports for electrical equipment and systems as required.

PART 2 –PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support System shall comply with MFMA-4, factory-fabricated components for field assembly EQUAL TO Unistrut, Tyco International, Ltd.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
- B. Raceway and Cable Supports shall be as described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices shall be steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints shall be ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners shall be threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used equal to Hilti, Inc.
 - 2. Mechanical-Expansion Anchors shall be insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used equal to Hilti, Inc.
 - 3. Concrete Inserts shall be steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements shall meet MSS SP-58, type suitable for attached structural element.

5. Through Bolts shall be structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts shall be all-steel springhead type.
7. Hanger Rods shall be threaded steel.

PART 3 – EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Space supports for tubing or conduit as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits for multiple raceways or cables.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements unless otherwise specified.
- B. Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring. The raceway and fittings shall include the conduit, wireway, and flexible metal conduit systems and their associated fittings as shown on the plans and in the specifications. The material herein described shall be approved for the service and shall be Underwriters Laboratories listed at the time of installation in every case where such a standard has been established.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FMC: Flexible metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. NBR: Acrylonitrile-butadiene rubber.
- F. RNC: Rigid nonmetallic conduit.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Electri-Flex Co.
 - 4. Maverick Tube Corporation.
 - 5. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.

- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

- 1. Fittings for EMT: Steel, compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. AFC Cable Systems, Inc.
 - 2. Arcco Corporation.
 - 3. CertainTeed Corp.; Pipe & Plastics Group.
 - 4. Electri-Flex Co.
 - 5. Thomas & Betts Corporation.

- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise specified.

- C. LFNC: UL 1660.

- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

- E. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Cooper B-Line, Inc.
 - 2. Square D; Schneider Electric.

- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

- D. Wireway Covers: Screw-cover type.

- E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Contracting Officer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company.
 - c. Wiremold Company; Electrical Sales Division.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Industries, Inc.
 2. Hubbell Incorporated.
 3. Thomas & Betts Corporation.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Metal Floor Boxes: Sheet metal, fully adjustable, rectangular.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Plastic.
- H. Cabinets:
 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.

PART 3 – EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 1. Exposed Conduit: Rigid steel conduit.
 2. Concealed Conduit, Aboveground: Rigid steel conduit.

- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

- 1. Fittings for EMT: Steel, compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. AFC Cable Systems, Inc.
 - 2. Arcco Corporation.
 - 3. CertainTeed Corp.; Pipe & Plastics Group.
 - 4. Electri-Flex Co.
 - 5. Thomas & Betts Corporation.

- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise specified.

- C. LFNC: UL 1660.

- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

- E. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Cooper B-Line, Inc.
 - 2. Square D; Schneider Electric.

- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

- D. Wireway Covers: Screw-cover type.

- E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Contracting Officer.

block, and install box flush with surface of wall.

J. Set metal floor boxes level and flush with finished floor surface.

END OF SECTION 26 05 33

SECTION 26 05 33.13 - RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE

The raceway and fittings shall include the conduit, wireway, and flexible metal conduit systems and their associated fittings as shown on the plans and in the specifications. The material herein described shall be approved for the service and shall be Underwriters Laboratories listed at the time of installation in every case where such a standard has been established.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Rigid steel conduit, intermediate metal conduit, electric metallic tubing, elbows and couplings shall be hot dipped galvanized and conform to the latest A.S.A.
- B. Fittings for rigid steel conduit shall be cast or malleable iron bodies, cadmium or zinc-plated, with taper threads and tapped holes for screw attached cover plates. For installation in moist or wet locations, fittings shall have gaskets of an appropriate material.
- C. Conduit boxes, outlet switch, junction, and pull boxes extension rings, adaptors and cover plates shall be sheradized galvanized, or PVC plated. Boxes for concealed work shall be stamped steel bodies with stamped steel accessories or solid PVC. Boxes for exposed work shall be cast or malleable iron.
- D. Rigid non-metallic conduit shall be U.L. listed, comply with NEC Article 347, and shall be Schedule 40. Approved PVC solvent shall be used for welding PVC conduit and fitting. Furnish expansion joints in each PVC schedule 40 conduit.

PART 3 - EXECUTION

3.1 WIRING IN CONDUIT

- A. When specified, feeders buried underground or in concrete shall be installed in galvanized rigid steel, or Schedule 40/80 PVC. Wiring in block walls and exposed wiring shall be in EMT conduit. Conduit and outlet installations shall be concealed or exposed in various areas as indicated on the drawings. Exposed conduit shall be run in neat symmetrical lines parallel with the building walls.
- B. All conduit and pull boxes shall be mechanically installed secure to permit the pulling in or pulling out of all cable proposed for same. Double locknut and bushings shall be used for termination of conduit at boxes and equipment.

- C. Conduits for service entrance shall be as detailed on the plans and shall comply with utility requirements.
- D. Install E 945 expansion joint in PVC conduit per the manufacturer's recommendations and the NEC.
- E. Conductors run in raceway must be derated per the NEC.

END OF SECTION 26 05 33.13

SECTION 26 05 41 - UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of underground ducts and raceways, and precast structures and pullboxes to form a complete underground electrical raceway system.
- B. The terms “duct” and “conduit” are used interchangeably in this section.

1.2 RELATED WORK

- A. Trenching, backfill, and compaction.

1.3 QUALITY ASSURANCE

- A. Coordinate layout and installation of ducts, structures, and pullboxes with final arrangement of other utilities, site grading, and surface features.

PART 2 - PRODUCTS

2.1 PRE-CAST CONCRETE STRUCTURES AND HARDWARE

- A. Structure: Factory-fabricated, reinforced concrete, monolithically poured walls and bottom. Frame and cover shall form top of manhole.
- B. Ground Rod Sleeve: Provide a 3 inches PVC sleeve in manhole floors so that a driven ground rod may be installed.
- C. Sump: Provide 12 inches x 12 inches covered sump frame and grated cover, where required.

2.2 PULLBOXES

- A. General: Minimum size for data/comm: 12”x18”. Minimum size for power: 24”x32”
Provide pullboxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pullbox material. Covers shall have molded lettering, ELECTRIC or SIGNAL as applicable. Provide pulling irons, 0.875 inch diameter galvanized steel bar with exposed triangular-shaped opening. See specification 26 05 43 for additional information.

2.3 DUCTS

- A. Number and sizes shall be as shown on the drawings.

C. Ducts (direct-burial):

1. Plastic duct:
 - a. Schedule 40/80 PVC or HDPE conduit.
 - b. Duct shall be suitable for use with 167° F rated conductors.
2. Rigid metal conduit: Galvanized rigid metal, PVC coated.

2.4 GROUNDING

- A. Provide grounding and bonding for all electrical systems.

2.5 WARNING TAPE

- A. 4-mil polyethylene 3 inches wide detectable tape, red with black letters, imprinted with "CAUTION - BURIED ELECTRIC CABLE BELOW" or similar.

2.6 PULL ROPE FOR SPARE DUCTS

- A. Plastic with 200 lb minimum tensile strength.

PART 3 - EXECUTION

3.1 STRUCTURE AND PULLBOX INSTALLATION

- A. Assembly and installation shall be per the requirements of the manufacturer.
1. Install structures and pullboxes level and plumb.
 2. Units shall be installed on a 12 inches thick level bed of 90% compacted granular fill, well-graded from the 1-inch sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.
- B. Access: Ensure the top of frames and covers are flush with finished grade.
- C. Grounding in Structures:
1. Ground Rods in Structures: Drive a ground rod into the earth, through the floor sleeve, after the manhole is set in place. Fill the sleeve with sealant to make a watertight seal. Rods shall protrude approximately 4 inches above the manhole floor.
 2. Install a No. 3/0 AWG bare copper ring grounding conductor around the inside perimeter of the manhole and anchor to the walls with metallic cable clips.
 3. Connect the ring grounding conductor to the ground rod by an exothermic welding process.

4. Bond the ring grounding conductor to the duct bank equipment grounding conductors, the exposed non-current carrying metal parts of racks, sump covers, and like items in the structures with a minimum No. 6 AWG bare copper jumper using an exothermic welding process.

3.2 TRENCHING

- A. Before performing trenching work at existing facilities, contact Digsafe to reveal all known existing underground ducts, conduits, cables, and other utility systems.
- B. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.
- C. Cut the trenches neatly and uniformly.
- D. Individual conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place using rigid metal conduit, or bored using plastic utilities duct or PVC conduit, as approved by the Engineer.

3.3 DUCT INSTALLATION

- A. General Requirements:
 1. Ducts shall be in accordance with the NEC, as shown on the drawings, and as specified.
 2. Join and terminate ducts with fittings recommended by the manufacturer.
 3. Slope ducts to drain towards structures and pullboxes, and away from building and equipment entrances. Pitch not less than 4 inch in 100 feet.
 4. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be PVC coated rigid metal conduit, and shall extend a minimum of 5 feet outside the building foundation. Tops of conduits below building slab shall be minimum 24 inches below bottom of slab.
 5. Stub-ups and sweeps to equipment mounted on outdoor concrete slabs shall be PVC coated conduit, and shall extend a minimum of 5 feet away from the edge of slab.
 6. Install insulated grounding bushings on the conduit terminations.
 7. Radius for sweeps shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter.
 8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 3 inches above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 5 feet. Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during concrete pour. Tie wires shall not act as substitute for spacers.
 9. Duct lines shall be installed no less than 12 inches from other utility systems, such as water, sewer, and chilled water.
 10. Clearances between individual ducts:
 - a. For similar services, not less than 3 inches.
 - b. For power and signal services, not less than 6 inches.
 - c. Data/Comm services not less than 12”.

11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
14. Spare Ducts: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
15. Duct Identification: Place continuous strip of warning tape approximately 12 inches above ducts before backfilling trenches. Warning tape shall be preprinted with proper identification.
16. Duct Sealing: Seal ducts, including spare ducts, at building entrances and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of foreign objects and material, moisture, and gases.
17. Use plastic ties to secure cables to insulators on cable arms. Use minimum two ties per cable per insulator.

B. Direct-Burial Ducts:

1. Install direct-burial ducts only where shown on the drawings. Provide direct-burial ducts only for low-voltage power and lighting branch circuits.
2. Tops of ducts shall be:
 - a. Not less than 24 inches and not less than shown on the drawings, below finished grade.
 - b. Not less than 36 inches and not less than shown on the drawings, below roads and other paved surfaces.
 - c. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
3. Do not kink the ducts. Compaction shall not deform the ducts.

C. Connections to Structures: Ducts connecting to structures shall be flared to have an enlarged cross-section to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the manhole shall be flared toward the inside or keyed to provide a positive interlock between the duct and the wall of the manhole. Use vibrators when this portion of the encasement is poured to ensure a seal between the envelope and the wall of the structure.

D. Connections to Existing Structures: For duct connections to existing structures, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

E. Connections to Existing Ducts: Where connections to existing ducts are indicated, excavate around the ducts as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.

F. Partially-Completed Ducts: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable plugs. Fit concrete envelope of partially completed ducts with reinforcing steel extending a

minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 12 inches apart. Restrain reinforcing assembly from moving during pouring of concrete.

3.4 ACCEPTANCE CHECKS AND TESTS

A. Duct Testing and Cleaning:

1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct, and to test for out-of-round conditions.
2. The mandrel shall be not less than 12 inches long, and shall have a diameter not less than 0.5 inch less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
3. If testing reveals obstructions or out-of-round conditions, the Contractor shall replace affected section(s) of duct and retest to the satisfaction of the Engineer at no cost to the Government.
4. Mandrel pulls shall be witnessed by the Engineer.

END OF SECTION 26 05 41

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install underground duct banks, and handholes including all necessary excavation, backfill and surface restoration.
- B. Provide underground conduit duct banks and pull boxes for power, and lighting circuits as shown on the Drawings.
- C. Coordination: Duct bank routing when shown on the Drawings is diagrammatic. Coordinate installation with piping and other underground systems and structures and locate clear of interferences. Coordinate installation with piping, sheet piling and other underground systems and structures and locate clear of interferences.

1.2 REFERENCES

A. Reference Standards:

- 1. National Electrical Manufacturers Association (NEMA)
- 2. The American National Standards Institute (ANSI)
- 3. The Institute of Electrical and Electronic Engineers (IEEE)
- 4. Insulated Cable Engineers Association (ICEA)
- 5. National Electrical Code (NEC)
- 6. National Electrical Safety Code (NESC)
- 7. ANSI A14.3, Safety Requirements for Fixed Ladders
- 8. OSHA
- 9. ASTM
 - a. ASTM A 48, Gray Iron Castings
 - b. ASTM D756, Procedure E: Accelerated Service Exposure
 - c. ASTM G53: Recommended Practice for Operating Light and Water Exposure on Nonmetallic Materials (with a U.V.A. 340 bulb)
 - d. ASTM D570, Section 5, 6.1, 6.5: Water Absorption
 - e. ASTM D790: Flexural Properties
 - f. ASTM D635: Flammability Test

B. Definitions:

- 1. Duct: Electrical conduit and other raceway, either metallic or nonmetallic, used underground, embedded in earth or concrete.
- 2. Duct bank: 2 or more conduits or other raceway installed underground in the same trench or concrete envelope.
- 3. Handhole: An underground junction box in a duct or duct bank with cover accessible from grade.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination, Sequencing, and Scheduling: per Contract Documents.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01 General Requirements.

- B. Shop Drawings:

1. Layouts showing the proposed routing of duct banks and the locations of handholes and areas of reinforcement.
2. Profiles of duct banks showing crossings with piping and other underground systems.
3. Typical cross sections.
4. Installation procedures.
5. Manufacturer's technical information for handholes and accessories proposed for use.
6. Drawings showing interior and exterior handhole dimensions and details of openings, jointing, inserts, reinforcing, size and locations of openings, and accessory locations.
7. Certificate of concrete and steel used in underground pre-cast concrete utility structures, according to ASTM C858.
8. Product Data for nonmetallic conduit and handhole accessories.

- C. Record Drawings:

1. Layouts showing the actual routing of duct banks including the dimensions and depth of the top of duct bank below grade. Record Drawings for duct banks should also include cross sections of the duct bank indicating the circuit, use, conduit size, orientation and number of conduits.
2. Locations of handholes, and areas of reinforcement.

1.5 QUALITY ASSURANCE

- A. Provide in accordance with Contract Documents.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Contract Documents.

1.7 SITE CONDITIONS

- A. Existing Conditions: per Contract Documents.

PART 2 – PRODUCTS

2.1 DUCT BANK CONDUIT

- A. Duct: Schedule 40 and Schedule 80 PVC conduit and fittings in accordance with Division 26, Section Raceways and Boxes for Electrical Systems.
- B. Rigid Steel Conduit: Rigid steel conduit and fittings in accordance with Division 26, Section Raceways and Boxes for Electrical Systems.

2.3 HANDHOLES

- A. The pull/splice box underground enclosures shall be constructed of polymer concrete consisting of sand and aggregate bound together with a polymer resin. Internal reinforcement may be provided by means of steel, fiberglass, or a combination of the two. Handholes for installation in roadways shall be concrete reinforced H20 traffic rated.
- B. Enclosure:
 - 1. The enclosure must be manufactured with an open or closed bottom and a removable cover. The enclosures shall be green or concrete gray in color.
 - 2. The enclosures shall be designed to be installed flush to grade with the cover fitting flush to the box.
 - 3. The enclosures shall be suitable for installation in either direct or buried native soil, embedded in concrete, or embedded in asphalt surfacing. (A concrete collar is required for installation in asphalt).
 - 4. The enclosures shall be of a stackable design for greater installation flexibility.
 - 5. All covers are to be equipped with a minimum of two stainless steel lockdown mechanisms. All covers shall have a logo recessed into the cover and it shall read ELECTRIC or COMM.
 - 6. All enclosure covers will have some type of recessed access point to allow removal of the cover with a hook. The access points will be placed in such a location to allow for the greatest amount of leverage and safety possible.
 - 7. Enclosures shall be designed and suitable for installation and use through a temperature range of minus 40°C (minus 40°F) to 60°C (140°F).
 - 8. A certified copy of all test reports must be signed and stamped by a registered professional Engineer and submitted prior to shipment of products.
- C. Material Performance Requirements:
 - 1. Permanent deflection of any surface shall not exceed 10 percent of the maximum allowable static design load deflection.
 - 2. The covers shall be skid resistant and have a maximum coefficient of friction of 0.50 on the top surface of the cover. Coatings will not be allowed.
 - 3. Any point on the covers must be able to withstand a 70 foot-pound impact administered with a 12-pound weight having a “C” tup (ASTM D-2444) without puncturing or splitting. The test shall be performed with the cover resting on a flat, rigid surface such as concrete or a 1 steel plate.

4. Covers shall have molded lettering, ELECTRIC or COMM as applicable
5. Fastening devices used to secure the cover to the box shall be capable of withstanding a minimum torque of 15 foot-pounds and minimum straight pullout strength of 750 pounds.
6. The material is tested according to the requirements of ASTM D543, Section 7, Procedure 1, for chemical resistance. The manufacturer is responsible for proof of compliance with the latest version of the ASTM standards.
7. Comply with the following acceptance standards:
 - a. ASTM D756
 - b. ASTM G53
 - c. ASTM D570
 - d. ASTM D790
 - e. ASTM D635

D. Acceptable level of quality for handholes: Strongwell Quazite, or approved equal with the salient characteristics described above.

2.4 SOURCE QUALITY CONTROL

A. Provide in accordance with Contract Documents.

PART 3 – EXECUTION

3.1 GENERAL

- A. Concrete shall be measured, mixed and placed, and compacted as required in Division 03.
- B. Provide not less than 3 inches of concrete between the outside of a duct and the earth. Provide not less than 2 inches of concrete between adjacent ducts. Refer to Drawings for spacing requirements. Provide side forms for each duct bank.
- C. All duct line concrete pours shall be continuous between handholes.
- D. Where duct lines pass through concrete walls, concrete envelopes shall be extended through the finished flush with inside surfaces. Watertight construction joints of an approved type shall be provided.
- E. Duct banks shall be reinforced when laid on backfill covering new pipelines, roads, parking lots or any are subject to vehicular traffic. Beneath these areas, install reinforcing bars as shown on the Drawings, extending 10 feet beyond area needing protection.
- F. Duct lines shall be laid in trenches on mats of gravel not less than 6 inches thick and well graded.

- G. All electrical duct banks shall be colored red for safety purposes.
- H. Install raceways to drain away from buildings. Raceways between handholes shall drain toward the handholes. Raceway slopes shall not be less than 3 inches per 100 feet.
- I. Make raceway entrances to buildings and vaults with hot dipped rigid galvanized steel conduit not less than 10 feet long. Conduits which are not concrete encased for runs below floor slabs in slab-on-grade construction shall be hot dipped rigid galvanized steel conduit. Conduits which are concrete encased for runs below floor slabs in slab-on-grade construction shall be encased under the slab to their respective equipment.
- J. Raceway terminations at handholes shall be with end bells for PVC conduit and insulated throat grounding bushings with lay-in type lugs for metal conduit.

3.2 PROJECT CONDITIONS AND COORDINATION

- A. Coordination with other Underground Utilities:
 - 1. Locate all existing underground utilities through the use of an underground utility piping location Services Company. Locate the existing underground utilities and piping before any excavation is to begin.
 - 2. Coordinate conduit routing and duct bank with other new and existing underground utilities. Revise locations and elevations as required to suit field conditions and ensure that conduits, duct runs, and handholes do not interfere with existing and new underground utilities and piping.

3.3 INSTALLATION

- A. Provide excavation and backfilling required for duct bank and handhole installation.
- B. Make duct bank installations and penetrations through foundation walls watertight.
- C. Assemble duct banks using non-magnetic saddles, spacers, and separators. Position separators to provide 3-inch minimum separation between the outer surfaces of the ducts.
- D. Firmly fix ducts in place during pouring of concrete. Carefully spade and vibrate the concrete to insure filling of all spaces between ducts.
- E. Make bends with sweeps of not less than 48-inch radius or 5 degree angle couplings.
- F. Make a transition from non-metallic to rigid steel conduit where duct banks enter structures or turn upward for continuation above grade. Terminate the ducts in insulated grounding bushings. Continue ducts inside buildings with steel, metallic conduit.
- G. Where ducts enter handholes, terminate the ducts in suitable end bells.

- H. Provide expansion/deflection fittings in accordance with the requirements specified in Division 26, Section Raceways and Boxes for Electrical Systems.
- I. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials that can damage or contribute to corrosion of ducts or cables or prevent adequate compaction of fill.
- J. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately 1/4 inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand or gravel have been left in the duct.
- K. Install a bare stranded copper duct bank ground cable in each duct bank envelope. Make ground electrically continuous throughout the entire duct bank system. Connect ground cable to building and station ground grid or to equipment ground buses. In addition, connect ground cable to steel conduit extensions of the underground duct system. Provide ground clamp and bonding of each steel conduit extension, where necessary to maintain continuity of the ground system. Terminate ground conductor at last handhole for outlying structures.
- L. Install a warning ribbon approximately 12 inches below finished grade over all underground duct banks. The identifying ribbon shall be a PVC tape, 3 inches wide, yellow color, permanently imprinted with CAUTION BURIED ELECTRIC LINE BELOW in black letters.
- M. Plug and seal all empty spare ducts entering buildings and structures. Seal all ducts in use entering buildings and structures. Seal shall be watertight.
- N. Install duct banks in conformance with National Electrical Code and National Electrical Safety Code.
- O. Install handholes where shown on Drawings. Verify final locations in field.
- P. Complete installation of handholes so that structures are watertight. Provide expansion/deflection fitting for each conduit entry into the handholes.
- Q. Duct Bank Conduit Spacers: Non-metallic, snap together intermediate and bottom pieces, sized for conduit diameter and code spacing. Separators shall be compatible with the conduit utilized. The joints of the conduits shall be staggered by rows and layers to provide a duct line having the maximum strength. During construction, partially completed duct lines, shall be protected from the entrance of debris such as mud, sand, and dirt by means of suitable conduits plugs. As each section of a duct line is completed, a testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the size of the conduit, shall be drawn through each conduit, after which a brush having the diameter of the duct, and having stiff bristles shall be drawn through until the conduit is clear of all particles of earth, sand and/or gravel; conduit plugs shall then be immediately installed. Provide a plastic pull rope, having a minimum of 3 additional feet at each end, in all spare ducts.

3.4 DUCT BANK INSTALLATION

- A. All bends shall have a radius greater than 36 inches or 12 times conduit inside diameter whichever is greater.
- B. Install duct with minimum slope of 4 inches per 100 feet. Slope duct away from building entrances.
- C. Install no more than equivalent of three 90-degree bends between pull points.
- D. Provide suitable fittings to accommodate expansion and deflection where required.
- E. Use suitable separators and chairs installed not greater than 4 feet on centers. Conduit separation shall be per code, and not less than 3 inches.
- F. Securely anchor duct to prevent movement during concrete placement. Use re-bar holders at spacers and secure with No. 4 re-bar driven into the earth at a minimum of 1 foot.
- G. Tops of concrete-encased ducts shall be:
 - 1. Not less than 24 inches and not less than shown on the Drawings, below finished grade.
 - 2. Not less than 30 inches and not less than shown on the Drawings, below roads and other paved surfaces.
- H. Tops of direct burial ducts and conduits shall be:
 - 1. Not less than 24 inches and not less than shown on the Drawings, below finished grade.
 - 2. Not less than 30 inches and not less than shown on the Drawings, below roads and other paved surfaces.

3.5 CABLE PULLING

- A. The inspection, handling, storage, temperature conditioning prior to installation, bending and training limits, pulling limits, and calculation parameters for installation of all cables must comply with the manufacturer's recommendations. For ease of installation and prevention of cable damage, the Contractor shall utilize quadrant blocks located properly along the cable run. Failure to comply with any of the above shall make this Contractor responsible for any cable failures that occur within the manufacturer's Warranty Period.
- B. Cable lubricant shall be soapstone, graphite, or talc for rubber or plastic jacketed cables.
- C. Lubricants for assisting in the pulling of jacketed cables shall be those specifically recommended by the cable manufacturer.
- D. Cable pulling tensions shall not exceed the maximum pulling tensions recommended by the cable manufacturer.
- E. All medium voltage cables shall be individually fire/arc proofed.

3.6 CABLE TERMINATING

- A. Terminations of insulated power and lighting cables shall be protected from accidental contact, deterioration of coverings and moisture by the use of terminating devices and materials. Terminations shall be made using materials and method as indicated or specified herein or as designed by the written instruction of the cable manufacturer and termination kit manufacturer.

3.7 GROUNDING

- A. Duct banks shall be grounded with a bare stranded copper ground wire that is run within the duct bank and is bonded and grounded at both ends. Conduit shall not be used as the ground conductor.
- B. Install a bare stranded copper duct bank ground cable in each duct bank envelope. Make ground electrically continuous throughout the entire duct bank system. Connect ground cable to building and station ground grid or to equipment ground buses. In addition, connect ground cable to steel conduit extensions of the underground duct system, and handholes. Provide ground clamp and bonding of each steel conduit extension, where necessary to maintain continuity of the ground system.

3.8 FIELD QUALITY CONTROL

- A. Provide in accordance with Contract Documents.

3.9 STARTUP & COMMISSIONING

- A. Provide in accordance with Contract Documents.

END OF SECTION 26 05 43

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS
AND CABLING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equal to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies shall be galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material shall be galvanized sheet steel.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

Sleeve-seal fittings shall be manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Grout shall be non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic cement grout.
- C. Design Mix shall be 5000-psi, 28-day compressive strength.

PART 3 – EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations shall use steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Install cast-iron pipe sleeves for underground, exterior penetrations. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 83 - WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SCOPE

- A. All equipment shown on the electrical plans shall be wired by the Contractor.
- B. The Contractors shall furnish and install their equipment and the Contractor shall wire them as shown on the plans and per manufacturer's instructions.
- C. All electrical work shall comply with the National Electrical Code (NEC) and all equipment shall be U.L. listed.
- D. Furnish shop drawings of starters, relays, and disconnect switches.
- E. Furnish all wire, conduit, fittings etc. to make all connections and complete all electrical work (equipment by others).

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Disconnects shall be per Section 26 06 20 and this section.
- B. Raceway and conductors shall be per Section 26 05 33, 26 06 20, and 26 27 26.
- C. Motor starter overload heaters sized for the actual motor shall be furnished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall wire line voltage power and line voltage control wiring to all equipment. The Contractor shall install wiring to the equipment in flexible metallic conduit using liquid tight flexible metal conduit where exposed to moisture.
- B. Control wiring shall be sized and protected as required by the NEC.
- C. The Contractor will furnish fuses sized by the NEC.
- D. Install motor disconnects in sight of the motor or provide lockable disconnects in compliance with the NEC.
- E. All motor disconnects and starters shall have name plates indicating motor being controlled.

END OF SECTION 26 05 83

SECTION 26 06 20 - ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.1 SCOPE

- A. Furnish and install all panelboards, disconnect switches, cabinets and boxes as required by the drawings, specifications and by the National Electrical Code (NEC).
- B. Submit shop drawings for all switches, panelboards, and circuit breakers.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Small motor disconnects shall be Westinghouse type MS or B101 unless noted otherwise. Fused switches shall be general duty.
- B. Fuses shall be furnished for fused disconnect switches. Fuses shall be of required or specified voltage and current rating. Furnish National Park Service with one set of spare fuses for all types installed. Current limiting fuses must be installed when indicated.
- C. Disconnect switches shall be heavy duty, U.L. listed, horsepower rated for motors, and be provided in a NEMA 1 enclosure or NEMA 4X as noted on plans.
- D. Panels, cabinets, and boxes shall be code gauge.
- E. All boxes shall be U.L. listed for intended uses and shall comply with the NEC requirements.
- F. Concealed outlet boxes shall be listed PVC or code gauge galvanized or sheradized metal not less than #14 gauge and sized to the NEC requirements.
- G. Junction boxes shall be of code gauge steel cast or PVC and sized to NEC requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set all electrical panels or boxes plumb and square with building lines. Mount panelboards so top is not higher than 6'7" AFF.
- B. Where more than one wiring device is to be mounted, solid gang boxes shall be used.
- C. All wiring shall be done in accordance with the NEC requirements.

- D. All panels shall have typed directories.
- E. The Electrical Contractor shall balance all panels and shall comply with the local utility company requirements.
- F. All disconnects shall be labeled with the use indicated. The label shall be plastic tape with embossed letters.
- G. All breaker panels shall have a plastic nameplate or equal indicating panel name.

END OF SECTION 26 06 20

SECTION 26 09 13 - ELECTRICAL POWER MONITORING

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

- A. The products specified herein are intended to provide a complete sub-metering solution. This solution shall be utilized to measure and monitor owner provided electricity.

1.2 STANDARDS

- A. Provide equipment of this Section in full compliance with the following applicable portions of the latest revisions of the following standards:
 - 1. ANSI C12.1 & C12.20 at 0.2 and 0.5 Accuracy Classes
 - 2. UL Certified to IEC/EN/UL/CSA 61010-1 2nd Edition.
 - 3. UL916:
 - a. These requirements cover energy management equipment and associated sensing devices rated 600 volts or less and intended for installation in accordance with the National Electrical Code, NFPA 70.
 - 4. NEMA -SM31000-1

1.3 SHOP DRAWINGS

- A. Installation and Shop Drawings to include the following:
 - 1. Manufacturer's literature and specification
 - 2. Component connection wiring diagrams

1.4 INSTALLATION, OPERATION, AND MAINTENANCE MANUALS

- A. Submit installation, operation, and maintenance manuals for the electrical sub-metering system and data collection system.

1.5 TECHNICAL PERFORMANCE

- A. Minimum measured technical performance of each piece of installed equipment shall meet the specifications published by the manufacturer.
- B. Optimize technical performance of all systems to produce the highest achievable technical performance to the satisfaction of consultant and/or client.
- C. Any deficiencies in the system, particularly information communication errors or operational deficiencies, shall be cause for rejection. Rectify any such deficiencies prior to calling for substantial completion review.

1.6 WARRANTY

- A. Manufacturer shall provide a comprehensive warranty for all products.

- B. All electrical sub-meters included in this specification to be free from defects in materials and workmanship from the date of substantial completion for a period of 5 Years.

PART 2 - PRODUCTS

2.1 METERS AND CURRENT TRANSFORMERS

- A. Standard single point metering devices: Leviton Series 1000/2000 or equal.

2.2 SYSTEM DESCRIPTION – SINGLE POINT METERING DEVICES

- A. Provide single point metering devices capable of metering 1PH/3W and/or 3PH/4W loads.
- B. Meters must be capable of directly metering North American 120/208/240v.
- C. Metering units must be capable of metering loads between 50A and 8000A. Provide meters specific to each project as indicated on construction drawings.
- D. Meters may have multiple mounting options:
 - 1. Indoor-Flush Mount, Surface Mount, Panel Mount -JIC Steel, Polycarbonate, Multiple Meter Unit
 - 2. Outdoor-Surface Mount, Polycarbonate NEMA 4X
- E. Metering Units may have the capability of paralleling up to 3 (three) sets of CTs per phase.
- F. Must meet all ISO 9001 standards for quality control where all meters test to a minimum of +/- 0.2% or 0.5% accuracy, dependent on stated accuracy class.
- G. The system shall be as described below:
 - 1. To consist of electronic meters with embedded communications capability, and solid core CT. The current transformers shall have a full scale output of 0.1A or .333v and secondary voltage clamps for safety purposes.
 - 2. The meters will be capable of remote communication from each metering device.
 - 3. Standard meters shall have isolated pulse output with output ranges from 10Wh to 1kWh.
 - 4. Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system.
- H. The electronic energy monitoring system shall be fully automated microprocessor-based electrical energy measurement system for Measurement & Verification. The system shall incorporate complete metering, communications, and threshold limit capabilities.

2.3 SYSTEM MEASUREMENTS

- A. Meters to be complete with a Liquid Crystal Display (LCD) to access all energy measurements and phase diagnostics when needed

- B. Standard Meter Energy Parameters:
 - 1. kWh real energy consumption
 - 2. kW peak peak demand (power)

2.4 SYSTEM DESCRIPTION – MULTIPOINT METERING DEVICES

- A. The system shall be as described below:
 - 1. To consist of electronic multiple point meters with embedded communications capability, and solid core current transformer technology. The current transformers shall have a full-scale output of 0.1A or .333v A/C outputs and secondary voltage clamps for safety purposes.
 - 2. Meters shall be capable of mounting in the following configurations:
 - a. Indoor-NEMA 1 Enclosure, Metallic backplate
 - b. Outdoor-NEMA 4X
 - 3. The meters will be capable of remote communication from each metering device. Each device shall have IP sockets and RS-485 terminals to accommodate data transmission via Modbus RTU, Modbus TCP/IP, BACNet MS/TP, BACNet IP and standard Ethernet. Data shall be transmitted by one or a combination of the following:
 - a. Standard Ethernet interface
 - b. Ethernet connection to PC or laptop via crossover cable.
 - c. RS-485 Network-Modbus RTU & BACNet MS/TP
- B. Meters must be capable of directly metering on board, North American 120/208/240V.
- C. Metering Units may have the capability of a Wiring Harness, single incoming cable containing 25 pairs of 22 AWG wire with associated current transformers (CT's) or optional Terminal Strips, screw terminal connections for CTs. Metering Units may also be configured with individual input channels for CT's secondary wires.
- D. Must meet all ISO 9001 standards for quality control where all meters test to a minimum of +/- 0.2% or 0.5% accuracy, dependent on accuracy class.

PART 3 - EXECUTION

3.1 WIRING AND CONNECTIONS

- A. All wiring must meet and or exceed national electrical code.
- B. Metering points show on submitted drawings only to be connected or installed.
- C. Install all wiring in conduit.
- D. Provide an Ethernet drop for remote meter reading and diagnostics of the system.
- E. Perform all necessary system calibration, testing, commissioning, and demonstrations as required.

- F. Prepare and submit record drawings and installation, operation and maintenance manuals as required.

3.2 TESTING AND COMMISSIONING

- A. Perform final testing, adjustment, and commissioning of the systems.
- B. Perform sufficient technical and operational tests to ensure the technical performance of the system meets the intent of the Contract Documents. Typical testing to include but not be limited to:
 - 1. Verification of meter readings and proper installation of meter equipment
 - 2. Communication system connectivity
 - 3. Meter communication with all software platforms
- C. Demonstrate the operation of the system to the Contracting Officer at a time suitable to them. Such demonstration to include product training on how to program the monitoring system.

3.3 FIELD VERIFICATION, ACCEPTANCE, AND TRAINING

- A. Provide all “AS BUILT” DRAWINGS and data showing each meter, serial number, address, cross reference, load and CT ratio prior to field verification.
- B. Manufacturer’s representative shall verify, adjust and test the system. Verification of the energy monitoring system is to be carried out with the assistance of an electrical contractor at all times. Upon completion, the manufacturer shall issue a “Commissioning Report” to the Contracting Officer, electrical consultant, contractor and client.
- C. Manufacturer’s representative shall demonstrate operation of the system as follows:
 - 1. Local and remote meter readings
 - 2. Phase diagnostics
 - 3. Provide manual of the installed system

END OF SECTION 26 09 13

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 – GENERAL

1.1 SUMMARY

This section includes time switches, photoelectric switches, indoor occupancy sensors, lighting contactors, etc. for control of lighting.

PART 2 – PRODUCTS

2.1 TIMER OPERATED SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Cooper Industries, Inc.
 2. Intermatic, Inc.
 3. Invensys Controls.
 4. Leviton Mfg. Company, Inc.
 5. Lithonia Lighting
 6. Tyco Electronics
 7. Or equal.
- B. Description: Digital wall switch timer, LED display, selectable time-on intervals, 24/7, 7 day programmable.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Cooper Industries, Inc.
 2. Intermatic, Inc.
 3. Lithonia Lighting
 4. Tyco Electronics
 5. Or equal.
- B. Description: Solid state, with SPST dry contacts to operate connected load.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
 3. Time Delay: Thirty-second minimum, to prevent false operation.
 4. Lightning Arrester: Air-gap type.
 5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Cooper Industries, Inc.
 2. Hubbell Building Automation, Inc.
 3. Leviton Mfg. Company, Inc.
 4. Lithonia Lighting
 5. NSi Industries LLC; TORK Products.
 6. Or Equal.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, as noted on plans, solid-state indoor occupancy sensors with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a ½-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: Digital display to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the “on” function in case of sensor failure.
 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling/Wall mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment – separate for each sensing technology.
 2. Detector Sensitivity shall detect occurrences of 6-inch minimum movement of any portion of human body that presents a target of not less than 36 sq. in., and detect a person of average size moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches.
 3. Detection Coverage (Standard Room) shall detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.

2.4 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Emerson Electric Co.
 - 2. Eaton Corporation
 - 3. Schneider Electric
 - 4. Or Equal.
- B. Lighting contactors shall be electrically operated and mechanically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching shall be consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Rating shall be equal to or exceeding the available fault current at the point of installation.
 - 3. The enclosure shall comply with NEMA 250.
 - 4. Provide with control and pilot devices.

2.5 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources shall not be smaller than No. 12 AWG.
- B. Classes 2 and 3 Control Cable shall be multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG.
- C. Class 1 Control Cable shall be multi-conductor cable with stranded-copper conductors not smaller than No. 14 AWG.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit National Park Service operations.

END OF SECTION 26 09 23

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of panelboards.

1.2 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, ELECTRICAL PROVISIONS equal to Eaton.
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, materials, wiring diagrams accessories and weights of equipment. Complete nameplate data including manufacturer's name and catalog number.
- C. Certification: Two weeks prior to final inspection, submit four copies of the following to the Contracting Officer:
 - 1. Certification that the material is in accordance with the drawings and specifications has been properly installed, and that the loads are balanced.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings and shall be fitted with arc fault and surge protection.
- B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.
- C. All panelboards shall be hinged “door in door” type with:
 - 1. Interior hinged door with hand operated latch or latches as required to provide access to circuit breaker operating handles only, not to energized ports.
 - 2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners requiring a tool for entry, hand operated latches are not acceptable.
 - 3. Push inner and outer doors shall open left to right.

- D. All panelboards shall be completely factory assembled with molded case circuit breakers. Include one-piece removable, inner dead front cover independent of the panelboard cover.
- E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings.
- F. Panelboards shall conform to NEMA 1 on interior installations and NEMA 4X on exterior installations:
 - 1. Nonreduced size copper bus bars, complete with current ratings as shown on the panel schedules connection straps bolted together and rigidly supported on molded insulators.
 - 2. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Three-phase, four-wire busing shall be such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two- or three-pole breakers can be installed at any location. Current-carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown.
 - 3. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys of sizes suitable for the conductors indicated to be connected thereto.
 - 4. Neutral bus shall be mounted on insulated supports.
 - 5. Grounding bus bar equipped with screws or lugs for the connection of grounding wires.
 - 6. Buses braced for the available short circuit current, but not less than 42,000 amperes symmetrical for 120/208/240 volt, and 14,000 amperes symmetrical for 277/480-volt panelboards.
 - 7. Branch circuit panels shall have buses fabricated for bolt-on type circuit breakers.
 - 8. Protective devices shall be designed so that they can be easily replaced.
 - 9. Where designated on panel schedule "spaces", include all necessary bussing, device support and connections. Provide blank cover for each space.
 - 10. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panels, and with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.

2.2 CABINETS AND TRIMS

- A. Cabinets:
 - 1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL 50, UL 67, and have NEMA 4X rating.
 - 2. Cabinet enclosure shall not have ventilating openings.
 - 3. Cabinets for panelboards may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

- A. Breakers shall be UL 489 listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.
- B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.

1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated but not less than:
 - a. 120/208/240 Volt Panelboard: 42,000 amperes symmetrical.
 - b. 277/480 Volt Panelboard: 14,000 amperes symmetrical.
2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100-ampere frame or less. Magnetic trip shall be adjustable from 3X to 10X for breakers with 600 ampere frames and higher.

C. Breaker features shall be as follows:

1. A rugged, integral housing of molded insulating material.
2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.
4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.
7. An operating handle which indicates ON, TRIPPED, and OFF positions.
 - a. Line connections shall be bolted.
 - b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals.
8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.
9. Shunt trips shall be provided where indicated.
10. Breakers shall be GFCI/AFCI type as required per NEC and/or as noted on Panel Schedules.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the Manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.
- C. Install a typewritten schedule of circuits in each panelboard after being submitted to and approved by the Contracting Officer. Schedules, after approval, shall be typed on the panel

directory cards and installed in the appropriate panelboards, incorporating all applicable contract changes pertaining to that schedule.

- D. Mount the panelboard fully aligned and such that the maximum height of the uppermost switch's center position is no more than 78 inches.
- E. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.
- F. Directory-card information shall be typewritten to indicate outlets, lights, devices, and equipment controlled and final room numbers served by each circuit and shall be mounted in holders behind protective covering.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are equal to:

1. Cooper Wiring Devices
2. Hubbell Incorporated
3. Leviton Mfg. Company Inc.

B. Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596, equal to commercial grade Leviton, and tamper resistant.

2.4 GFCI/AFCI/DFCI RECEPTACLES

A. General Description: Commercial Grade

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FSW-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
4. GFCI receptacles in damp and wet locations shall be rated weather resistant per NEC.
5. All receptacles shall be tamper resistant type.

B. Duplex GFCI/AFCI/DFCI Convenience Receptacles, 125 V, 20 A, tamper resistant:

1. Available products or equal that may be incorporated into the work include the following:
 - a. Cooper; VGF20.
 - b. Hubbell; GFR5352L.
 - c. Leviton; 7590.

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A, Commercial Grade:

1. Available products or equal that may be incorporated into the work include the following:
 - a. Single Pole:
 - 1) Cooper; AH1221.
 - 2) Hubbell; HBL1221.
 - 3) Leviton; 1221-2.
 - b. Two Pole:
 - 1) Cooper; AH1222.
 - 2) Hubbell; HBL1222.
 - 3) Leviton; 1222-2.
 - c. Three Way:
 - 1) Cooper; AH1223.
 - 2) Hubbell; HBL1223.
 - 3) Leviton; 1223-2.
 - d. Four Way:
 - 1) Cooper; AH1224.
 - 2) Hubbell; HBL1224.
 - 3) Leviton; 1224-2.

2.6 WALL-BOX DIMMERS

- ### A. Dimmer Switches shall be modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters, commercial grade, compatible with LED fixtures.

- B. Dimmers shall have a continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

2.7 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws shall be metal with head color to match plate finish.
 - 2. Material for Finished Spaces shall be 0.035-inch- thick, Type 302 stainless steel.
 - 3. Material for Unfinished Spaces shall be galvanized steel.
 - 4. Material for Damp Locations shall be cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plate shall be NEMA 250, complying with Type 3R, weather-resistant, diecast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.
 - 5. Conceal all wiring.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
10. Provide sound gaskets in STC rate partitions

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates. Devices for adjacent rooms in STC partitions shall not share a common stud bay.

H. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

B. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 27 26

SECTION 26 27 28 - DISCONNECT SWITCHES

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Disconnect Switches.
- B. Enclosures.

1.2 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 (N.E.C.) Latest Edition.
- C. U.L. Standards.
- C. ANSI Standards.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- C. Size per N.E.C. and Equipment Manufacturers' Recommendations.
- D. Heavy duty type.

1.4 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."
- B. Include outline drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit.

1.5 SPARE PARTS

- A. Fuses: Furnish to National Park Service three (3) spare fuses for each circuit and each device requiring fuses. Maximum of six (6) spare fuses of each type and rating installed.
- B. Fuse Pullers: Furnish one fuse puller to National Park Service.

PART 2 - PRODUCTS

2.1 DISCONNECT_SWITCHES

- A. Acceptable Manufacturers, Commercial Grade, Heavy Duty type:
 - 1. Eaton.
 - 2. I-T-E Siemens.
 - 3. General Electric.
 - 4. Square D.
- B. Nonfusible Switch Assemblies: Heavy-duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Rated: Horsepower rated, 600-volt and 250-volt as required by the particular circuit with ampere rating and number of poles as indicated, or as required by the specific equipment.
- D. Enclosures: NEMA KS 1; Type 1 for interior dry locations, Type 4X rain tight for exterior locations and types as indicated on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Section Division 26 for Equipment Wiring.

END OF SECTION 26 27 28

SECTION 26 51 00 - INTERIOR LIGHTING - LED

PART 1 - GENERAL

1.1 SCOPE

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections.
- B. The complete lighting system will consist of indoor lighting, outdoor lighting with all necessary fixtures, switches, sensors, etc.
- C. All devices shall be U.L. listed and approved for the location and application. All wiring methods and materials shall comply with the National Electrical Code (NEC) requirement.
- D. The Electrical Contractor shall submit shop drawings of all light fixtures and lamps.

1.2 SUBMITTALS

- A. Product Data: Arrange in order of luminaire designation. The submittals shall include data on features, ratings, listings, certifications, accessories, finishes, dimensions, emergency components, photometric data, and luminaire efficiency data.
- B. Installation, Operation, and Maintenance Manuals.

1.3 QUALITY ASSURANCE

- A. Lighting fixtures shall be of specification grade and listed or labeled by Underwriters Laboratories (UL) or an approved Nationally Recognized Testing Laboratory (NRTL).
- B. LED fixtures shall comply with the following:
 - 1. UL Standard 8750 "Light Emitting Diode Equipment for Use in Lighting Products", IES Standard LM-79 "Electrical and Photometric Measurements of Solid-State Lighting Products", IES Standard LM-80 "Measuring Lumen Maintenance of LED Light Sources", and IES Standard TM-21 "Projecting Long Term Lumen Maintenance of LED Light Sources".
 - 2. ANSI C78.377 "Specifications for the Chromaticity of Solid State Lighting Products" with LEDs binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaries of the same type.

1.4 WARRANTY

For fixtures, lamps, drivers, and components, provide a complete warranty for parts and labor for a minimum of five years from the date of Substantial Completion.

PART 2 – PRODUCTS

2.1 LIGHTING

- A. Provide lighting fixtures in accordance with the Fixture Schedule.
 - 1. Provide only LED fixtures with a U.S. Environmental Protection Agency (EPA) Energy Star label.
- B. Recessed lighting fixtures shall be thermally protected.
- C. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.
- D. Dimmable LED fixtures shall have a 0-10 volt, 3-wire dimming driver.

2.2 LAMPS

- A. LED lamps shall have a color temperature of 4000 degrees K, a CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum unless noted otherwise.
- B. Retrofit LED lamps shall comply with NEMA SSL 4 “SSL Retrofit Lamps: Suggested Minimum Performance Requirements”.

2.3 DRIVERS

- A. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems”. LED drivers shall have a sound rating of “A”, have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.
- B. Dimmable LED drivers shall be 0-10V type. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.
- C. Drivers shall be rated for the ambient temperatures in which they are located. Outdoor fixtures shall be equipped with ballasts or drivers rated for reliable starting to -20 degrees F. Indoor fixtures located in areas with direct sunlight or above normal ambient temperatures shall have ballasts or drivers rated at 65 degrees C minimum.
- D. Drivers shall have their fuses accessible from outside of the fixture chassis.
- E. Induction lamp drivers shall be electronic and comply with radio frequency interference (RFI) requirements of FCC Title 47 Part 15 and be rated for a total harmonic distortion (THD) of less than 20 percent at all input voltages.

2.4 EMERGENCY LIGHTING

- A. Emergency Lighting shall be at a minimum those fixtures that illuminate the pathway of egress, including building mounted fixtures lighting at exits and sidewalk paths.
- B. Emergency Lighting shall consist of normal lighting fixtures with generator or battery-inverter system backup, emergency lighting fixtures with individual battery backup, or sealed beam emergency lighting units in accordance with the Fixture Schedule. Emergency lighting shall be installed at all exits.
 - 1. Battery-backed LED emergency lighting fixtures shall consist of a normal LED fixture with some or all of the LEDs connected to a battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of fixture operation. The charger shall be solid-state and provide overload, short circuit, brownout, and low battery voltage protection. The battery and charger shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The fixture shall include a test/monitor module with LED status indicating lights mounted to be visible to the public. The fixture shall not contain an audible alarm.
 - 2. Emergency lighting shall maintain a minimum of 1 FC average output in spaces served.
 - 3. Sealed beam emergency lighting units shall consist of sealed beam LED lamps connected to an internally mounted battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of battery operation. The charger shall be solid-state and provide overload, short circuit, brownout, and low battery voltage protection. The unit shall be suitable for wall or ceiling mounting as required. The unit shall include a test/monitor module with LED status indicating lights mounted to be visible to the public. The unit shall not contain an audible alarm.

2.5 EXIT SIGNS

- A. Exit signs shall be of the LED type. Fluorescent, electro luminescent light panel, or self-powered luminous signs shall not be used.
 - 1. LEDs shall be wired in parallel to prevent multi-lamp failure and shall be concealed within the sign by a clear panel and red optical diffuser. Power consumption shall not exceed 2 watts per face.
 - 2. Exit signs shall have white die cast aluminum or polycarbonate housings with universal mounting brackets; brushed aluminum stencil faces with red letters and multi-directional knockout arrows.
 - 3. Exit signs shall be provided with emergency battery packs and battery chargers. Batteries shall be maintenance-free nickel cadmium and shall be mounted within the signs.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. Support recessed troffers independently of the ceiling grid system by using two safety wires minimum on diagonally opposite corners of the fixtures. Support recessed downlights by

using safety wires or by rigidly attaching the fixtures to the building structure or ceiling grid system. Removable T-bar clips shall not be used to attach fixtures to the ceiling grid system.

- B. Install fixtures level, with no gaps between adjacent fixtures or between fixtures and surrounding surfaces. Lenses, reflectors, and trims of fixtures shall be properly and uniformly aligned.
- C. Where fixtures are shown with dual switches, control all inner lamps with one switch and all outer lamps with the other switch. Where dimming or occupancy sensor-controlled fixtures are shown, control the fixtures in accordance with the appropriate wiring diagram or manufacturer's instructions.
- D. Connect night light fixtures and emergency lighting fixtures to the hot (unswitched) side of lighting circuits.
- E. Provide an individual feed with ground conductor from a junction box to each lighting fixture. Lighting fixtures shall not be daisy-chained.
- F. Drops to recessed fixtures may be flexible metallic conduit, or manufactured wiring systems may be used where accessible. Fixtures shall be provided with sufficient length to permit removal and lowering of the fixtures 12" below the ceiling.
- G. Provide green grounding conductors back to the panel ground for lighting circuits. Raceways shall not be used as grounding conductors.
- H. Fixtures shall have their exterior labels removed and shall be thoroughly cleaned. Burned out lamps shall be replaced.
- I. Locate emergency lighting remote battery packs and remote test/monitor modules identically so their status indicating lights are visible to the public and they form a straight line when viewed from the end of the corridor or room. Where a suspended ceiling exists, center the status indicating lights in adjacent ceiling tiles.
- J. Mount sealed beam emergency lighting units where shown and aim their lamps to light the egress path as uniformly as possible.
- K. When emergency lighting fixtures contain audible alarms, disable the alarms in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

- A. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures. Misalignment and light leaks shall be corrected, and rattles due to ventilation system vibration shall be eliminated.
- B. Perform an operational test to verify that all fixtures illuminate properly, dimming systems dim properly (i.e., no flicker), and lighting zones are switched according to the drawings.

END OF SECTION 26 51 00

SECTION 26 56 19 - EXTERIOR LIGHTING - LED

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. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 26 09 43 "Network Luminaire Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 SUBMITTALS

- A. Product Data: For each type of luminaire.
 1. Arrange in order of luminaire designation.
 2. Include data on features, accessories, and finishes.
 3. Include physical description and dimensions of luminaire.
 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.

5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 IES LM-80.
 - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
 6. Wiring diagrams for power, control, and signal wiring.
 7. Photoelectric relays.
 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.
- D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For luminaire supports.
1. Include design calculations for luminaire supports.
- F. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Structural members to which equipment and luminaires will be attached.
 3. Underground utilities and structures.
 4. Existing underground utilities and structures.
 5. Above-grade utilities and structures.
 6. Existing above-grade utilities and structures.
 7. Building features.
 8. Vertical and horizontal information.
- G. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- H. Product Certificates: For each type of the following:
1. Luminaire.
 2. Photoelectric relay.

- I. Source quality-control reports.
- J. Sample warranty.
- K. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.5 MAINTENANCE MATERIAL

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- F. Mockups: For exterior luminaires, complete with power and control connections.
 - 1. Obtain Contracting Officer's approval of luminaires in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.8 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Contracting Officer prior to the start of luminaire installation.

1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- F. Bulb shape complying with ANSI C79.1.
- G. CRI of minimum 80. CCT of 4100 K.
- H. L70 lamp life of 50,000 hours.
- I. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- J. Internal driver.
- K. Nominal Operating Voltage: 120-277 V ac.
- L. In-line Fusing: Separate in-line fuse for each luminaire.
- M. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.
- N. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- O. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Atlas Lighting Products.
 2. Cooper Lighting, an Eaton business.
 3. Deco Lighting.
 4. Eaton.
 5. GE Lighting Solutions.
 6. Intelligent Illuminations, Inc.
 7. Intermatic, Inc.
 8. Lithonia Lighting; Acuity Brands Lighting, Inc.
 9. Philips Lighting Company.
 10. Schneider Electric USA, Inc.
 11. Siemens Building Technologies, Inc.
- B. Comply with UL 773 or UL 773A.
- C. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.
3. Network based contact to match the interior lighting system or the existing exterior "Roam" system by Lithonia.

2.4 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - a. Color: Dark bronze.
- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Contracting Officer's sample of manufacturer's standard color.
 - c. Color: As selected by Contracting Officer from manufacturer's full range.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Contracting Officer, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- K. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - a. IES LM-5.
 - b. IES LM-50.
 - c. IES LM-52.
 - d. IES LM-64.
 - e. IES LM-72.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.

- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

- A. Train National Park Service maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.8 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Contracting Officer.

END OF SECTION 26 56 19

**DIVISION 27 –
COMMUNICATIONS**

SECTION 27 20 00 - DATA COMMUNICATIONS

PART 1 - GENERAL

1.1 SCOPE

- A. Data wiring within the building shall be furnished and installed by the Electrical Contractor.
- B. The system shall include all cables from the distribution center patch panel (network switch) to the individual outlets indicated on the drawings. This work will be coordinated by the Electrical Contractor.
- C. All work shall comply with the cable manufacturer's recommendations and the National Electrical Code (NEC).
- D. Cable within the building to the various locations shall be concealed above the ceiling and in the cavity walls. Inside conduit. No open wiring shall be allowed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plywood panelboard shall be 3/4" plywood painted gray and mounted to receive computer equipment and located as shown on the plans.
- B. Conduit and outlet boxes shall be per Section 26 05 33.
- C. Modular Jack -Leviton Quick Port or equal with following salient characteristics – 61110 Series 8 conductor, Duplex TIA/EIA-568-B wiring patterns and Category 6 Certification.
- D. Computer Wire -23 AWG 8 Conductor unshielded twisted pair (UTP) – blue Category 6 four pair which complies with TIA/EIA 568B standards.
- E. Media Converter – Gigabit ethernet 10/100/1000 Base-TX shall comply with IEEE 802.3.
- F. IT Cabinet – Wall mounted enclosure cabinet. Minimum 12U size, ventilated panels, hinged cabinet swings, locking front door. Shall comply with EIA-310-E, IEC 60297-3-100, NOM, ROHS, PCI-DSS, and IP250 protection rating.
- G. Network Switch – Rack mount, gigabit, POE, 10/100/1000 ports, detachable AC power cord with NEMA 5-15P plug, 5ft. Shall comply with ROHS, IEEE 802.3AB 1000 Base-T, IEEE 802.3az (energy efficient ethernet)m FCC Part 15 Class A (USA).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Conduits shall be furnished and installed by the Electrical Contractor.
- B. The Contractor shall verify all wiring with the Contracting Officer before proceeding.
- C. See notes and plans for installation instructions. Comply with cable manufacturer installation requirements.
- D. Minimum burial depth for direct burial computer cable shall be 36" and minimum separation shall be 12" between computer and power conductors.

END OF SECTION 27 20 00

SECTION 27 30 00 - VOICE COMMUNICATIONS

PART 1 – GENERAL

1.1 SCOPE

- A. Telephone/data wiring within the building shall be furnished and installed by the Electrical Contractor.
- B. The telephone/data system shall include cable/fiber from the utility pole to the building furnished and installed by the Contractor. This work will be coordinated by the Electrical Contractor.
- C. All work shall comply with telephone/data company regulations and the National Electrical Code (NEC).
- D. Cable within the building to the various phone locations shall be concealed above the ceiling and in the cavity walls. Inside conduit. No open wiring shall be allowed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plywood panelboard shall be 3/4" plywood painted gray and mounted to receive telephone/data equipment and located as shown on the plans.
- B. Size conduit based on Telephone/Data Company recommendations. Conduits underground or in concrete shall be rigid steel or schedule 40 PVC.
- C. Phone/data Wire -Category 6E four pair which complies to EIA/TIA 568A standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Conduits shall be furnished and installed by the Electrical Contractor. All exterior wiring shall be furnished and installed by the Contractor.
- B. The Contractor shall verify all wiring with Telephone/Data Company Engineer before proceeding.
- C. See notes and plans for instructions for telephone/data entrance. Comply with Telephone/Data Company requirements.

END OF SECTION 27 30 00

**DIVISION 28 – ELECTRONIC
SAFETY & SECURITY**

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SCOPE

- A. All fire alarm equipment shall be U.L. listed and furnished complete by one U.L. listed supplier. All wiring materials shall comply with the National Electrical Code (NEC), Article 760 and NFPA 72. The equipment and services supplier shall employ NICET Certified Engineers and Technicians.
- B. The Contractor shall furnish shop drawings of all fire alarm devices and factory wiring diagrams.
- C. The fire alarm system shall be a complete non-coded, LOCAL, supervised closed circuit, automatic system.
- D. The fire alarm system and all components shall be non-proprietary. Notifier and Wheelock Model numbers are used only to establish a level of quality.
- E. Equipment needing special tools for modifications and program changes shall not be allowed. Full onsite diagnostics and programming shall be allowable via keypad on main panel.
- F. All equipment and devices submitted must meet UL 864 9th Edition Listing.
- G. Submittals shall include copies of NICET Certifications for Technicians, and UL 864 9th Edition Listing Documents. Submittals shall include final proposed device layout. Submittals without these documents will not be considered.

1.2 QUALITY ASSURANCE

- A. Designer Qualifications: The designer of the Fire Detection and Alarm System shall be one of the following:
 - 1. A Fire Protection Engineer.
 - 2. NICET III technician for the system type.
 - 3. Or approved by AHJ.
- B. Installer Qualifications: The installer of the Fire Detection and Alarm System shall be one of the following:
 - 1. State or municipal certified/licensed for alarm contractor.
 - 2. Qualified by the manufacturer.
 - 3. NICET Level II
 - 4. Or approved by AHJ.

PART 2 - PRODUCTS

2.1 MATERIALS (Not all components may be required.)

- A. Fire alarm control panel shall be Class B Microprocessor based. Notifier #SFP1024 panel with main chassis in enclosure complete with 10 Class B initiating circuits, 4 Class B indicating circuits, and 6 amp power supply. Accessories to include initiating circuit module, and DACT (Digital Alarm Communicator). Enclosure shall be for surface wall mounting with lock and keys. Include battery operated emergency power supply with capacity for operating system in standby mode for 24 hours.
- B. Manual pull stations basis of design shall be semi-flush Notifier #NBG12L Series.
- C. Smoke detectors basis of design shall be:
 - 1. Standard – Notifier #2WB.
 - 2. Duct System – Notifier #DH100ACDCP with auxiliary form C relay.
- D. Automatic heat detectors basis of design shall be:
 - 1. Notifier #5604-200 (Boiler Room), 194° fixed temperature heat sensor.
 - 2. Notifier #5603-135 (Kitchen, Hazardous Storage, etc.), 135° fixed temperature heat sensor.
 - 3. Notifier #5601P (all other locations) 135° rate-of-rise heat sensor.

All devices shall be furnished with outlet boxes.
- E. Combination alarm horn/strobe devices basis of design shall be:
 - 1. Notifier Wheelock #NS24MCWFR adjustable for 4 strobe settings – 15, 30, 75 & 110 candela, and two-horn db settings. All strobe devices shall be synchronized.
- F. Strobe devices basis of design shall be:
 - 1. Notifier Wheelock #RSS24MCWFR adjustable for 4 strobe settings – 15, 30, 75 & 110 candela. All strobe devices shall be synchronized.
- G. Remote annunciator basis of design shall be:

Notifier #LED10N remote annunciator chassis with semi-flush enclosure with trim ring and lock and key. Annunciator shall provide alarm and trouble LEDES per zone and system control switches.
- H. Mini horn devices basis of design shall be:
 - 1. Notifier #MIZ-24S Series.
- I. Initiating and Notification Circuit Wiring: Power limited fire-protective signaling cable, copper conductor, 300 volts, insulation rated 105 degrees C.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices as shown on the plans and as required by code.
- B. All 24 VDC wiring shall not be smaller than #16 AWG. Any wiring exposed or concealed lower than 7 feet from the floor shall be in EMT.

Size and number of wires shall be in accordance with wiring diagrams supplied by the manufacturer.

- C. The Contractor shall arrange for the factory representative to demonstrate the complete system for the National Park Service. Contractor shall also notify the Contracting Officer of the test.
- D. The AC service for the fire alarm shall be from a lockable circuit breaker located in the panelboard.
- E. The Contractor shall, upon completing the installation of the Fire Alarm System, conduct a complete test of the system in the presence of a representative of the Fire Alarm Equipment Manufacturer. During the course of the test, each manual station shall be activated, each smoke detector shall be smoke tested, or an equal test performed, each rate of rise heat detector shall be activated by way of applying heat, each fixed temperature heat detector shall be activated by way of removing the fixed temperature heat element or shorting the terminal of the heat detector. The manufacturer shall supply a minimum of one-year guarantee on all new Fire Alarm Equipment.
- F. During testing each supervised circuit, associated with the Fire Alarm System shall be opened at the most remote point in that circuit causing the trouble indication at the control panel to operate, thereby ascertaining that each circuit is supervised as required. At the completion of the test, a letter shall be submitted by the Contractor to the National Park Service stipulating that the Fire Alarm system was installed according to these specifications.
- G. This contractor shall include in his price a one-year contract, effective from the date of acceptance, for maintenance and inspection services of the manufacturer's equipment with a minimum of two inspections during that contract year. Written evidence of such inspections shall be left with the appropriate authorities, verifying that at the conclusion of each inspection, the Fire Alarm System has been tested.

END OF SECTION 28 31 00

DIVISION 31 - EARTHWORK

SECTION 31 00 00 – EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the work specified in this section, and as shown on the Drawings.
- B. Work performed under this Section of the Specifications shall be subject to the General Conditions, Supplementary Conditions and Division 01 General Requirements Division 1 - General Provisions of the Contract Documents.
- C. The work of this section includes but is not necessarily limited to:
 - 1. Excavation, fill, and backfill, as indicated or required, including compaction.
 - 2. Excavation, as required, to the lines and grades indicated on the Drawings.
 - 3. Excavation and offsite disposal of unsuitable or excess materials unless on-site locations are designated. Excavation shall include removal and satisfactory disposal of all unclassified material encountered throughout the site.
 - 4. Rough grading, including placement, moisture conditioning, and compaction of fills and backfill.
 - 5. Placement of base and subbase course materials under structures, pavements, slabs, and footings, including compaction.
 - 6. Trench excavation, bedding, and backfill for structures, foundations, and utilities, including compaction.
 - 7. The removal, hauling and stockpiling of suitable excavated materials for subsequent use in the work. Stockpiling shall include protection to maintain materials in a workable condition.
 - 8. Rehandling, hauling, and placing of stockpiled materials for use in refilling, filling, backfilling, grading, and such other operations.
 - 9. Protect and preserve all existing buildings, pavements, and utilities to remain.
 - 10. Furnishing and installing all sheeting, shoring, and bracing of structural and trench excavations and its satisfactory removal, unless otherwise directed to have it remain in place.
 - 11. Environmental controls.

12. Providing products in sufficient quantities to meet the project requirements.
 13. Providing adequate pumping and drainage facilities to keep the work area sufficiently dry.
 14. Obtain all required permits, licenses, and approvals of appropriate municipal and utility authorities, prior to commencing the work of this Section, and pay costs incurred therefrom.
- D. Provide facilities, labor, materials, tools, equipment, appliances, and related work necessary to provide and maintain erosion control during construction operations. All erosion control measures shall be installed prior to earthwork operations and shall be maintained according to plans and other sections of the specifications.
1. Refer to Section 312500 – EROSION AND SEDIMENTATION CONTROLS.
- E. Contractor shall be responsible for notifying all affected utility companies before starting work. Comply with the requirements of the State of Maine "Dig Safe" Utilities Underground Plant Damage Prevention System.

1.2 RELATED SECTIONS

- A. Carefully examine all of the Contract Documents for requirements which affect the work in this Section. Other Specification Sections which directly relate to the work of this Section include, but are not limited to, the following:
1. Section 311100 – CLEARING AND GRUBBING.
 2. Section 313219.23 – GEOTEXTILE LAYER SEPARATION.
 3. Section 312500 – EROSION AND SEDIMENTATION CONTROL.
 4. Section 321216 – ASPHALT PAVEMENT.
 5. Section 329220 – SEEDING.
 6. Section 331000 – WATER UTILITIES.
 7. Section 333900 – SANITARY UTILITY SEWERAGE STRUCTURES.
 8. Section 334000 – STORM DRAINAGE UTILITIES.

1.3 LAWS AND REGULATIONS

- A. Work shall be accomplished in accordance with regulations of local, county, state and federal agencies or utility company standards as they apply.

1.4 QUALITY ASSURANCE

- A. The Contractor is responsible for retaining and paying for the services of an independent testing and inspection firm to perform on-site observation and testing during the various phases of the construction operations. The services of an independent testing firm may include, but not necessarily be limited to, the following:
1. Observation during excavation and dewatering of building areas and controlled fill areas.
 2. Laboratory testing and analysis of fill materials as specified herein and proposed by the Contractor for incorporation into the Work.
 3. Observation of construction and performance of water content, gradation and compaction tests at a frequency and locations that the independent testing and inspection firm may require to ensure compliance with the Contract Document requirements. The results of these tests will be submitted to the Contracting Officer and Contractor on a timely basis so that action can be taken to remedy indicated deficiencies. During the course of construction, the independent testing and inspection firm will advise the Contracting Officer in writing, if at any time in their opinion, the Work hereunder is of unacceptable quality. Failure of independent testing and inspection firm to give notice, shall not excuse the Contractor from latent defects discovered in his work.
- B. The Contractor shall make provisions for allowing observations and testing of Contractor's work by the independent testing and inspection firm.
1. The presence of the independent testing and inspection firm does not include supervision or direction of the actual work of the Contractor, and his employees or agents. Neither the presence of the independent testing and inspection firm, nor any observations and testing performed by them, nor failure to give notice of defects shall excuse the Contractor from defects discovered in his work.
- C. Costs related to retesting due to unacceptable qualities of work and failures discovered by testing shall be paid for by the Contractor at no additional expense to National Park Service.
- D. Whenever floodplain compensation areas are designated on the plans, grading elevations are to be considered critical to the floodplain volumetric calculations and shall be constructed by the Contractor in strict conformance with the indicated grades.

1.5 SUBMITTALS

- A. Submit, in an airtight container for the testing laboratory, a 50-pound sample of each type of off-site fill material that is to be used at the site. Submit samples a minimum of one week prior to use of proposed material at the site. Submit samples to the

testing laboratory (copy of these transmittal forms shall be simultaneously sent to Contracting Officer) or if no testing laboratory is identified, then the Contracting Officer shall be the recipient of the samples. Use of these proposed materials by the Contractor prior to testing and approval shall be at the Contractor's risk.

- B. The Contracting Officer will be responsible for the approval or rejection of the suitability of all materials.
- C. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the project requires approval of the Contracting Officer.
- D. For use of geotextile fabrics or geogrids, submit manufacturer's product data including material's properties for approval by the Contracting Officer.

1.6 COORDINATION

- A. Prior to start of earthwork the Contractor shall arrange an on-site meeting with the Contracting Officer, the independent testing firm for the purpose of establishing the Contractor's schedule of operations and scheduling observation and testing procedures and requirements.
- B. As construction proceeds, the Contractor shall be responsible for notifying the Contracting Officer prior to the start of earthwork operations requiring observation and/or testing.

1.7 SUBSURFACE SOIL DATA

- A. A geotechnical engineering report has been prepared by S.W. Cole. This report is specifically not part of the Contract Documents, but is available to bidders for informational purposes.
- B. Review available logs of borings, test pit logs, jar soil samples, records of explorations and other pertinent data for the site. After obtaining National Park Service permission, take whatever additional subsurface explorations deemed necessary at no expense to the National Park Service.
- C. Boring logs have been supplied in the contract documents for reference.
- D. The above data are for general information and are accurate only at the particular locations and times the subsurface explorations were made. It is the Contractor's responsibility to make interpretations and to draw conclusions based on the character of materials to be encountered and the impact on his work based on his expert knowledge of the area and of earthwork techniques.
- E. The Drawings in the geotechnical report showing existing ground elevations are only for whatever use the Contractor may make of them with no responsibility on the part of the engineers, surveyors, the National Park Service, the Contracting

Officer, and/or their representatives for the accuracy and/or the reliability of the information given.

- F. If a potential conflict exists between the Geotechnical Report and these technical Specifications, the Contractor shall, immediately upon its discovery, request clarification from the Contracting Officer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Subgrade is the material in excavation (cuts) and fills located below subbase, base course layer for slabs, sidewalks, pavement, and other improvements.
- B. Common Borrow: Fill to raise grades in paved and landscape areas should be non-organic compactable earth meeting the requirements of 2020 MaineDOT Standard Specification 703.18 Common Borrow. Where used beneath paved areas, Common Borrow fills shall be capped with a 12-inch layer of Granular Borrow prior to installing Pavement Subbase materials.
- C. Granular Borrow: Fill to raise grades in paved areas or in building footprints below depths of 4.5 feet from FFE should be sand or silty sand meeting the requirements of 2020 Maine Department of Transportation (MaineDOT) Standard Specification 703.19 Granular Borrow.
- D. Sand shall consist of clean, inert, hard, durable grains of quartz or other hard, durable rock, free from loam or clay, surface coatings and deleterious materials.
 - 1. The allowable amount of material passing a No. 200 sieve as determined by AASHTO-T11 or ASTM D422 shall not exceed 10 percent by weight. The maximum particle size shall be 1/4-inch (i.e., 100 percent passing the No. 4 sieve).
 - 2. In addition to the above criteria when sand is used for bedding concrete pavers and for utility bedding it shall conform to the following gradation:

<u>Sieve (ASTM D422)</u>	<u>Percent Passing by Weight</u>
No. 4	100
No. 8	80 – 95
No. 16	55 – 85
No. 50	0 – 35
No. 200	0 – 5
- E. Crushed Stone, used below footings and for underdrain aggregate, should meet the requirements of 2020 MaineDOT Standard Specification 703.22 Type C Underdrain Aggregate.
- F. Gravel Base and Subbase Materials below pavement or as noted:
 - 1. Base: MaineDOT 703.06 Aggregate Base Type A

2. Subbase: MaineDOT 703.06 Aggregate Subbase Type D

G. Washed Crushed Stone for Stormwater Recharge shall be composed of durable crushed rock consisting of angular fragments, free from a detrimental quantity of thin, flat, elongated pieces or shall be durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone. The crushed stone shall be free from clay, loam, or deleterious material.

1. Washed Crushed Stone for Stormwater Recharge shall conform to the following gradation:

Sieve Size	Percent Passing by Weight	
	2-inch Stone	1-1/2 inch Stone
2 inch	90 – 100	100
1-1/2 inch	-	95 – 100
1-1/4 inch	25 - 50	45 – 80
1-inch	-	35 – 70
3/4 inch	0 - 15	0 – 25
1/2 inch	0 - 5	0 – 5
No. 4	-	0

2. AASHTO Designations

Sieve Size	Percent Passing by Weight		
	No. 57	No. 3	No. 2
3 inch			100
2-1/2 inch		100	90 - 100
2 inch		90 - 100	35 - 70
1-1/2 inch	100	35 - 70	0 - 15
1 inch	95 - 100	0 - 15	0 - 5
1/2 inch	25 - 60	0 - 5	
No. 4	0 - 10		
No. 8	0 - 5		

H. Structural Fill: Backfill for foundations and within the design frost depth below on-grade slabs, should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below

Sieve Size	Percent Passing by Weight
4-inch	100
3-inch	90-100
1/4-inch	25-90
#40	0-30
#200	0-6

- I. Choke Stone shall be hard, durable, clean, rock with a maximum rock diameter of nine inches (9") and shall conform to the following gradation requirements:

Sieve Size	Percent Passing by Weight
9 inches	100
6 inches	75 - 100
2 inches	70 - 85
¾ inches	45 - 60
No. 4	15 - 30
No. 40	5 - 15
No. 200	0 - 10

- J. Stone Fill shall be hard, durable, clean, washed rock with a minimum diameter of 1-1/2 inches and a maximum diameter of 3 inches with void ratio of 30 to 40 percent.
- K. Revetment shall consist of slope protection of the required type at the location shown on the plans, and in conference with the lines and grades shown on the plans.

1. Riprap. Riprap shall consist of a protective covering of angular shaped stones laid on slopes in front of structures, wingwalls, piers, and elsewhere as required, to insure protection of structures and embankments.
 - a. Riprap shall be sound, durable rock, which is angular in shape. Rounded stones, boulders, sandstone, or similar soft stone or relatively thin slabs will not be acceptable. Each stone shall weigh not less than 50 pounds and at least 75% of the volume shall consist of stones weighing not less than 500 pounds each. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.
2. Stone for Pipe Ends and Energy Dissipaters: Stone for pipe ends and energy dissipaters shall be sound, durable rock, which is angular in shape. Rounded stones, boulders, sandstone, or similar stone or relatively thin slabs will not be acceptable. The majority of the larger stones shall weigh not less than 50 pounds nor be less than 1.4 ft. long, 0.5 ft. wide, and 0.5 ft. in height. Each larger stone shall weigh not more than 125 pounds nor be more than 2.0 ft. long, 0.8 ft. wide, and 0.8 ft. in height and at least 50 percent of the larger stone volume shall consist of stones weighing not less than 75 pounds nor be less than 1.6 ft. long, 0.6 ft. wide, and 0.6 ft. height. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.
3. Slope Paving: Slope paving shall consist of angular shaped stones, having a reasonable flat face, carefully placed on slopes to insure the slope is protected.
 - a. Stone for slope paving shall be sound, angular in shape, and free from structural defects. Each stone shall have one reasonably flat face and a thickness perpendicular to the face of not less than 6 inches, which shall be the least dimension of the stone.

- b. Approximately 60 percent of the stones shall vary from 2 to 3 cubic feet each in volume and the remainder of the stones shall each be from 1 to 2 cubic feet in volume.
4. Channel Paving and Grouted Channel Paving. Channel Paving of the type specified shall be placed as protective covering along the slopes around culvert inlets or outlets, around foundations, structure and dikes.
 - a. Stones for Channel Paving and Grouted Channel Paving shall be sound, approved quality angular blocks, as nearly rectangular or cubical as practicable. Rounded stones or relatively thin slabs will not be acceptable. At least 75 percent of the volume shall consist of stones weighing at least 200 pounds each. The remainder of the stones shall be so graded that when placed with the larger stones a compact mass will result.

Refer to the State of Maine Department of Transportation Standard Specifications section 703.29 Stone Ditch Protection.

Filter Fabric used with riprap, stone for pipe ends, slope paving, or channel paving (grouted or ungrouted) shall be a woven geotextile fabric meeting the requirements of Section 31 32 19.23.

L. Filter Fabric / Geotextiles:

1. Geotextile Fabric shall be used to prevent soil intrusion into drains and/or assist in stabilizing soil subgrades to be laid on approved soil subgrades prior to placement of fill materials.
 - a. Contractor shall use a non-woven geotextile fabric in drainage recharge systems, underdrain systems between crushed stone and granular soils, leaching areas, or where indicated on the plans meeting the requirements of Section 31 32 19.23.

M. Stormwater Detention Embankment Fill: In addition to the placement and compaction requirements for the embankment fills, the following shall apply:

1. The fill designated for the core of detention basin embankment shall be low permeability fill.
2. The Core Fill shall be placed and compacted in a manner to provide an in-situ permeability rate of not more than 1.0×10^{-5} cm/sec

N. Controlled Low Strength Material or Controlled Density Fill:

1. Controlled low strength material or controlled density fill shall be a cement concrete backfill material that flows like a liquid, supports like a solid when cured, and levels without tamping or vibrating to reach 100 percent

compaction. The material shall be used primarily as a backfill in lieu of compacted fill. The material shall be proportioned to yield a 28—day minimum compressive strength of 200 pounds per square inch. The material shall be produced and installed in accordance with ACI 229R, and ACI 116R, with a mix formulation to be approved by the Contracting Officer prior to placement of the material in the project.

- O. Topsoil/Loam – Refer to Specification SECTION 32 94 00 – TOPSOIL.
- P. Soil Filter Underdrain Layer - The underdrain material consists of well-graded, clean, coarse gravel meeting the Maine DOT specification 703.22 Underdrain Backfill for Type B Underdrain:

Sieve Size	Percent Passing by Weight
1”	95-100
½”	75-100
No. 4	50-100
No. 20	15-80
No. 50	0-15
No. 200	0-5.0

- Q. Soil Filter Bed Material - This soil mixture should be a uniform mix, free of stones, stumps, roots, or other similar objects larger than two inches. No materials or substances that may be harmful to plant growth can be mixed within the filter. Except for agricultural sources, most organic sources may be acceptable for the organic component of the media. Soil filter media consists of a silty sand soil or soil mixture combined with a mature, moderately fine shredded bark or wood fiber mulch 20% to 25% by volume (no less than 10% by dry weight). The resulting mixture should have 8% to 12% passing the No. 200 sieve and a clay content of less than 2%. The media mixture should have very little or no clay content as tested via hydrometer test. The proportions of the mixture can be adjusted so it will contain sufficient fines and organic matter. As an example, the soil filter media may contain the following (by volume):

- 50% of sand (Maine DOT specification #703.01)
- 20% of sandy loam to fine sandy loam (see below)
- 30 % of mature composted woody fibers and fine shredded bark, superhumus or equal (adjusted for mineral soil content).

Sandy Loam Specification:

Sieve Size	Percent Passing by Weight
No. 4	75-95
No. 10	60-90
No. 40	35-85
No. 200	20-70
200 (clay size)	< 2.0

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

- A. Cut and remove trees, remove stumps and brush. Legally dispose of off-site. Wood wastes may be chipped and shredded on-site and reused on-site with prior approval of the Engineer.
- B. Strip all topsoil, subsoil and other unsuitable materials to its full depth within the Contract limits. In building areas, limits of excavation are defined in Section 3.03B.
- C. Under pavement areas, unsuitable materials shall be removed and disposed of by the Contractor in an approved location, or if no approved location exists on site to an approved off site location and replaced with structural fill. Treatment of existing fill and removal of topsoil, subsoil, and stumps are defined in Section 3.03B.8. These materials shall be processed to remove all roots, stones larger than 3/4 inch in diameter, and other deleterious materials. Stockpile as approved by the Engineer. Protect the topsoil from contamination by other materials.
- D. Other Specification Sections shall apply to clearing and grubbing under demolition and shall include air quality, erosion control, and hazardous waste.
- E. Remove all topsoil, subsoil, vegetative matter, and non-soil materials and, after screening out the roots, rocks greater than 3/4 inch in size, and deleterious debris, separately stockpile the topsoil and subsoil materials.
- F. Return to the National Park Service all topsoil that is not re-used on the project site. Protect topsoil from contamination. Deliver topsoil to a location designated by the Contracting Officer within a five-mile radius of the project site and stockpile in windrows.
- G. For topsoil that will be stored for two weeks or longer, including topsoil stored on site and all topsoil delivered to off-site locations, keep the maximum height of each stockpile less than six feet. Cover stockpiled topsoil for two weeks prior to handling, including use and transportation, to protect from excess moisture.

3.2 DEWATERING

- A. Provide, operate, and maintain site and subsurface drainage and dewatering in an acceptable manner as required to complete the work throughout the course of the project.
- B. Remove, by pumping or other means, water accumulated in excavations and within two (2) feet below subgrade until earthwork, utilities, concrete, and other work operations are complete. Dewatering shall be considered incidental to the defined

work items and costs for performing same shall be included in the bid price(s) and no separate payment shall be made to the Contractor for dewatering operations.

- C. Provide, maintain, and operate wells, pumps, and related equipment including stand-by equipment of sufficient capacity to maintain excavations and trenches free of water 24 hours per day to enable all work to be conducted in-the-dry and to protect bearing surfaces from disturbance.
- D. Water from excavations shall be disposed of in such manner as will not cause injury to public health, public and private property, existing work, work to be completed or in progress, roads, walks, and streets, or cause any interference with use of same by public. Concrete or fill shall not be placed in excavations containing free water.
- E. Construction may require excavation below water level in soil. The Contractor shall complete this work in-the-dry to maintain the undisturbed condition of the bearing soil.
- F. Maintain groundwater at least two (2) feet below lowest exposed subgrade level. If the dewatering methods have not been adequate and the bearing soils are disturbed, remove disturbed soil and replace with compacted Structural Fill or lean concrete at no additional cost to the National Park Service.
- G. Sumps shall be surrounded by suitable filter media to minimize the fines removed during pumping.
- H. Pumped groundwater and surface water runoff shall be initially pumped to a settling basin to remove suspended solids prior to discharge. The Contractor shall furnish all treatment systems that are necessary for pretreatment of groundwater prior to discharge in accordance with all applicable permits and regulations.
- I. Discharge of pumped water, either surface water runoff or groundwater, shall be in compliance with discharge criteria contained in permits issued by governing agencies, and all legal requirements and regulations. All permits shall be obtained by the Contractor.

3.3 EXCAVATIONS

A. General Definitions

1. Unclassified Materials

Unclassified excavation includes the satisfactory removal and disposal of all materials (except contaminated materials defined below) encountered regardless of the nature of the materials and shall be understood to include, but not be limited to, blast rock, bedrock, earth, hardpan, fill, foundations, pavements, curbs, piping, railroad track and ties, cobblestones, footings, bricks, concrete, abandoned drainage and utility structures, and debris. Drilling, blasting, excavation, and disposal of rock shall be considered

unclassified excavation and shall be included as a part of the Contract Price, with no separate payment items for its excavation and handling.

2. Contaminated Materials

- a. The Contractor shall be familiar with the Maine State Department of Environmental Protection (DEP) Hazardous Waste Regulations when conducting earthwork operations.
- b. In general, a hazardous waste (contaminated with oil or hazardous materials) is a waste or combination of wastes which, because of its quantity, concentration, physical, chemical or infectious characteristics, may cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or pose a substantial present or potential hazard to human health, safety, or welfare, or to the environment when improperly stored, treated, transported, or disposed of, or otherwise managed.
- c. The Contractor shall immediately halt soil movement activities and notify the Contracting Officer if visual, olfactory, or other evidence suggests that soils may be contaminated with oil or hazardous materials. Contractor shall provide reasonable assistance to Contracting Officer for access to potential contamination areas for proper assessment of hazardous conditions.
- d. The Contractor shall contact an environmental professional (such as a Licensed Site Professional) to test any earth materials suspected of containing hazardous waste. The results shall be evaluated by the environmental professional and compared with reporting thresholds found in the Maine DEP standards. The Contractor shall inform the Contracting Officer of the laboratory test results as soon as possible and discuss the possible soil management, disposal, and recycling options available. Contaminated soils shall be managed and handled in compliance with the referenced state/federal regulations, guidelines, and policies. Time and expenses associated with contaminated soils shall be negotiated between the Contractor and the National Park Service prior to the start of the soil management, soil disposal, and recycling work. National Park Service reserves the right to negotiate and contract with other entities for remedial work and, in that event, this Contractor shall make reasonable accommodations for other entities to perform this work.
- e. Although there is no evidence of oil or hazardous material, there is a possibility of the presence of such wastes on this site. Appropriate testing, as recommended by an environmental professional shall be accomplished to assess the potential presence of oil or hazardous material. Earth material shall not be removed from the site unless on-site reuse is not possible.

- f. Proper documentation of legal disposal of hazardous materials handled by this Contractor shall be provided by the Contractor to the Contracting Officer. Additional guidance for possible disposal activities can be found in the Department of Environmental Protection's Policy.
- g. Unless specifically identified as contaminated material under referenced statues and as defined above, as judged by the Engineer, excavated materials shall be considered unclassified as defined in item 1., above.

B. Site General Requirements

1. Control the grading so that ground is pitched to prevent water from running to excavated areas, damaging other structures, or adjacent properties.
2. Where soil has been softened or eroded by flooding, equipment, traffic, or placement during unfavorable weather, or such other conditions, it shall be removed and replaced by the Contractor with suitable material, and at no cost to the National Park Service.
3. Exercise care to preserve the material below and beyond the lines of excavation. Where excavation is carried out below indicated grade or beyond the lines of excavation, Contractor shall backfill and compact the over excavation with structural fill to the indicated grade, at no additional cost to the National Park Service and at the direction of the Engineer.
4. Provide sheeting, shoring and bracing to complete and protect all excavated areas, as required for safety and compliance with OSHA. Costs for sheeting, shoring, and bracing shall be included as a part of the Contract Price for completing the work and National Park Service shall make no separate payment for this work.
5. Excavated materials unsuitable for reuse, surplus excavated rock, and surplus excavated soil not used to fulfill requirements of the Contract, shall become the property of the Contractor and shall be removed from the site in accordance with the regulations and requirements of all municipalities or agencies having jurisdiction over the disposal sites and the route between the project and the disposal sites.
6. Limits of excavation are such that all unsuitable material shall be removed to firm natural ground in the manner specified below. In building areas, unsuitable materials shall be removed to a distance of five feet (5') beyond the building lines or within the area defined by a one horizontal to one vertical (1h:1v) line sloping down from outside bottom edge of exterior footings to firm natural ground, whichever is greater. Limits of unsuitable material excavation also apply to areas below exterior column footings. All abandoned pipes within building areas shall be removed and the excavations shall be properly backfilled.

7. Unsuitable materials which are classified as organics such as peat, trash, fill, stumps, debris, material determined to be hazardous, and topsoil and subsoil when determined by Engineer to be unacceptable for incorporation into the work.
8. Under pavement areas, existing fill shall be densified in place and shall not be excavated. Abandoned pipes, that are buried more than four feet (4') from finish grade to the top of the pipe and that do not interfere with utilities to remain or to be installed, shall be pumped full of flowable fill or grout, and capped and/or grouted at both ends and left in place. Abandoned pipes less than four feet (4') from finish grade shall be removed and the trench shall be appropriately backfilled with structural fill.
9. The existing base materials and native soils are unsuitable for reuse as fill in the building footprints but may be suitable for reuse in landscape areas or subgrade fill in paved areas, provided they are used as the lower lifts of fill and they are at a compactable moisture content at the time of reuse. Suitable material, as determined by the Engineer, may be reused on the site provided it meets the gradation requirements for the given materials in the information of fill sections, embankments, pavement subgrades, backfills, etc.
10. Do not over excavate below proposed design grades for the purpose of obtaining borrow for use off-site.

C. Proof Rolling

1. Prior to placing compacted fills, the Contractor shall proof roll the natural grades to remain. Where materials of low density are indicated by rutting or weaving under the compactor, the Contractor may be required to make up to three (3) additional complete coverages of the area with the compactor as determined by the Engineer. The cost of all proof rolling shall be included in the Contract Price. If materials of low density are encountered that cannot be compacted to the extent necessary to support the proposed embankment fills as determined by the Engineer, the Contractor shall remove those materials and replace them with compacted fill.
2. Alternately, an initial layer of fill may be allowed to form a working platform. The need, manner of construction, and thickness of such a layer shall be subject to approval of the Engineer and the layer will be permitted only where the lack of support is, as determined by the Engineer, not due to deficient ditching, grading or drainage practices, or where the embankment could be constructed in the approved manner by the use of different equipment or procedures. Thickness of up to eighteen inches (18") may be permitted for such a layer.

3.4 TRENCH EXCAVATION

- A. Excavate as necessary for all drainage pipes, utilities, and related structures and appurtenances, and for any other trenching necessary to complete the work.

B. Definitions:

1. Trench shall be defined as an excavation of any length where the width is less than twice the depth and where the shortest distance between trench wall lines does not exceed ten feet (10'). All other excavations shall be defined as open excavations.
2. The words "invert" or "invert elevation" as used herein shall be defined as the elevation at the inside bottom surface of the pipe or channel.
3. The words "bottom of the pipe" as used herein shall be defined as the base of the pipe at its outer surface.

C. In general, machine excavation of trenches will be permitted with the exception of preparation of pipe beds which will be hand work. Excavate by hand or machine methods to at least six inches (6") below the bottom of pipe or as shown on the Drawings. Excavation to final grade shall be made in such a manner as to maintain the undisturbed bearing character of the soils exposed at the excavation level.

D. Utilities or piping shall not be laid directly on boulders, cobbles, or other hard material. This material shall be removed to a minimum of six inches (6") below the bottom of pipe at all points and backfilled or compacted as specified.

E. Remove unsuitable material encountered at subgrade elevations, backfill with material specified herein and as otherwise indicated on the Drawings, specified, or directed. Compact as specified with approved compactors.

F. In general, the width of trenches shall be kept to a minimum and in the case of piping shall not exceed the sum of the pipe's outside diameter plus 2'-0" to at least twelve inches (12") above the pipe.

3.5 ROCK EXCAVATION

A. Blasting

1. Contractor shall, before doing any blasting work, present to the Contracting Officer written certificate of insurance showing evidence that their insurance includes coverage for blasting operations.
2. No blasting shall be done without giving 24 hour prior notice to the Contracting Officer. Written permission and approval of methods must be obtained from appropriate governing authorities.
3. The driller and Contracting Officer shall log the bottom elevation of all drill holes made for blasting within the building area.
4. Experienced powdermen or persons who are licensed or otherwise authorized to use explosives shall conduct the blasting. Accurate records shall be

maintained, noting location of each blast, time of detonation, total explosive weight in each blast, maximum explosive weight per delay in each blast hole, and designation of delay cap used in each hole.

5. Explosives shall be stored, handled, and employed in accordance with federal, state and local regulations, or, in the absence of such, in accordance with the provisions of AGC Manual of Accident Prevention in Construction of The Associated General Contractors of America, Inc. and in accordance with applicable OSHA regulations.
6. The amount of vibration and airblast overpressure generated by blasting shall not exceed regulatory statutes or directives established by state, local or other governing authorities. In no case shall the maximum Peak Particle Velocity (PPV) exceed the limits indicated on Figure B-1, Appendix B, of the United State Bureau of Mines Report of Investigations, RI8507, 1980. These limits shall apply at all existing and under construction structures and utilities, as well as at property and construction limits.
7. Contractor shall take great care to prevent damage to existing buildings, foundations, glass and glazing, and trees to remain. Damage caused by Contractor's blasting operations shall be repaired by Contractor at no additional cost to the National Park Service.

B. Clearance Limits

1. Foundations and Slabs: Within the limits of the concrete lines as defined by the working plans or by duly authorized modifications thereto, plus twelve inches (12") outside the vertical concrete lines and twelve inches (12") below base.
2. Utility Trenches: All parts of pipe, valves, and fittings to a depth of six inches (6") below the bottom of the bell and for a width equal to the outside diameter of the pipe, plus fifteen inches (15") beyond the outside diameter on each side, provided that overlapping computed volumes of any ledge or boulder excavation shall be paid for only once.
3. Paved Areas: To the underside of the respective subbase for such areas.
4. Site Structures: Twelve inches (12") outside of structure all around.
5. Lawn areas and shrub planting areas: To a depth of eighteen inches (18") below finished grade.
6. Planting areas for trees over two inches (2") in caliber size: To depth of thirty-six inches (36") below finished grade and for a radius of 3 feet (3') around each tree, except volumes in radius areas shall not overlap.
7. Any foreseen rock or boulder encountered, as defined above, which must be removed for construction of the work defined on the plans or in modification

thereto, shall be measured in its original position to the limits of clearly defined vertical construction lines and to the depth required for the defined construction.

C. Reuse of Excavated Rock

1. Riprap

- a. Excavated rock may be used as riprap, for construction of stone masonry walls, and for sloped riprap for retaining walls, provided that the rock is judged to be adequate quality by the Contracting Officer and the rock is sufficiently broken to meet gradation requirements established for the intended use.

2. Fills

- a. Reuse of excavated rock for fill materials shall require prior approval of the Contracting Officer and shall require compliance with gradation requirements for the specific type of fill for which it is being used.

D. Rock Subgrades under Building Footings and Paved Areas

1. Excavation of rock under footings and paved areas shall include the removal of all loose material to the top of sound bedrock that is acceptable to the Contracting Officer. Sound bedrock is defined as hard, intact rock that cannot be excavated with a track mounted excavator.
2. Rock surface for footings shall have a maximum slope of four (4) horizontal to one (1) vertical.
3. Rock excavations for footings carried below design grades shall be backfilled by placement of concrete with same strength as footing at the Contractor's cost. At the discretion of the Structural Engineer of Record (SER), footings could be dropped below design elevation onto competent rock.

3.6 PREPARATION OF EXCAVATION BOTTOMS

A. General Rock Subgrade Areas

1. Rock surfaces to receive backfill shall have a maximum slope of four (4) horizontal to one (1) vertical.

B. Building and Pavement Areas

1. Loose rock is covered with 6 inches (6") of crushed stone or choke stone; and
2. Prior to placing crushed or choked stone, the area is rolled with a heavy vibratory roller or fully loaded ten wheel dump truck.

3. Proof-roll subgrade with a vibratory roller or a fully loaded ten-wheeled dump truck. Soft or hard areas and other objectionable material (stumps, wood, organics) shall be excavated and backfilled with compacted structural fill.
4. Prior to the placement of blast rock fill over a bedrock subgrade, voids in the rock surface shall be choked off with appropriately graded choke stone or crushed stone to prevent migration of fines into fractures, and as approved by the Contracting Officer.

C. Subgrades under Proposed Landscape Areas.

1. Depth to rock under planting areas shall be a minimum of 48 inches (48") below subgrade elevations. Backfill up to subgrade shall be done with topsoil/loam materials.
2. In lawn areas, scarify subsoil a minimum depth of six inches (6"). Subsoil shall also be cleared of debris and stones larger than four inches (4") prior to topsoil spreading.
3. In planting areas, scarify subsoil a minimum depth of six inches (6") below the required root ball excavation prior to placement of plant backfill mixture.

D. Trenches

1. Compaction equipment used in open areas where space permits shall consist of vibratory rollers, fully loaded ten-wheel dump trucks, pneumatic compactors, or other similar equipment.
2. Compaction equipment for fill against foundation walls and in other confined areas shall be accomplished by means of drum-type, power-driven, hand-guided vibratory compactors operating at 2,000 cycles per minute, or by hand-guided vibratory plate tampers.

3.7 BACKFILLING AND PLACEMENT OF FILL MATERIALS

A. Site

1. Dewater subgrade areas prior to filling.
2. Compaction by puddling or jetting is prohibited.
3. Control groundwater and surface runoff to minimize disturbance of exposed natural ground surface, previously placed and compacted fill and material being placed.
4. Soil fill moisture shall be maintained at an acceptable working range to allow for proper compaction.

5. Do not place fill on frozen ground.
6. Do not place frozen fill.
7. Place fill in uniform horizontal layers and compact immediately after placement. Where the horizontal layer meets a rising slope, the layer shall be keyed into the slope by cutting a bench during spreading of preceding lift.
8. To the extent that is practical, each layer of fill shall be compacted to the specific density the same day it is placed.
9. Slope fill surfaces at the end of each day to provide for free surface drainage.
10. Protect structures and pipes from damage during backfilling operations. Repair damage at no cost to National Park Service.
11. Placement of fill shall not begin prior to observation and approval of subgrade conditions by Contracting Officer.
12. Protect foundations, footings, and waterproofing during backfilling. Repair damage at no cost to National Park Service.
13. Prior to backfilling between foundation wall and sheeting, remove unsuitable material, including rubbish, organic materials, or other debris. Do not commence filling operations until conditions have been observed by Contracting Officer.
14. Backfill shall not be placed against walls until they are braced or have cured sufficiently to develop strength necessary to withstand, without damage, pressure from backfilling and compacting operations.
15. Provide shoring, sheeting, and bracing of excavations as required to assure complete safety against collapse of the earth at the site of excavations. Alternatively, lay back excavations to suitable slope.
16. Upon completion of the work, the final ground surface shall be left in a firm, unyielding, true, uniform condition free from ruts. Repair disturbed areas caused equipment traffic at no cost to National Park Service.

B. Equipment

1. Compaction equipment used in open areas where space permits shall consist of vibratory rollers, fully loaded ten-wheel dump trucks, pneumatic compactors, or other similar equipment.
2. Compaction equipment for fill against foundation walls and in other confined areas shall be accomplished by means of drum-type, power-driven, hand-guided vibratory compactors operating at 2,000 cycles per minute, or by hand-guided vibratory plate tampers.

C. Blast Rock Backfill – Structure and Foundation Backfilling and Compacting

1. Prior to the placement of blast rock fill over a bedrock subgrade, voids in the bedrock surface shall be choked off with appropriately graded crushed stone or choke stone to prevent migration of fines into fractures as approved by the Contracting Officer.
2. Blast rock fill and crushed stone shall be placed and compacted as indicated below:
 - a. Maximum lift thickness prior to compaction shall be 24 inches (24").
 - b. Material shall be dumped 25 feet behind the fill face and pushed forward to allow mixing and removal of oversized rock and backfilling voids.
 - c. Should the maximum size of blast rock exceed 18 inches (18"), then use a rock rake with teeth spaced at 18 inches (18"), or other means to separate and remove oversized rock.
 - d. Provide a minimum of 18 inch thick transition zone of choke stone between blast rock fill and granular borrow materials. All blastrock fill shall be choked with a transition zone of choke stone, where structural fill is to be placed above or adjacent to it.
 - e. Compact each lift of blast rock fill with a vibratory drum roller or fully loaded ten wheel dump truck.
 - f. Crushed stone and choke stone placement shall not exceed a maximum lift thickness of 12 inches (12") prior to compaction.

D. Placing Fill

1. Fill sections and embankments shall be constructed of earth, rock, or a mixture of earth and rock deposited in successive lifts. Except as hereinafter permitted, the loose thickness of each lift shall not be more than twelve inches before compaction.
2. Rock fill may be used in deep fill areas, placed to the levels and under the conditions described in Section 2.01K.
3. No rock in excess of six inches (6") in its largest dimension shall be incorporated in the top two-foot (2') layer of embankment immediately below the subgrade.
4. During fill and embankment construction operations, earth moving equipment shall be routed as evenly as possible over the entire width of the work.

5. At the close of each day's work the working surface shall be crowned, shaped, and rolled with smooth steel or pneumatic tired rollers to ensure proper drainage.
6. Prior to placing compacted structural fill below the slab, the surface of natural ground, shall be proof-rolled with a heavy vibratory drum roller or a fully loaded ten wheel dump truck. Hard and soft spots shall be excavated and replaced with structural fill or other material acceptable to the Contracting Officer.
7. Where excavations for slab-on-grade extend to weathered fractured or blasted bedrock, the Contracting Officer shall assess the rock surface for the presence of voids and may require placement of a 2 inch to 18 inch layer of choke stone or crushed stone prior to placement of structural fill.

E. Fills under Parking Areas

1. Paved area subgrades shall be excavated to a minimum of 12 inches (12") beneath required bituminous surface elevation or existing grade, whichever is lower.
2. Proof-roll subgrade with a vibratory roller or a fully loaded ten-wheeled dump truck. Soft or hard areas and other objectionable material (stumps, wood, organics) shall be excavated and backfilled with compacted common borrow.
3. Where excavations for pavements extend to weathered, fractured, or blasted bedrock, prepare surface as indicated in Section 3.05B. for building and pavement areas.

F. Subgrades under Proposed Landscape Areas

1. Fills under tree and shrub planting areas shall be backfilled with topsoil/loam materials.

G. Buildings

1. Prior to the placement of blast rock fill over a bedrock subgrade, voids in the rock surface shall be choked off with appropriately graded choke stone or crushed stone to prevent migration of fines into fractures, as approved by the Contracting Officer.
 - a. Blast rock fill and crushed stone shall be placed and compacted as indicated below.
2. Blast Rock Fill Placement and Compaction:
 - a. Maximum lift thickness prior to compaction shall be 24 inches (24").

- b. Material shall be dumped 25 feet behind the fill face and pushed forward to allow mixing and removal of oversized rock and backfilling voids.
 - c. Should the maximum size of blast rock exceed 18 in., (18") then use a rock rake with teeth spaced at 18 in. (18") or other means to separate and remove oversized rock.
 - d. Provide a minimum of one-foot thick transition zone of crushed stone between blast rock fill and granular borrow. All blast rock fill shall be choked with a transition zone of crushed stone, where granular borrow is to be placed above it.
 - e. Compact each lift of blast rock fill with a vibratory drum roller or a fully loaded ten wheel dump truck.
3. Crushed Stone Placement and Compaction:
- a. Maximum lift thickness prior to compaction shall be 12 inches (12").

H. Revetments

1. General

- a. Areas to be protected by revetment shall be free of brush, trees, stumps, and other organic material and be dressed to a smooth surface. All soft or spongy material shall be removed to the depth shown on the plans or as directed by the Contracting Officer and replaced with approved materials.
- b. A toe trench shall be dug and maintained until the revetment is placed.
- c. Protection for structure foundations shall be provided as early as the foundation construction permits.
- d. The area to be protected shall be cleaned of waste materials and the surface to be protected shall be prepared as shown on the plans.
- e. Where shown on the plans, a foundation filter bed shall be placed on the area before the stone is placed. The foundation filter bed will be six inches (6") of dense graded crushed stone and six inches (6") of one-half inch crushed stone and at least 12 inches (12") in total thickness.

2. Riprap

- a. The stones shall be placed upon an approved filter bed to the lines and grades shown on the plans and as directed.

- b. Each stone shall be carefully placed, by hand or machine as required, on a prepared bed, normal to the slope and firmly bedded thereon.
 - c. The larger stone shall be placed closely together and the intervening spaces filled with smaller stones in such a manner that the entire surface will form a compact mass.
3. Stone for Pipe Ends
- a. Stone for pipe ends shall consist of a protective covering of angular shaped stones laid on slopes in front of and around drainage line ends or structures to insure protection of the pipe ends and the embankment and shall conform to the requirements for "Stone for Pipe Ends."
 - b. The stone shall be placed to line and grade as shown on the plans or as directed on a prepared bed of embankment material or existing materials. Each stone shall be carefully placed by hand, normal to the slope and firmly bedded thereon. The larger stones shall be placed directly at the drainage end to prevent erosion and displacement. Each stone shall weigh not less than the minimum specified nor more than the maximum specified and at least 75 percent of the volume shall consist of stones weighing not less than the d_{50} Median. The remainder of the stones shall be so graded that when placed with the larger stones, the entire mass will be compact with a minimum amount of voids and a minimum thickness of 9 inches (9").
4. Slope Paving
- a. The stones shall be placed upon an approved filter bed to the lines and grades shown on the plans and as directed. The larger stones shall be placed closely together throughout the surface and the interstices carefully chinked with smaller stones. All stones shall be securely bedded, with the exposed surfaces approximately parallel to and within 6 inches (6") of the slope shown on the plans. When the paving cannot be laid to the required line and grade below water, a suitable foundation of dumped riprap shall be constructed.
5. Channel Paving and Grouted Channel Paving
- a. All stones shall be placed upon an approved bed to the lines and grades shown on the plans and as directed. The larger stones shall be placed as closely together as possible throughout the surface. All stones shall be securely bedded and laid so that the exposed surfaces will be approximately parallel to and within a tolerance of 3 inches (3") of the grade shown on the plans. The finished paving shall present a continuous uniform surface of stone.

- b. Grouting, when required, shall be done after the paving is completely in-place. The paving stones shall be sprinkled with water immediately before placing the grout.

3.8 TRENCH BACKFILLING

A. General

1. Trenches shall be backfilled as soon as practicable with suitable approved materials. All trench backfilling shall be done with special care, in the following manner and as the Contracting Officer may direct from time to time.
2. Backfill material for pipe bedding shall be deposited in the trench, uniformly on both sides of the pipe, for the entire width of the trench to the spring-line of the pipe. The backfill material shall be in layers not more than 6 inches (6") thick in loose depth and each layer shall be thoroughly and evenly worked by hand shovels and compacted by tamping on each side of the pipe to provide uniform support around the pipe.
3. Trench backfilling shall be placed so as not to disturb the previously installed pipes, utilities, concrete, and other work within and near the trench. The moisture content of the backfill material shall be such that proper compaction will be obtained. Backfill of trenches within areas of pavement construction shall be made in controlled compacted lifts extending to grades required to establish the proper pavement base courses.
4. In backfilling trenches, each layer of backfill material shall be adequately compacted in such a manner as to provide the required bearing value, so that paving can proceed immediately after backfilling is completed.
5. Any trenches or excavations improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional cost to the National Park Service.
6. During filling and backfilling operations, pipelines will be checked to determine whether any displacement of the pipe has occurred. If the inspection of the pipelines shows poor alignment, displacement of pipe, or any other defects, the condition shall be remedied by removal, realignment, and backfill of the pipe, in a manner satisfactory to the Contracting Officer at no additional cost to the National Park Service.

B. Embedment

The type of materials to be used in bedding and backfilling shall conform to the details shown on the Drawings and the following:

1. Embedment materials are those used for bedding, haunching and initial backfill. Perform in accordance with ASTM D2321. The following will describe the soils:
 - a. Class I - Angular crushed stone or rock, dense or open graded with little or no fines (3/4 inch stone size) (to be used in wet conditions or where shown on the Drawings).
 - b. Class II - Clean, coarse grained gravel, with a maximum stone size of 1-1/2 inches.
 - c. Embedment materials shall be free from lumps of frozen soil or ice when placed. Embedment materials shall be placed and compacted at optimum moisture content.
2. Foundation: A stable utility foundation of Class I or II material must be provided to ensure proper line and grade is maintained. Unsuitable foundations such as organics, soft clay, and other soft materials must be removed and the material stabilized. Unsuitable or unstable foundation materials shall be undercut and replaced with a suitable bedding material of Class I or Class II (see 3.08B.5.), placed in 6 inch (6") lifts. The Contracting Officer may approve other methods of stabilization, such as the use of geotextiles.
3. Bedding: Provide a stable and uniform bedding for the pipe and any protruding features of its joints and/or fittings. The bedding for the middle 1/3 of the pipe outside diameter should be loosely placed so that the pipe conforms to the trench. The remainder of the bedding at the base of the trench shall be compacted to a minimum of 95 percent modified proctor density as determined by ASTM D1557. Class I or Class II materials are suitable for use as bedding.
4. Haunching: Proper haunching provides a major portion of the pipe's strength and stability. Care must be exercised to insure placement and compaction of the embedment material in the haunches. For larger diameter pipes (greater than 30" in diameter), embedment materials should be worked under the haunches by hand. Haunching materials may be Class I or Class II materials and shall be placed and compacted in 6-inch (6") maximum lifts, compacted to 95 percent modified proctor density.
5. Initial Backfill: Initial backfill materials are required for a minimum of 3/4 of the pipe diameter. The initial backfill shall be from the pipe's springline to 12 inches above the pipe to provide protection for the pipe from construction operations during placement of the final backfill and protect the pipe from stones or cobbles in the final backfill.
 - a. Class I materials must be used in wet trenches and Class I bedding and haunching materials shall be used.

- b. Class II materials shall be used unless noted otherwise or wet conditions are encountered. The material shall be compacted in 6 inch (6") lifts to 95 percent modified proctor density (ASTM D1557).
 - c. Flooding or jetting as a procedure for compaction are not allowed.
6. Controlled Low Strength Materials (CLSM) or Controlled Density Fill (flowable fills) are acceptable backfill materials. Several considerations should be accounted for when using CLSM/CDF backfill. Provisions to prevent flotation of the pipe during placement of the CLSM/CDF must be used. This can include anchoring the pipe by placing flowable fill at the each joint and allowing the fill to partially cure prior to placing the flowable fill along the entire length of the pipe. Also, mechanical anchors such as bent rebar driven into competent soil or precast weights may be used at each joint to prevent flotation. When using CLSM/CDF, the fill should always be placed to completely encase the pipe.
 7. Backfill. Backfill from one foot (two feet for HDPE pipe) above the top of the pipe to subgrade elevations shall be structural fill material. Generally, the excavated trench material may be used as this backfill. This backfill shall be placed in 12-inch (12") maximum lifts and compacted to a minimum of 92 percent modified proctor density to prevent excessive settlement at the surface.
 8. Vehicular and Construction Loads: Pipe installation shall be suitable to carry H-25 live loads (40,000 lbs. axle - legal load) with 24 inches (24") of cover.

3.9 BACKFILLING AGAINST STRUCTURES

- A. Backfilling against masonry or concrete shall only be done when approved. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed, any leakage tests or other testing of the structures shall be made by the Contractor, as required by the Contracting Officer, at the Contractor's expense.
 1. After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures, the backfilling around the structures shall proceed. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.
- B. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures.
 1. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these

fills. Except as otherwise specified or directed, backfill shall be placed in layers not more than 12 inches (12") in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.

- C. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over and adjacent to structures. Repair damage made by the Contractor, at no additional cost to the National Park Service.
- D. After backfilling the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface at all times level with adjacent surfaces. The Contractor shall repair any subsequent settling over backfilled areas immediately, in a manner satisfactory to the Contracting Officer, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional cost to the National Park Service.
- E. The finished subgrade of the filled excavations upon which pavements are to be constructed shall not be disturbed by traffic of other operations and shall be maintained in a satisfactory condition until the finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.
- F. Uniformly smooth grade all areas to be graded, as indicated including excavated sections and all areas disturbed as a result of the Contractor's operations. The finished surfaces shall be reasonably smooth, compacted and free from surface irregularities.

3.10 COMPACTION

A. Compaction Requirements

1. The degree of compaction is expressed as a percentage of the maximum dry density at optimum moisture content as determined by ASTM D1557, Method C. The compaction requirements are as follows:

Area	Minimum Degree of Compaction
Below footings	95%
Below slabs	95%
Detention basin berms	95%
Pavement base course	95%
Pavement subbase	95%
General fill below pavement subbase	90%
Trench backfill	92%
Lawn areas	90%

2. Compaction percentages are based on the laboratory derived Maximum Density Values.

B. Moisture Control

1. Fill that is too wet for proper compaction shall be harrowed or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.
2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.
3. In no case shall fill be placed over material that is frozen. No fill material shall be placed, spread, or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.

C. Lift Thickness of Material

1. Structural Fill and Sand Borrow. Place in layers not to exceed 12 inches (12") in thickness when utilizing heavy compaction equipment, and 6 inches (6") when utilizing light hand-operated compaction equipment.
2. Common Borrow. Place in layers not to exceed 12 inches (12") in thickness when utilizing heavy compaction equipment, and 8 inches (8") when utilizing light hand-operated compaction equipment.
3. Crushed Stone, Gravel, Dense, Graded Crushed Stone for Subbase. Place in layers not to exceed 9 inches (9") in thickness when utilizing heavy compaction equipment, and 6 inches (6") when utilizing light hand-operated compacted equipment. Compact with a minimum of four (4) coverages of acceptable compaction equipment.

D. Placing Fill

1. Fill sections and embankments shall be constructed of earth, rock, or a mixture of earth and rock deposited in successive lifts. Except as hereinafter permitted, the loose thickness of each lift shall not be more than twelve inches (12") before compaction.
2. Rock fill may be used in deep fill areas.
3. No rock in excess of six inches (6") in its largest dimension shall be incorporated in the top two (2) foot layer of embankment immediately below the subgrade.

4. During fill and embankment construction operations, earth moving equipment shall be routed as evenly as possible over the entire width of the work.
5. At the close of each day's work the working surface shall be crowned, shaped, and rolled with smooth steel or pneumatic tired rollers to ensure proper drainage.

E. Protection of Fill

1. Protection of compacted fill shall be the responsibility of the Contractor. Newly graded areas shall be protected from the actions of the elements and traffic. Any settlement or washing that occurs prior to acceptance of the work shall be repaired and grades shall be established to the required elevations and slopes. Damage to any compacted lift (including those lifts previously tested and approved by the Contracting Officer) occurring at any time during the course of construction, which is caused by equipment, moisture entering the embankment, or from any other cause, shall be fully repaired by the Contractor prior to placement of overlying materials, at no additional cost to National Park Service and to the complete satisfaction of the Contracting Officer.
2. In the event of and prior to the commencement of heavy rains, the Contractor shall suspend fill operations immediately and shall take all necessary steps to keep the site as well drained as possible. Fill operations shall not be resumed until the moisture content of the fill is such as to permit compliance with the Specifications.
3. All corrective work or operations necessary to maintain proper moisture control of the fill material shall be at the expense of the Contractor.

F. Grading Tolerances

1. Grading shall be completed to meet or exceed the following tolerances of uniformity*:

<u>Location</u>	<u>Tolerance</u>
Top of Subgrade Beneath Structures	1/2 inch
Top of Subgrade Beneath Paving	1/2 inch
Top of Subgrade Beneath Landscape Areas	1 inches
Top of Gravel and Gravel Bases	1/4 inch

* Uniformity is defined as no variations in the surface materials at the grades and slopes indicated on the Drawings that exceed the listed tolerance over a length of ten feet (10') horizontally in any direction.

2. The bottom of earth and rock excavations shall be formed to provide a smooth, uniform slope and grade. The bottom of the excavated grade shall be free of pockets, depressions or ridges that would collect or concentrate water,

silts, or other such objectionable material prior to the placement of backfill or other finish materials.

G. Finish

1. Upon completion of the work, ground surface shall be left in a firm, unyielding, true, uniform condition, free of ruts.

3.11 SHEETING AND BRACING

A. General

1. Whenever sheeting and bracing will be required, it shall be furnished and installed by the Contractor in accordance with the recommendations of the structural engineer and/or geotechnical engineer engaged by the Contractor.
2. The Contractor shall engage licensed professional structural engineer and/or geotechnical engineer. These engineers shall be licensed in the state where the work is occurring and they shall prepare designs for the sheeting and bracing.
3. Submit the sheeting and bracing designs to the National Park Service and the Engineer for the project record. The sheeting and bracing plans and calculations shall bear the professional seals and signatures of the Contractor's engineers. These plans and calculations shall be submitted prior to the start of work.
4. The Contractor shall furnish and install the required sheeting and bracing in accord with the submitted designs. The Contractor shall include the costs for this work in his bid price for the project. No additional or separate compensation will be allowed.

END OF SECTION 31 00 00

SECTION 31 11 00 – CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for site clearing including demolition of site structures.
- B. The work includes:
 - 1. Protection of existing vegetation to remain.
 - 2. Clearing and grubbing.
 - 3. Selective clearing and thinning.
 - 4. Site demolition of structures, retaining walls, signage, lighting, foundations and appurtenances.
 - 5. Removal and abandonment of utilities.
 - 6. Filling or removal of underground tanks and piping.
 - 7. Disposal of material from clearing, grubbing, thinning and demolition in approved off-site disposal areas.
 - 8. Filling of voids and excavations resulting from the work.

1.2 RELATED SECTIONS

- A. Other Specification Sections which directly relate to the work of this Section include:
 - 1. Section 31 25 00 – EROSION AND SEDIMENTATION CONTROLS.
 - 2. Section 31 00 00 - EARTHWORK.

1.3 SITE CONDITIONS

- A. Site conditions existing during the bidding period will be maintained by the National Park Service insofar as practical.
- B. Actual site condition variations that differ from those of the bidding period and which affect site clearing operations shall be brought to the attention of the National Park Service prior to the commencement of any site work.

1.4 SUBMITTALS

- A. The Contractor shall submit the following information to the Engineer for review before commencing work:
 - 1. All permits and notices authorizing site clearing and demolition.
 - 2. Certificates of utility service severances.
 - 3. Permits for transport and disposal of debris.
 - 4. Demolition procedures and operational sequence.
 - 5. Calculations.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCING

- A. Tree protection fencing shall be an orange plastic web fence, 4 feet high minimum. Wood stakes shall be six (6) foot long by 1 inch by 1 inch square driven a minimum of two (2) feet into the ground. Posts shall be spaced eight (8) feet on center, maximum.

PART 3 - EXECUTION

3.1 PROTECTION

- A. The Contractor shall flag the limits of clearing shown on the drawings by accurate field survey with marked stakes or other means acceptable to the Engineer. Trees to remain and trees to be saved and transplanted shall be clearly identified during this staking process. The Engineer shall be notified a minimum of five (5) working days prior to scheduled commencement of clearing operations to review the flagged limits. Limits of all clearing shall be approved by the Contracting Officer prior to the clearing. Adjust the clearing limits as directed by the Engineer or Contracting Officer.
- B. Before clearing begins, protect designated trees to remain with tree protection fencing to the approximate diameter of foliage (dripline of the tree) to prevent damage to the trunk, foliage and root system by construction equipment and procedures. Trees to be transplanted may be removed to another location as detailed in Section 329600 – TRANSPLANTING, or may be left in place and be protected in similar fashion as the trees to remain as described above.
- C. Place tree protection fencing as required to protect other plants, adjacent property areas to remain uncleared, monuments, and existing improvements from damage.
- D. The Contractor shall repair or replace immediately any damage to existing trees or root systems that are to remain and to trees that are to be transplanted. The Contractor shall employ an arborist licensed in the jurisdiction of the Project State of Maine to determine the repair and replacement needs and methods for approval by the Engineer.
- E. Replace damaged shrubs and other vegetation designated to remain with the same size and species.
- F. The tree protection fencing shall be maintained for the duration of construction operations. The work shall include immediate replacement of any damaged fence. Fencing shall be removed from the site at the completion of construction operations. The fencing disposal shall be in accordance with local, state, and federal laws and regulations for the disposal of the material.

3.2 UTILITIES

- A. Notify all corporations, companies, individuals, or local authorities owning or having jurisdiction over utilities running to, through, or across areas to be affected by site clearing operations.
- B. Locate and identify existing utilities that are to remain and protect them from damage.
- C. For utilities to be disconnected, have utility services disconnected in accordance with the requirements of the utility owner.

3.3 CLEARING AND GRUBBING

- A. Clearing shall include cutting, removal, and off-site disposal of trees, bushes, shrubs, stumps, fallen timber, brush, refuse, trash, fencing and other incidental materials not required for reuse on the site.
- B. The Contractor shall grub the area within the clearing limits to completely remove stumps and root systems, except for those to remain or those to be transplanted.
- C. Depressions, excavations and voids resulting from the removal of stumps or roots shall be filled with suitable material and compacted as specified under Section 310000 – EARTHWORK.

3.4 SELECTIVE CLEARING AND THINNING

- A. Selective clearing and thinning shall be completed as directed by the Engineer. Approximate limits of selective clearing and thinning are shown on the Drawings.
- B. The work shall include the removal of dead and diseased tree limbs and plants, and pruning and removal of live vegetation that interferes with the growth of other trees and plants. Areas of dense growth shall be thinned to provide room for healthy growth.

3.5 DEMOLITION REQUIREMENTS

- A. Conduct demolition operations in a manner that will prevent damage to adjacent structures, utilities, pavements, and other facilities to remain.
- B. Cease operations immediately if any damage, settlement or other adverse effect on adjacent structures occurs. However, if an obvious unsafe condition is created that would potentially cause injury to persons or undue harm to properties, the Contractor shall take whatever measures are warranted to prevent such injury or harm. Immediately notify the Engineer and regulatory authorities. Do not resume operations until conditions are corrected, damage repaired and approval has been received from the appropriate authorities and the Contracting Officer.

- C. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or affect access to their property. Copies of the permission documents shall be submitted to the Engineer.
- D. Provide hoses and water connections. Spray water on demolition debris to minimize dust.
- E. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition which existed prior to start of work.
- F. All hazardous waste removal shall be performed by a hazardous waste contractor qualified and duly licensed in the jurisdiction of the State of Maine to remove, transport, and dispose of each type of hazardous substance.
- G. Comply with federal, state, and local regulations pertaining to the crushing, processing, and reuse of Asphalt Pavement, Brick and Concrete Rubble.

3.6 REMOVAL AND ABANDONMENT OF UTILITIES

- A. All existing structures, utilities, and appurtenances of any kind shall be completely removed within the limits of excavation for the new buildings and for a distance of 10 feet beyond. Remove all utilities beneath exterior columns and for a distance of 10 feet beyond.
- B. Outside the limits of excavation for the new buildings, all abandoned utilities and utility structures greater than 8 inches in diameter located at least 4 feet below bottom of finished grade shall be infilled with flowable fill or injected grout and sealed with concrete or brick masonry at the limit of excavation. All utilities shall be entirely removed within 4 feet of finished grade.
- C. Manholes and catch basins designated to be abandoned shall have all lines plugged with brick and mortar prior to filling with sand or gravel. The top 4 feet of these structures shall be removed and the bottom slab broken up to permit drainage prior to filling.
- D. The Contractor shall remove frames, covers, and grates from manholes, catch basins and gate valves and satisfactorily store and protect them for use by National Park Service. If elected by National Park Service, contractor shall dispose of these items in a lawful manner at no additional cost to National Park Service.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from site all materials resulting from site clearing and demolition operations.
- B. No burning of any material will be allowed.

END OF SECTION 31 11 00

SECTION 31 21 13 - RADON MITIGATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Slab on grade base course.
- B. Under slab vapor retarder.
- C. Gas collection pipe.
- D. Gas vent pipe.
- E. Joint sealants.
- F. Electrical junction box for future fan connection.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - 3. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
 - 4. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 5. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 6. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 7. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
 - 8. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
 - 9. ASTM E2121 – Standard Practice for Installing Radon Mitigation Systems in Low-Rise Residential Buildings.
- B. U.S. Environmental Protection Agency:
 - 1. EPA 402-R-94-009 - Model Standards and Techniques for Control of Radon in New Residential Buildings.
 - 2. EPA 625-R-92-016 - Radon Prevention in the Design and Construction of Schools and Other Large Buildings.
 - 3. EPA 402-R-93-078 - Radon Mitigation Standards (RMS).

1.3 SYSTEM DESCRIPTION

- A. Radon venting system consists of the following:
 1. Permeable foundation slab base course.
 2. Sealing joints, cracks, and other penetrations through foundation floor slab and foundation walls.
 3. Passive Radon gas collection and venting system.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate dimensions, layout of collection and vent piping, roof flashing details, location of electrical junction box.
- B. Product Data: Submit data on base course, pipe, vapor retarder, Radon pipe Identification tags, sealants, and accessories.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record locations and invert elevations of concealed piping, connections.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with EPA 402-R-93-078, EPA 625-R-92-016, and ASTM 2121.
- B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.10 COORDINATION

- A. Coordinate work with foundations, slabs on grade, interior partitions, and roofing to ensure openings capable of permitting radon gas penetration to building interior are sealed.
- B. Coordinate work of other sections to conceal work of this section.

PART 2 - PRODUCTS

2.1 SLAB ON GRADE BASE COURSE

- A. Base Course: Refer to Division 31 – Excavating, Filling, and Grading. Also see as indicated on plans.

2.2 VAPOR RETARDER

- A. Vapor Retarder shall be continuous as identified on the drawings.

2.3 PIPE MATERIALS

- A. Pipe: ASTM D2729; polyvinyl chloride pipe.
 - 1. Joints: Socket ends for solvent welding.
 - 2. Joint Cement: ASTM D2564, solvent type.
 - 3. Fittings: Polyvinyl chloride.
- B. Gas Vent Pipe: Un-perforated (Solid) pipe, 4 inch nominal size.
- C. Gas Collection Pipe Perforated pipe, 4 nominal size.

2.4 JOINT SEALERS

- A. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber, or ASTM D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- B. Sealants:
 - 1. Vapor Retarder Joints: Butyl sealant as specified in Division 7.
 - 2. Slab on Grade Joints: Polyurethane traffic sealant as specified in Division 3.
 - 3. Foundation Wall Joints: Polyurethane sealant as specified in Division 7.

2.5 ACCESSORIES

- A. Penetration Boot: Form using vapor retarder with stainless steel clamping ring.
- B. Roof Flashing: Sheet metal as specified in Division 7.
- C. Vent Cap: PVC Plastic without screen or grate.
- D. Joint Filler: Compressible type with recovery rate of minimum 95 percent.
 - 1. PVC Foam: ASTM D1752; closed cell polyvinyl chloride foam.
 - 2. Sponge Rubber: ASTM D1752; premolded sponge rubber.
- E. Tape: Self-adhering type, minimum 2 inches wide, compatible with vapor retarder.
- F. Electrical Junction Box: As specified in Division 26.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.
- B. Verify slab on grade subbase is compacted, graded, and ready to receive work.
- C. Verify subbase elevations are as indicated on Drawings.

3.2 GAS COLLECTION PIPE INSTALLATION

- A. Install gas collection pipe on clean cut subsoil. Lay pipe level.
- B. Place pipe with perforations facing down. Mechanically join pipe ends with solvent welded fittings.
- C. Connect gas collection pipe to gas vent pipe with solvent welded Tee fitting.
- D. Stub gas vent piping minimum 12 inches above top of slab on grade. Temporarily cap pipe stub to prevent material from entering piping.

3.3 GAS VENT PIPE INSTALLATION

- A. Install gas vent pipe where indicated on Drawings.
 - 1. Manifold multiple vent pipes from isolated floor areas in basement into single vent pipe. Single vent pipe to be installed up through pipe chase as shown on drawings. Each system to have a single exhaust penetration through the roof.
- B. Extend gas vent pipe [in concealed location] to minimum 24 inches above roof and minimum of 10 feet (horizontally) from fresh air intakes.
 - 1. Make pipe joints gas tight with solvent welded fittings.
 - 2. Support pipe at each floor and attic penetration.
- C. Identify gas vent pipe with permanent markings maximum 10 on center along center line of pipe, and within 12 inches of both sides of floor construction and below roof construction. Mark pipe as RADON VENT.
- D. Install PVC rain cap at gas vent pipe termination above roof.
- E. Firestop gas vent pipe penetrations through fire rated assemblies as specified in Division 7.
- F. Install electrical junction box near gas vent pipe for future connection to in-line fan and system failure alarms. Maximum horizontal distance between Radon exhaust pipe and electrical junction box shall be 6 feet.
 - 1. Wire junction box to separate circuit on power panel.
 - 2. Label circuit for intended use.
 - 3. Coordinate electrical installation with work of Division 16.

3.4 SLAB ON GRADE BASE COURSE INSTALLATION

- A. Install slab on grade base course as indicated on the Contract drawings and per the material requirements of Division 31 – Excavating, Filling and Grading.
- B. Cover gas collection piping as indicated on the Contract drawings.

3.5 VAPOR RETARDER INSTALLATION

- A. Install vapor retarder over entire base course surface as specified in Division 7.
- B. Lap joints minimum 12 inches. Seal laps with one continuous bead of sealant. Tape joints to retain retarder in place.
- C. Inspect vapor retarder immediately before placing concrete for slab on grade.
 - 1. Repair tears and punctures with patches extending minimum 12 inches beyond extent of tears and punctures.
 - 2. Seal and tape repairs as specified for lap joints.

3.6 SLAB ON GRADE INSTALLATION

- A. Install joint filler around penetrations through slab on grade and slab perimeter.
 - 1. Secure joint filler to prevent displacement when concrete is installed.
- B. Install slab on grade as specified in Division 3.

3.7 JOINT SEALANT INSTALLATION

- A. Install sealant joints, perimeter, and penetrations of slab on grade and foundation walls as specified in Section 07 92 00 to prevent radon gas from entering building interior.

3.8 FIELD QUALITY CONTROL

- A. Field inspecting, testing, adjusting, and balancing as specified.
- B. Request inspection of gas collection pipe before placing aggregate cover over pipe.
- C. Request inspection of vapor retarder before placing slab on grade.

SECTION 31 25 00 – EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work consists of furnishing, constructing, and maintaining permanent and temporary erosion and sediment control measures.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Erosion control bales, wattles, logs, and rolls

- 1. Straw bales. Furnish bales tied with either commercial quality baling wire or string. Conform to the following:
 - a) Straw Subsection 2.1 E
 - b) Approximate length 3.5 feet
 - c) Shape rectangular
 - d) Approximate mass 70 pounds
- 2. Wood excelsior bales. Furnish bales of curled wood excelsior. Tie the bales with either a commercial baling wire, plastic, or string. Conform to the following:
 - a) Approximate dimensions 16 by 18 by 36 inches
 - b) Approximate mass 70 pounds
- 3. Excelsior fiber wattles, logs or rolls. Furnish wattles, logs, or rolls of curled excelsior fiber rolled into a cylindrical shape and encased in a seamless photodegradable tubular netting. Conform to the following:
 - a) Diameter 12 inches min.
 - b) Mass 3 pounds per foot min.
- 4. Straw wattles, logs or rolls. Furnish straw wattles that are manufactured from weed free straw and wrapped in a biodegradable netting. Conform to the following:
 - a) Diameter 9 inches min.
 - b) Netting strand thickness 0.030 inches
 - c) Netting knot thickness 0.055 inches
 - d) Mass of netting 0.315 to 0.385 ounces per foot

- B. Mulch.

- 1. Straw. Furnish certified weed free straw from oats, wheat, rye, or other grain crops that is free from mold or other objectionable material. Furnish straw in an air-dry condition suitable for placing with mulch blower equipment.
- 2. Wood fiber. Furnish processed wood fiber from wood chips conforming to the following:
 - a) Colored with a green dye non injurious to plant growth;
 - b) Readily dispersible in water;

- c) Nontoxic to seed or other plant material;
 - d) Free of growth or germination inhibiting substances;
 - e) Free of weed seed;
 - f) Air dried to an equilibrium moisture content of 12 ± 3 percent;
 - g) Packaged in new labeled containers; and
 - h) Packaged in a condition appropriate for mixing in a homogeneous slurry suitable for application with power spray equipment
3. Grass straw cellulose fiber. Furnish processed grass straw fiber conforming to the following:
- a) Colored with a green dye noninjurious to plant growth;
 - b) Readily dispersible in water;
 - c) Nontoxic to seed or other plant material;
 - d) Free of growth or germination inhibiting substances;
 - e) Free of weed seed;
 - f) Air dried to a moisture content of 10 ± 0.2 percent;
 - g) Air dried to a uniform mass of ± 5 percent;
 - h) Packaged in new containers labeled with the manufacturer's name and air-dry mass; and
 - i) Packaged in a condition appropriate for mixing in a homogeneous slurry suitable for application with power spray equipment.
4. Peat moss. Furnish a granulated sphagnum peat moss conforming to the following:
- a) Sticks, stones, and mineral matter 0%
 - b) Partially decomposed stems and leaves of sphagnum 75% min.
 - c) Color brown
 - d) Textured from porous fibrous to spongy fibrous
 - e) pH 3.5 to 7.5
 - f) Air-dried
5. Mature compost. Furnish partially decomposed organic material, such as leaves, grass, shrubs, and yard trimmings, cured for 4 to 8 weeks. Maturity is indicated by temperature stability and soil-like odor. Furnish friable, dark brown, weed-free, and pathogen-free mature compost conforming to the following:
- a) Carbon/nitrogen ratio 25/1 to 35/1
 - b) Carbon/phosphorus ratio 120/1 to 240/1
 - c) pH 6.0 to 7.8
 - d) Water content 40% max.
 - e) Particle size
 - Seeding and sodding 1/2 inch max.
 - Erosion control 1 inch max.
 - f) Organic material 50% min.
 - g) Man-made inserts (plastic, glass, metal) 2% max.
6. Straw for hydroseeding. Furnish clean agricultural straw milled to 1 inch or less in length. Dry the fibers to 10 percent moisture for compaction. Bale in heat-sealed plastic bags.

7. Bonded fiber matrix hydromulch. Furnish a mixture of long-wood fibers and bonding agent which, when hydraulically applied and dried, produce a matrix conforming to the following:
 - a) Does not dissolve or disperse when wetted;
 - b) Holds at least 10 ounces of water per ounce of dry matrix;
 - c) Has no germination or growth inhibiting factors;
 - d) Forms no water insensitive crust;
 - e) Contains material that is 100 percent biodegradable; and
 - f) Is colored with a green dye non injurious to plant growth.

8. Recycled pulp fiber. Furnish cellulose fiber mulch products manufactured from natural material diverted from the waste-stream of manufacturing processes or produced from recycled material. These include newsprint, chipboard, corrugated cardboard, wood chips, and similar material. Process the material to eliminate substances that inhibit seed germination and plant growth. Add a colored dye that is non-injurious to plant growth and fades rapidly with exposure to light. The fiber shall readily blend with water, grass seed, fertilizer, and other additives to for a slurry suitable for application with power spray equipment. Furnish a homogeneous mixture conforming to the following:

a) Synthetic, plastic, metal, or glass material	0%
b) Weed Seed	0%
c) Moisture content	15% max.
d) Ash content	7% max.
e) Organic matter	90% min.
f) Boron	250 ppm max.
g) Water-holding capacity	800 to 1200% by mass
h) pH	4.0 to 8.5

C. Seed - Coordinate the temporary erosion control see mix with COR.

D. Silt fence – Conform to AASHTO M 288.

E. Water – Conform to the following:

1. Water for mixing or curing cement concrete, mortar, or grout. Conform to AASHTO M 157. Potable water of known quality may be used without testing according to AASHTO T 26. Potable water is safe for human consumption as defined by the public health authority having jurisdiction.
2. Water for planting or care of vegetation. Furnish water that is free of substances injurious to plant life such as oils, acids, alkalies, or salts.
3. Water for earthwork, pavement courses, dust control, and incidental construction. Furnish water free of substances detrimental to the work.

F. Geotextile – Refer to specification Section 31 32 19.23.

G. Riprap rock – Refer to specification Section 31 00 00.

PART 3 – EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. General

1. Provide permanent and temporary erosion control measures to minimize erosion and sedimentation during and after construction according to the state and local standards and this Section. Contract permits amend the requirements of this Section.
2. When erosion control measures are not functioning as intended, immediately take corrective action.

B. Controls and Limitations on Work

1. Before clearing and/or grubbing construct erosion controls for the project
2. Construct erosion control and sediment control measures as follows:
 - a. Construct temporary erosion controls in incremental stages as construction proceeds.
 - b. Construct temporary slope drains, diversion channels, and earth berms to protect disturbed areas and slopes.
 - c. Apply permanent turf establishment to the finished slopes and ditches within 14 days.
 - d. Construct outlet protection as soon as culverts or other structures are complete.
 - e. Construct permanent erosion controls including slope treatments as soon as practical or upon completion of the roadbed.
 - f. Construct and maintain erosion controls on and around soil stockpiles to prevent soil loss.
 - g. Following each day's grading operations, shape earthwork to minimize and control erosion from storm runoff.

C. Filter Barriers

1. Construct silt fence, bales, wattles, logs, rolls, and brush barriers for filtering sediment from runoff and reducing the velocity of sheet flow.

D. Outlet Protection

1. Construct riprap aprons or basins to reduce water velocity and prevent scour at the outlet of permanent and temporary erosion control measures. Construct riprap according to Subsection 2.1 B.

E. Slope Protection and Stabilization

1. Use plastic lining, riprap, check dams, erosion control blankets and mats, and temporary slope drains as follows:
 - a. Plastic lining. Use plastic lining to protect underlying soil from erosion. Place the plastic lining loosely on a smooth soil surface free of projections or depressions that may cause the liner to puncture or tear. Lap transverse joints a

minimum of 36 inches in the direction of flow. Do not use longitudinal joints. Anchor the lining in place using riprap.

- b. Riprap. Construct riprap for channel lining according to Subsection 2.1 A.
- c. Check dams. Construct riprap, sandbags, or earth berms for temporary dams to reduce the velocity of runoff in ditches and swales.
- d. Rolled erosion control products. Use rolled erosion control products to stabilize waterways and slopes before or after temporary or permanent seeding.
- e. Temporary slope drains. Use drainpipe, riprap, or plastic lined waterway for temporary slope drains to channel runoff down slopes. Channel water into the slope drain with an earth berm constructed at the top of a cut or fill. Anchor slope drains to the slope. Provide outlet protection.

F. Inspection and Reporting

1. Inspect all erosion control facilities at least every 7 days, within 24 hours after more than 3/8 inch of rain in a 24-hour period, and as required by the contract permits.
2. Within 24 hours, furnish inspection reports to the Contracting Officer (CO) which include all of the following:
 - a. Summary of the inspection;
 - b. Names of personnel making the inspection;
 - c. Date and time of inspection;
 - d. Observations made; and
 - e. Corrective action necessary, action taken, and date and time of action.

G. Maintenance and Cleanup

1. Maintain temporary erosion control measures in working condition until the project is complete or the measures are no longer needed. Clean erosion control measures when half full of sediment. Use the sediment in the work, if acceptable, or dispose of it legally off the project.
2. Replace erosion control measures that cannot be maintained and those that are damaged by construction operations.
3. Remove and dispose of temporary erosion control measures when the vegetation is satisfactorily established, and drainage ditches and channels are lined and stabilized. Dispose of debris and unsuitable and excess material as follows:
 - a. Remove from project. Recycle or dispose of material legally off the project. Furnish a statement documenting the nature and quantity of material processed or sold for recycling. Otherwise, furnish a signed copy of the disposal agreement before disposal begins.
 - b. Hazardous material. Furnish a copy of all disposal permits. Dispose of material according to Federal, State, and local regulations.
4. Restore the ground to its natural or intended condition and provide permanent erosion control measures.

END OF SECTION 31 25 00

SECTION 31 32 19.23 – GEOTEXTILE LAYER SEPARATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work consists of furnishing and placing a geotextile as a permeable separator, stabilizer, or permanent erosion control measure. Geotextile types are designated as shown in Subsection 2.1.A.

1.2 REFERENCES

- A. ASTM - ASTM International, formerly known as American Society for Testing and Materials
 1. ASTM D 276 - Standard Test Methods for Identification of Fibers in Textiles
 2. ASTM D 3786 - Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method
 3. ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus
 4. ASTM D 4362 - Standard Specification for Propane Thermophysical Property Tables
 5. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
 6. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles
 7. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
 8. ASTM D 4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile
 9. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
 10. ASTM D 5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles
 11. ASTM D 6140 - Standard Test Method to Determine Asphalt Retention of Paving Fabrics Used in Asphalt Paving for Full-Width Applications
- B. FAR - Federal Acquisition Regulations
 1. FAR 46.105 Contractor responsibilities
 2. FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements
 3. FAR 52.246-12 Inspection of Construction

1.3 SUBMITTAL

- A. Submit material certificate to the Contracting Officer, signed by the material producer and Contractor, certifying that materials comply with these specifications

and the construction plans.

PART 2 – MATERIALS

2.1 MATERIALS

A. Geotextile – Use long-chain, synthetic polymers, composed at least 95 percent by mass of polyolefins or polyesters, to manufacture geotextile or the threads used to sew geotextile. Form the geotextile, including selvages, into a stable network such that the filaments or yarns retain their dimensional stability relative to each other.

1. Physical requirements. Conform to the following tables for the type of geotextile specified:

a) Type I (A - F) Subsurface drainage	Table 714-1
b) Type II (A - C) Separation	Table 714-2
c) Type III (A - B) Stabilization geotextile	Table 714-3
d) Type IV (A - F) Permanent erosion control	Table 714-4
e) Type V (A - C) Temporary silt fence	Table 714-5
f) Type VI Paving fabric	Table 714-6

2. All property values, with the exception of apparent opening size (AOS), in these specifications represent minimum average roll values in the weakest principal direction (i.e., average test results of any roll in a lot sampled for conformance or quality assurance testing shall meet or exceed the specified values). Values for AOS represent maximum average roll values.

Elevate and protect rolls with a waterproof cover if stored outdoors. When using a geotextile for a permanent installation, limit the geotextile exposure to ultraviolet radiation to less than 10 days.

3. Evaluation procedures. Geotextile will be evaluated under Subsection 01 90 00 1.3. Furnish a commercial certification including the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns, and other pertinent information to fully describe the geotextile.

When samples are required, remove a 3-foot long, full-width sample from beyond the first outer wrap of the roll. Label the sample with the lot and batch number, date of sampling, project number, item number, manufacturer, and product name.

**Table 714-1
Physical Requirements for Subsurface Drainage Geotextile**

Property	Test Method ASTM	Units	Specifications ⁽¹⁾					
			Type I-A	Type I-B	Type I-C	Type I-D	Type I-E	Type I-F
Grab strength	D 4632	N	1100/700	1100/700	1100/700	800/500	800/500	800/500
Sewn seam strength	D 4362	N	990/630	990/630	990/630	720/450	720/450	720/450
Tear strength	D 4533	N	400 ⁽³⁾ /250	400 ⁽³⁾ /250	400 ⁽³⁾ /250	300/175	300/175	300/175
Puncture strength	D 4833	N	400/250	400/250	400/250	300/175	300/175	300/175
Burst strength	D 3786	kPa	2750/1350	2750/1350	2750/1350	2100/950	2100/950	2100/950
Permittivity	D 4491	s ⁻¹	0.5	0.2	0.1	0.5	0.2	0.1
Apparent opening size	D 4751	mm	0.43 ⁽²⁾	0.25 ⁽²⁾	0.22 ⁽²⁾	0.43 ⁽²⁾	0.25 ⁽²⁾	0.22 ⁽²⁾
Ultraviolet stability	D 4355	%	50 % after 500 hours of exposure					

(1) The first values in a column apply to geotextiles that break at < 50 percent elongation (ASTM D 4632). The second values in a column apply to geotextiles that break at ≥ 50 elongation (ASTM D 4632).

(2) Maximum average roll value.

(3) The minimum average roll tear strength for woven monofilament geotextile is 245 N.

In addition, when geotextile joints are sewn, submit the seam assembly description and a sample of the sewn material. This description shall include the seam type, seam allowance, stitch type, sewing thread tex ticket number(s) and type(s), stitch density, and stitch gauge. If the production seams are sewn in both the machine and cross-machine directions, provide sample sewn seams that are oriented in both the machine and cross-machine directions. Furnish a sewn sample that has at least 2 meters of sewn seam and is at least 1.5 meters wide. Sew the sample seams with the same equipment and procedures that are used to sew the production seams. For seams sewn on-site, conform to the manufacturer's recommendations. Obtain approval of the seam before installation.

**Table 714-2
Physical Requirements For Separation Geotextile**

Property	Test Method ASTM	Units	Specifications ⁽¹⁾		
			Type II-A	Type II-B	Type II-C
Grab strength	D 4632	N	1400/900	1100/700	800/500
Sewn seam strength	D 4632	N	1260/810	990/630	720/450
Tear strength	D 4533	N	500/350	400 ⁽³⁾ /250	300/180
Puncture strength	D 4833	N	500/350	400/250	300/180
Burst strength	D 3786	kPa	3500/1700	2700/1300	2100/950
Permittivity	D 4491	s ⁻¹	0.02	0.02	0.02
Apparent opening size	D 4751	mm	0.60 ⁽²⁾	0.60 ⁽²⁾	0.60 ⁽²⁾
Ultraviolet stability	D 4355	%	50% after 500 hours of exposure		

(1) The first values in a column apply to geotextiles that break at < 50 percent elongation (ASTM D 4632). The second values in a column apply to geotextiles that break at ≥ 50 percent elongation (ASTM D 4632).

(2) Maximum average roll value.

(3) The minimum average tear strength for woven monofilament geotextile is 245 N.

**Table 714-3
Physical Requirements For Stabilization Geotextile**

Property	Test Method ASTM	Units	Specifications ⁽¹⁾	
			Type III-A	Type III-B
Grab strength	D 4632	N	1400/900	1100/700
Sewn seam strength	D 4632	N	1260/810	990/630
Tear strength	D 4533	N	500/350	400 ⁽³⁾ /250
Puncture strength	D 4833	N	500/350	400/250
Burst strength	D 3786	kPa	3500/1700	2700/1300
Permittivity	D 4491	s ⁻¹	0.05	0.05
Apparent opening size	D 4751	mm	0.43 ⁽²⁾	0.43 ⁽²⁾
Ultraviolet stability	D 4355	%	50% after 500 hours of exposure	

(1) The first values in a column apply to geotextiles that break at < 50 percent elongation (ASTM D 4632). The second values in a column apply to geotextiles that break at ≥ 50 percent elongation (ASTM D 4632).

(2) Maximum average roll value.

(3) The minimum average tear strength for woven monofilament geotextile is 245 N.

**Table 714-4
Physical Requirements for Permanent Erosion Control Geotextile**

Property	Test Method ASTM	Units	Specifications ⁽¹⁾					
			Type IV-A	Type IV-B	Type IV-C	Type IV-D	Type IV-E	Type IV-F
Grab strength	D 4632	N	1400/900	1400/900	1400/900	1100/700	1100/700	1100/700
Sewn seam strength	D 4632	N	1260/810	1260/810	1260/810	990/630	990/630	990/630
Tear strength	D 4533	N	500/350	500/350	500/350	400 ⁽³⁾ /250	400 ⁽³⁾ /250	400 ⁽³⁾ /250
Puncture strength	D 4833	N	500/350	500/350	500/350	400/250	400/250	400/250
Burst strength	D 3786	kPa	3500/1750	3500/1750	3500/1750	2750/1350	2750/1350	2750/1350
Permittivity	D 4491	s ⁻¹	0.7	0.2	0.1	0.7	0.2	0.1
Apparent opening size	D 4751	mm	0.43 ⁽²⁾	0.25 ⁽²⁾	0.22 ⁽²⁾	0.43 ⁽²⁾	0.25 ⁽²⁾	0.22 ⁽²⁾
Ultraviolet stability	D 4355	%	50 % after 500 hours of exposure					

(1) The first values in a column apply to geotextiles that break at <50 percent elongation (ASTM D 4632). The second values in a column apply to geotextiles that break at ≥ 50 elongation (ASTM D 4632).

(2) Maximum average roll value.

(3) The minimum average roll tear strength for woven monofilament geotextile is 245 N.

**Table 714-5
Physical Requirements For Temporary Silt Fence**

Property	Test Method ASTM	Units	Specifications		
			Type V-A	Type V-B ⁽²⁾	Type V-C ⁽³⁾
Grab strength	D 4632	N			
Machine direction			400	550	550
Cross direction			400	450	450
Permittivity	D 4491	s ⁻¹	0.05	0.05	0.05
Apparent opening size	D 4751	mm	0.60 ⁽¹⁾	0.60 ⁽¹⁾	0.60 ⁽¹⁾
Ultraviolet stability	D 4355	%	70% after 500 hours of exposure		

(1) Maximum average roll value.

(2) Elongation at break ≥ 50 percent elongation (ASTM D 4632).

(3) Elongation at break < 50 percent elongation (ASTM D 4632).

**Table 714-6
Physical Requirements For Paving Fabric**

Property	Test Method	Units	Specifications Type VI
Grab strength	ASTM D 4632	N	500
Ultimate elongation	ASTM D 4632	%	50% at break
Asphalt retention	ASTM D 6140	L/m ²	0.90
Mass per unit area	ASTM D 5261	g/m ²	140
Melting point	ASTM D 276	°C	150

PART 3 – EXECUTION

3.1 PREPARATION

1. Where placing a geotextile on native ground, cut the trees and shrubs flush with the ground surface. Do not remove the topsoil and vegetation mat. Remove all sharp objects and large rocks. Fill depressions or holes with suitable material to provide a firm foundation. Replace or repair all geotextile that is torn, punctured, or muddy. Remove the damaged area and place a patch of the same type of geotextile overlapping 3 feet beyond the damaged area.

3.2 APPLICATION

A. Separation and Stabilization Applications

1. Placing a geotextile on a subgrade
 - a) Shaping. Shape the subgrade to a smooth surface and to the cross-section

required. Shape slopes to gradually transition into slope adjustments without noticeable breaks. At the ends of cuts and at intersections of cuts and embankments, adjust slopes in the horizontal and vertical planes to blend into each other or into the natural ground.

- b) Finishing. Remove all material larger than 6 inches from the top 6 inches of the roadbed. Remove unsuitable material from the roadbed, and replace it with suitable material. Finish roadbeds that are compacted to within ± 0.05 feet of the staked line and grade. Finish ditch cross-sections to within ± 0.10 feet of the staked line and grade. Maintain proper ditch drainage.

Place the geotextile smooth and free of tension, stress, or wrinkles. Fold or cut the geotextile to conform to curves. Overlap in the direction of construction. Overlap the geotextile a minimum of 2 feet at the ends and sides of adjoining sheets, or sew the geotextile joints according to the manufacturer's recommendations. Do not place longitudinal overlaps below anticipated wheel loads. Hold the geotextile in place with pins, staples, or piles of cover material.

End dump the cover material onto the geotextile from the edge of the geotextile or from previously placed cover material. Do not operate equipment directly on the geotextile. Spread the end-dumped pile of cover material maintaining a minimum lift thickness of 12 inches. Compact the cover material with rubber-tired or nonvibratory smooth drum rollers. Avoid sudden stops, starts, or turns of the construction equipment. Fill all ruts from construction equipment with additional cover material. Do not regrade ruts with placement equipment.

Place subsequent lifts of cover material in the same manner. Vibratory compactors may be used for compacting subsequent lifts. If foundation failures occur, repair the damaged areas and revert to the use of nonvibratory compaction equipment.

B. Permanent Erosion Control Applications

1. Place and anchor the geotextile on an approved smooth-graded surface. For slope or wave protection, place the long dimension of the geotextile down the slope. For stream bank protection, place the long dimension of the geotextile parallel to the centerline of the channel.

Overlap the geotextile a minimum of 12 inches at the ends and sides of adjoining sheets or sew the geotextile joints according to the manufacturer's recommendations. Overlap the uphill or upstream sheet over the downhill or downstream sheet. Offset end joints of adjacent sheets a minimum of 5 feet. Pins may be used to hold the geotextile sheets in place. Space pins along the overlaps at approximately 3-foot centers.

Place aggregate, slope protection, or riprap on the geotextile starting at the toe of the slope and proceed upward. Place riprap onto the geotextile from a height of less than 12 inches. Place slope protection rock or aggregate backfill onto the geotextile from a height less than 3 feet. In underwater applications, place the geotextile and cover material in the same day.

END OF SECTION 31 32 19.23

**DIVISION 32 –
EXTERIOR IMPROVEMENTS**

SECTION 32 12 16 - ASPHALT PAVEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. General: Work under this Section shall consist of constructing one or more courses of Asphalt Pavement. Furnish all labor, material, equipment, tools, transportation and supplies necessary to complete the work according to the contract including:

1. Furnish asphalt pavement composed of mineral aggregate, performance graded asphalt binder, recycled asphalt, mineral filler, anti-strip additives and, if applicable, manufactured warm mix asphalt (WMA) additive and/or WMA plant process modifications that are mixed in a central mixing plant and placed on a prepared surface(s) in accordance with these specifications and in conformance to the lines, grades, compacted thicknesses and typical cross sections shown on the contract drawings or as directed by the Contracting Officer (CO).

B. Quality Control and Acceptance:

1. The Contractor is responsible for controlling the quality of materials and workmanship during production and placement.
2. The CO will monitor the adequacy of the Contractor's QC activities during production and placement and may perform inspection, sampling and testing to verify conformance with contract requirements.
3. The acceptance of plant produced and placed asphalt mixtures shall be determined by the CO in accordance with the requirements of subsection 3.07 ACCEPTANCE SAMPLING AND TESTING.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Performance Graded Asphalt Binders: The asphalt binder shall be a Performance Graded Asphalt Binder (PGAB) which meets the specification requirements of AASHTO M320 and AASHTO R26. The PG binder shall be achieved by the use of Neat Asphalt with elastomer polymer modification if needed. The grade of asphalt for the PGAB will be as indicated in Table 2-1 for the project location.

Table 2-1
Performance Graded Asphalt Binder (PGAB)

State	Standard PG Grade	Notes/Exceptions:
CT	PG 64S-22	
MA	PG 64-28	
ME	PG 64-28	
NH		
NJ	PG 64-22	
NY	PG 64S-22	All Counties excluding: Orange, Putnam, Rockland, Westchester, Nassau, Suffolk counties & NY City. All above shall use PG 64H-22
PA	PG 76-22	
RI	PG 64S-28	Base course mixes w/ less than 15% RAP shall use PG 64S-22. Base course mixes w/15-25% RAP shall use PG 58S-28
VA	PG 64-22	
VT	PG 58-28	

- B. Acceptance of the PGAB will be in accordance with AASHTO R26 “Standard Practice for Certifying Suppliers of Performance Graded Asphalt Binders”. PGAB shall be provided by an Approved Supplier (AS) under the Approved Supplier Certification (ASC) system. Provide a Certification of Compliance (COC) for the specified PGAB with each bulk delivery to the mixing plant during the production of asphalt. Sample in accordance with Table 3-3 and provide samples to the CO. Sample identification shall include: sample number, time and date of sampling, applicable copies of the PGAB bulk delivery COCs, and the quantity of material in the liquid asphalt storage tanks at the time of delivery.

The blending at the asphalt plants of PG binders from different suppliers is strictly prohibited.

The Certificate of Compliance for binder shall be a production certificate. All materials requiring a production certification shall require the manufacturer to furnish a production certification for each shipment of material. Include the following with each production COC:

- (1) Date and place of manufacture;
- (2) Lot number or other means of cross-referencing to the manufacturer’s inspection and testing system; and
- (3) Substantiating evidence that the material conforms to the contract quality requirements as required by FAR 46.105(a)(4), including all of the following:
 - (a) Test results on material from the same lot and documentation of the inspection and testing system;
 - (b) A statement from the manufacturer that the material complies with all contract requirements; and
 - (c) Manufacturer’s signature or other means of demonstrating accountability for the certification.

All other manufactured non-project produced materials shall require Commercial Certification such as mineral filler, antistripping additives and WMA additives.

C. Recycled Asphalt Pavement (RAP) Material:

1. General Requirements: RAP may be used as a component of the asphalt mixture if approved by the CO. Usage of RAP is subject to the following requirements: a maximum of 20 percent for surface courses; and a maximum of 25 percent for all other courses. Percent RAP is computed by mass.

D. When required by the mix design (job mix formula) furnish lime conforming to AASHTO 303

E. Aggregates: Shall conform to the requirements of subsection 2.02 for the designated grading.

F. WMA – If WMA is proposed, use a WMA technology that has been approved by the state in which the project is being constructed. Provide evidence of the state approval.

2.2 COMPOSITION OF ASPHALT MIXTURE (JOB MIX FORMULA)

A. Furnish mixes of aggregate, asphalt binder, recycled asphalt pavement, and additives that meet applicable material specifications and the design requirements as designated in

B. Table 2-2. Volumetric mix properties will be determined and approved at N_{des} according to AASHTO T-312 and R35 after all additives/technologies have been incorporated. This includes meeting PGAB specification requirements.

Table 2-2
Asphalt Pavement Design Requirements

Design ESAL ⁽⁵⁾ (Million)	Gyratory Compaction Level (% Theoretical Maximum Specific Gravity, G _{mm}) AASHTO T 312 ⁽⁴⁾			Minimum Voids-in-the Mineral Aggregate (VMA), % ⁽¹⁾				Voids Filled with Asphalt (VFA), %	Dust-to-Binder Ratio ⁽³⁾	Minimum Tensile Strength Ratio, AASHTO T 283 ⁽⁴⁾
				Nominal Maximum Size Aggregate ⁽²⁾						
	N _{initial}	N _{design}	N _{max}	1 inch	¾ inch	½ inch	⅜ inch			
< 0.3	6 (≤91.5%)	50 (96.0%)	75 (≤98.0%)	12.0	13.0	14.0	15.0	70.0 - 80.0	0.8 -1.6	0.80
0.3 to < 3	7 (≤90.5%)	65 (96.0%)	95 (≤98.0%)					65.0 - 78.0		
3 to 30	8 (≤89.0%)	100 (96.0%)	160 (≤98.0%)					65.0 - 78.0		

(1) When mineral filler or hydrated lime is used, include in the calculation for compliance with the VMA.

(2) The nominal maximum size aggregate is one size greater than the first sieve to retain more than 10 percent of the combined aggregate.

(3) Dust to binder ratio is the effective asphalt content divided by the total percent of material passing the No. 200 (75 µm) sieve. Dust includes lime, bag house fines, and other mineral matter. Use washed sieve analysis.

(4) Prepare specimens in accordance with AASHTO T-312. AASHTO T-283 specimens shall be 4-inches in diameter for freeze thaw.

Use AASHTO T-166 regardless of the volume of water absorbed.

(5) The design requirements for < 0.3 million ESALs will be referred to as Level NPS-1, 0.3 to <3 million ESALs will be referred to as

Level NPS-2, and the design requirements for 3 to 30 million ESALs shall be designated at Level NPS-3.

- C. Aggregate Gradation: Furnish nominal maximum size aggregate gradation(s) as specified in the contract and that conform to AASHTO M-323, Superpave Volumetric Mix Design, Table 3.
- D. Fractured Faces Coarse Aggregate, Uncompacted Void Content of Fine Aggregate (% min), Sand Equivalent (% min), and Flat and Elongated (% max) shall meet requirements specified in AASHTO M-323, Superpave Volumetric Mix Design, Table 5.
- E. Furnish hard durable particles or fragments of crushed stone conforming to state specifications.
- F. For the surface course, do not use aggregates known to polish or carbonate aggregates containing less than 25 percent by mass of insoluble residue when tested according to ASTM D3040.
- G. WMA – Comply with the manufacturer’s recommendations for incorporating the WMA technology. Test specimens may be made from plant produced or laboratory prepared

WMA. Test specimens must be made from plant produced WMA if adding the WMA technology in the laboratory does not simulate the production process.

PART 3 – EXECUTION

3.01 GENERAL

- A. The Contractor shall place asphalt pavement at the locations, widths, thickness and to the grades shown on the Drawings
- B. Maintain all equipment in safe and satisfactory operating condition.
- C. Protection and Restoration of Property and Landscape—follow the requirements of FAR Clause 52-236-9 Protection of existing Vegetation, Structures, Equipment, Utilities and Improvements. In addition:
 - 1. Protect adjacent work from contamination by paving materials and placement activities. Remove any stains or damage from adjacent work, structures, curbing, or other facilities, resulting from such contamination. Remove and dispose of all waste and spillage.
 - 2. Do not damage or disturb existing improvements, facilities, features or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
 - 3. Restore damaged improvements, including existing paving on or adjacent to the site that has been damaged as a result of construction work.
 - 4. Check frames, covers, grates, water valve boxes and other miscellaneous castings that are located in the proposed pavement areas to ensure that they have been correctly positioned and set to the proper slope and elevation.
- D. Notification – Notify the CO at least 14 days prior to beginning paving work. A prepaving conference will be scheduled at least 7 days prior to starting placement. All CO, Contractor and supplier representatives critical to the paving operation will be required to attend this meeting. At this meeting be prepared to discuss work schedule, traffic control, proposed equipment to be used, control strip construction and acceptance, production and placement quality control, final acceptance procedures and requirements, and any other elements critical to the successful execution of paving operations.

3.02 SUBMITTALS

- A. Job Mix Formula (JMF): No asphalt mixtures shall be placed on the project site until a JMF has been submitted by the Contractor, approved by the CO and a prepaving meeting conducted.
- B. JMF Submittal: The job mix formula shall be submitted in writing by the Contractor at least 30 days prior to the start of paving operations. The submittal shall be a signed statement

prepared by the contractor's testing laboratory that certifies the proposed JMF meets the requirements of the contract and can be placed and compacted in the field during production. For each JMF submit the following:

1. Individual bin/stockpile percentages including average percent passing each specified sieve size, resulting blend gradations and proposed designated sieve Target Values (TV's) for specified gradation. Gradation shall be performed using AASHTO T-11 procedure B.
2. Percent of performance graded asphalt binder (PGAB) required by the JMF to meet the specified design parameters.
3. Performance graded asphalt binder Production Certificate of Compliance (COC) certifying the specified binder grade and properties are in accordance with AASHTO M 320 and R 26. State the type of modification, if applicable. The PAV test temperature shall be 212°F.
4. Mixing temperature: Conform to recommendations of PGAB supplier. Do not heat above 350F.
5. Compaction temperature requirements for the asphalt binder grade specified for either hot mix asphalt (HMA) or WMA.
6. Percent and type of anti-stripping additive, if required.
7. At the time of JMF submittal, if requested by the CO, the Contractor shall provide samples of aggregates, binder, mineral filler, bag house fines (if used in the submitted JMF), and antistrip additive (if used in the submitted JMF). Provide sufficient quantity of each component for JMF verification by the CO. This may require up to 800 pounds of aggregates, proportioned according to individual bin combinations, five individual gallons of PGAB, and proportionate amounts of the other components necessary to complete JMF verification. Confirm with the CO the actual quantities required before delivering samples for JMF verification. Allow the CO the opportunity to witness sampling and splitting of JMF submittal samples.

WMA – If proposed for use, include a full description of the WMA technology and the target dosage rate together with the submission of an MSDS for the additive, if applicable, and submission of either enough of the additive for the laboratory mix design verification, or the additive pre-blended in the PGAB at the correct dosage. If the additive is not pre-blended into the PGAB, include directions for properly incorporating the additive into the laboratory made mixture. Include documentation of at least three successful past WMA technology field applications including project type, project owner, tonnage placed, mix design, mixture volumetrics and performance, temperature range for laboratory mixing and compacting, asphalt binder performance grade test data over the range of WMA additive percentages proposed for use, if applicable, evidence of compatibility of WMA additive with asphalt binder and anti-strip agent, and the temperature range for field mix production, delivery, laydown and compaction.

8. The JMF shall identify the specific part of the work for which it is intended to be used (i.e. base course, intermediate course, surface course, sidewalk, etc.) and shall indicate minimum criteria listed above for each JMF. If multiple mixing plants are proposed to be used, submit a separate JMF for each plant.
9. Submit a list of materials proposed for use in the work under this sub- section including the name and address of the materials producers and the locations from which the materials are to be obtained.
10. Submit aggregate quality test results and furnish certificates of compliance signed by the materials producers or subcontractors and suppliers, stating that materials when tested according to specified test method(s) meet or exceed the specified contract requirements.

3.03 CONTROL TEST SECTION

- A. After the JMF has been approved a Control Test Section (CTS) shall be placed, and accepted, prior to beginning full production. The purpose of the CTS is to demonstrate the contractors ability to produce, place and compact the mixture as designed, specified and approved. If necessary, during this time, adjustments to the mix design may be made according to Subsection 3.05(E). Target value adjustments to the JMF greater than those designated in Table 3-1 may require a complete new mix design submittal and verification, if requested by the CO.

Table 3-1
Allowable JMF Revision Limits

Test Property	Verification and Adjustment Limits, %
Asphalt Binder Content	+/- 0.4
Gradation: 2.36mm & Larger 600um & 300um	+/- 3.0 +/- 2.0
Gradation: 0.075mm	+/- 1.0
Voids in Mineral Aggregate, VMA,	Min. per Table 2-2
Voids Filled with Asphalt, VFA,	Range per Table 2-2

- B. The CTS will be, unless otherwise recommended by the CO due to project configuration, a minimum of 500 feet long and two lanes wide, and will include a Longitudinal Joint-Wedge (if the placement thickness is equal to or greater than 1-1/2 inches) as described in 3.05 G(1). It shall be of the same depth, and placed on the same underlying material, as the work that it represents. The equipment used in construction of the CTS shall be the same type and weight(s) to be used on the remainder of the work.
- C. Take three(3) random samples from behind the laydown machine. The samples shall be split and the split portion shall be delivered to the CO for verification testing. Testing shall include: VMA, VFA, VTM, TSR, aggregate gradation and asphalt binder content. The contractor shall test his portion of the samples and report data to the CO. Test samples according to contract specified testing methods. PGAB shall be verified using approved documentation production COC meeting the specified grade.

- D. Take five (5) randomly selected cores from the finished pavement mat and five (5) randomly selected cores from the longitudinal joint in the CTS. Provide splits to the CO for evaluation. Test samples according to contract specified testing methods. Correlation of density equipment with cores will be as described in the QCP and approved by the CO. Provide correlation data between the density gauge and the cores to the CO.

All density gauges shall be calibrated in accordance with manufacturers' recommendations prior to use on the project. Provide calibration record to the CO.

- E. The Control Test Section shall be considered acceptable and allowed to remain in place if:
1. Mixture and Density. The mix and placed mat and longitudinal joint are acceptable if the mean of the multiple test results are within specification limits for: gradation, asphalt content, air voids, VMA, TSR and density; and, no single test result falls outside the specification limits as defined in Section 3.10.
 2. Smoothness: Pavement mat is uniform in texture and smoothness, with no surface deviations in excess of 1/4-inch in 10 feet.
- F. If the initial CTS is unacceptable as described above, adjust the JMF, plant operations or placing and compacting procedures, as necessary and construct another CTS.

Additional CTSs, as required, shall be constructed and evaluated until an acceptable CTS is constructed. All unacceptable CTSs shall be removed at the Contractor's expense. Costs incurred by the Government, if any, for additional sampling, testing and inspection required due to unacceptable CTSs will be deducted from payments owed the contractor.

Full production shall not begin until an acceptable CTS has been constructed. However, production may begin, contingent upon the TSR results, if all other test results are acceptable, at the Contractor's risk.

3.04 EQUIPMENT

A. Mixing Plant.

Use mixing plants conforming to AASHTO M 156 supplemented as follows:

1. All plants.
 - (a) Automated controls. Control the proportioning, mixing, and discharging of the mix automatically.
 - (b) Dust collector. AASHTO M 156, Requirements for All Plants, Emission Controls is amended as follows: Equip the plant with a dust collector. Dispose of the collected material. In the case of bag house dust collectors, dispose of the collected material or return the collected material uniformly. Use of bag house fines in asphalt concrete mixes requires approval unless included as part of the approved job-mix formula.

- (c) Recycled asphalt pavement. When recycled asphalt pavement material is incorporated into the mixture, modify plants according to the plant manufacturer's recommendations to process reclaimed material, and according to any state specific specifications related to processing RAP.
- (d) WMA- when proposed and approved, modify the asphalt plant as required by the manufacturer to introduce the WMA technology.

2. Drum dryer-mixer plants.

- (a) Bins. Provide a separate bin in the cold aggregate feeder for each individual aggregate stockpile in the mix. Use bins of sufficient size to keep the plant in continuous operation and of proper design to prevent overflow of material from one bin to another.
- (b) Stockpiling procedures. Separate aggregate into at least 2 stockpiles with different gradations. As a minimum, stockpile mostly coarse material in one stockpile and mostly fine material in another.

3. Batch and continuous mix plants.

- (a) Hot aggregate bin. Provide a bin with 3 or more separate compartments for storage of the screened aggregate fractions to be combined for the mix. Make the partitions between the compartments tight and of sufficient height to prevent spillage of aggregate from one compartment into another.
- (b) Load cells. Calibrated load cells may be used in batch plants instead of scales.
- (c) Recycled asphalt pavement. Modify batch plants so the recycled asphalt pavement is introduced into the mix after bypassing the dryer. Design the cold feed bin, conveyor system, and special bin adjacent to the weigh hopper, if used, to avoid segregation and sticking of the recycled asphalt pavement material. Heat aggregate to a temperature that will transfer sufficient heat to the recycled asphalt pavement material to produce a mix of uniform temperature within the range specified in the approved job-mix formula.

B. Hauling Equipment

Use vehicles with tight, clean, and smooth metal beds for hauling asphalt mixtures. Thinly coat the beds with an approved material such as a small amount of lime solution or an approved soap solution or detergent to prevent the mix from adhering to the beds. Do not use petroleum derivatives or other coating material that contaminates or alters the characteristics of the mix. Drain the bed before loading. Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mix from the weather and thermal segregation and during hauling. When necessary to maintain temperature, use insulated truck beds and securely fastened covers pinned on the sides. Provide a minimum of two (2) access port or holes for checking temperature of asphalt mix in the truck, located near the midpoint of the body, at least 12 inches above the bed.

C. Pavers: Use pavers that are:

1. Self-contained, power-propelled units with adjustable vibratory screeds with full width screw augers;
2. Heated for the full width of the screed;
3. Capable of spreading and finishing courses of asphalt mix in widths at least 12 inches more than the width of one lane;
4. Equipped with a receiving hopper having sufficient capacity to ensure a uniform spreading operation;
5. Equipped with automatic feed controls, which are properly adjusted to maintain a uniform depth of material ahead of the screed;
6. Operable at forward speeds consistent with satisfactory mix lay down;
7. Capable of producing a finished surface of the required smoothness and texture without segregating, tearing, shoving, or gouging the mix; and
8. Equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line, sensing the transverse slope of the screed, and providing the automatic signals that operate the screed to maintain grade and transverse slope.
9. Do not use diesel during paving operations as release agent on any parts that come in contact with the mix.

D. Rollers

Rollers of the vibratory, steel wheel, oscillatory, and pneumatic-tired type may be used. They shall be in good condition, capable of reversing direction without backlash, and operating at slow speeds to avoid displacement of the asphalt mixture. Static rollers shall be operated at speeds not to exceed 3 mph and vibratory rollers shall be operated at a minimum of 10 to 12 impacts/ft. in vibratory mode. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

The Contractor shall exercise caution when using vibratory rollers so as not to cause damage to buried infrastructure or adjacent infrastructure. Damage to buried or adjacent infrastructure will be the responsibility of the Contractor. The new Oscillation type rollers are acceptable for use for compaction rolling. Oscillation rolling is allowed on bridge decks with a low frequency setting.

3.05 CONSTRUCTION

A. Preparation of the Underlying Surface

Immediately before placing the asphalt mixtures, the underlying course shall be thoroughly cleaned of all dust and debris by a self-propelled sweeper. Areas inaccessible by power sweepers shall be broom swept manually until the surface is clean. Ensure that the surface to receive the asphalt mixture has been approved by the CO, is properly compacted and free from soft areas or other deficiencies that might affect the quality of the final pavement course.

Place all courses with an asphalt paver or device approved by the CO. On bridge decks or concrete pavement, remove excess crack and joint material by trimming the excess material flush with the pavement surface prior to placing the asphalt mixture. Remove all excess joint or crack material on any pavement surface in excess of 1/16 inch in depth prior to placing new asphalt pavement courses.

The Contractor shall furnish, set, and maintain all line and grade stakes, string lines or other controls necessary to guide and control the paving equipment.

Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to an internal temperature of 140°F (60°C) minimum.

Prevent damage by construction operations to gutters, catch basins, curbs, concrete structures, pavement surfaces and other facilities adjacent to the work. If damage occurs, repairs shall be made to the satisfaction of the CO at no additional cost to the Government.

B. Weather Limitations

Place HMA pavement on a dry, unfrozen surface when the air temperature in the shade is above 35 °F and rising for minimum 2.1 inches; above 40°F and rising for minimum 1.5 inches; above 50°F and rising for less than 1.5 inches and, the temperature of the road surface in the shade conforms to Table 3-2.

Place WMA on dry, unfrozen surfaces and only when weather conditions allow for proper production, placement, handling and compaction for the specific WMA technology used.

Table 3-2

HMA Placement Temperature Compacted Lift Thickness Road Surface Temperature °F	Minimum Lay-Down Temperature ⁽¹⁾ °F		
	<2 Inches	2.1-3 Inches	>3.1 Inches
< 35	(2)	(2)	(2)
35 - 39.9	(2)	(2)	280
40 - 49.9	(2)	285	275
50 - 59.9	295	280	270
60 - 69.9	285	275	265
70 - 79.9	280	270	265
80 – 89.9	270	265	260
≥ 90	265	260	255

(1) Never heat the asphalt concrete mix above the temperature specified in the approved mix design.

(2) Paving not allowed.

Rain and Surface Conditions: Immediately cease transportation of asphalt mixtures from the plant when rain begins at the project. Do not place asphalt mixtures while rain is falling, or when there is water on the surface. Placing asphalt mixtures may continue, when the rain has stopped and water has been removed from the tacked surface to the satisfaction of the CO and if the temperature of the asphalt mixture meets the specification requirements.

Information regarding the air temperature, average wind speed, overcast conditions, mix delivery temperature, and existing moisture conditions shall be evaluated by the CO and a Contractor's representative located at the paving operation prior to placement. The Contractor assumes responsibility for constructing the pavement to meet compaction, bonding to the underlying surface and specification requirements.

C. Production

Do not heat asphalt binder above 350°F unless approved by the manufacturer.

Weigh or meter aggregates, additives and asphalt binder material and introduce into the mixer in the proportions specified by the JMF. Take corrective action as outlined in the QC plan when testing results indicate the material is not in compliance with the requirements of the contract and the approved JMF and when the test results fall outside of the action limits noted in Subsection 3.10B(1) Action Limits.

Mix the combined materials until the aggregate particles are uniformly coated with asphalt binder and thoroughly distributed throughout the mixture.

The temperature of the mixture shall be in accordance with the Performance Graded Asphalt Binder (PGAB) and, if applicable, WMA technology allowable mixing and compaction temperature range. The temperature of the mixture when discharged from the mixer or silo shall be + 25°F from the value stated in the JMF. Mixtures exceeding these limits shall be subject to rejection.

D. Aggregate Preparation.

For batch plants, heat, dry, and deliver aggregate for pug mill mixing at a temperature sufficient to produce an asphalt concrete mix temperature within the approved range. Adjust flames used for drying and heating to prevent damage to and contamination of the aggregate.

Control plant operations so the moisture content of the asphalt concrete mix behind the paver is 0.5 percent or less according to AASHTO T 329.

Before starting asphalt concrete mix production, obtain approval of synchronized metering and weighing devices used to introduce a constant rate of lime and water.

When lime is used as an anti-strip, adjust the aggregate moisture to at least 4 percent by mass of aggregate. Mix the lime uniformly with the aggregate before introducing the aggregate into the dryer or dryer drum. Use calibrated weighing or metering devices to measure the amount of lime added to the aggregate.

Add lime to the aggregate by one of the following methods:

Method A: Add lime to the combined cold feed aggregate using an enclosed in-line cold feed mechanical pug mill mixer. Use a twin-shaft, continuous mixing pug mill with adjustable mixing paddles. Adjust the retention time of the mixture in the pug mill so no unmixed lime is visible after the lime and aggregate exit the pug mill.

Method B: Add lime to the produced aggregates during stockpiling using a pug mill. Distribute the lime per the stockpile ratios stated in the asphalt concrete mix design.

A minimum moisture content of two percent by dry weight for coarse aggregate and 4 percent by dry weight for fine aggregate is required at the time the aggregates and lime are mixed. Marinate treated aggregate in stockpiles from 24 hours to 60 days before using in asphalt concrete mix. Do not use aggregate marinated longer than 60 days.

Method C: Add lime to the combined cold feed aggregate by introducing the lime between aggregate layers as the aggregate flows from the cold feed bins. Mix the lime and aggregate on the conveyor belt by placing a minimum of six paddles over the conveyor belt. Make the paddles protrude into the aggregate flow and direct the aggregate to fold over itself causing the material to migrate from one side of the conveyor belt to the other. Space the paddles to provide complete mixing. Provide a water spray over the conveyor belt as necessary to control dust and to maintain minimum moisture content.

WMA – All metering devices will meet the current state agency requirement for liquid or mineral additives. Document the integration of plant controls and interlocks when using WMA additive metering devices.

E. Mix Design Revisions

During production, the Contractor may request target value revisions to the approved JMF. Proposed changes are subject to meeting the following requirements: (1) the changed target value(s) must be within the limits defined in Table 3-1, test results from the new asphalt mixtures indicate that the proposed JMF changes will produce asphalt mixtures with the specified VTM, VMA, VFA, TSR and F/A ratio, and the resulting mixture gradations are within the grading band for the specified nominal maximum size grading.

Proposed changes must include new and revised materials unit weights (T-209) for controlling mat density.

Any proposed changes to the approved JMF, along with supporting documentation, shall be submitted in writing to the CO for approval prior to placement on the project.

Approved JMF changes will not be used retroactively for determining acceptance of material already placed. Changes to the approved JMF may necessitate and require additional evaluation and verification of the mix by the CO prior to final approval.

F. Tack Coat

Materials shall conform to an Emulsified Asphalt. An equal anionic grade emulsion may be substituted for a cationic grade and vice versa. The sieve test in AASHTO M 140 and M 208 is not required.

Anionic emulsions. Conform to AASHTO M 140. For RS-1h and RS-2h, conform to AASHTO M 140 for RS-1 and RS-2, except conform to the following for the residue from distillation: Ductility, 77 °F,
2 inches/min, AASHTO T 51 40 mm min.

Cationic emulsions. Conform to AASHTO M 208. For CRS-1h and CRS-2h, conform to AASHTO M 208 for CRS-1 and CRS-2, except conform to the following for the residue from distillation: Ductility, 77 °F, 2 inches/min, AASHTO T 51 minimum shall be 40 mm.

Apply a uniform tack coat of asphalt emulsion to the contact surfaces of manholes, structures, existing pavement edges and surfaces and other abutting surfaces immediately prior to placing new asphalt mixtures. This includes freshly placed layers if one day has elapsed since placement, or if dust or debris has contaminated the fresh surface, or if traffic has been allowed on the surface to be paved.

A thin uniform coating of tack coat shall be applied to the pavement immediately before overlaying and be allowed sufficient time to break (set). This should be carefully applied by a distributor truck having calibrated nozzles set to provide a triple overlap of spray on the pavement surface that results in a uniform overlapping coverage at a target application rate of 0.07 +/- 0.02 gallons per square yard for a non-milled surface and a target application rate of 0.10 +/- 0.02 gallons per square yard for a milled surface. For areas where both milled and un-milled surfaces occur, the tack coat shall be a target application rate of 0.07 +/- 0.02 gallons per square yard. The CO must approve the material, equipment and the application rate prior to application. The material for tack coat shall not be heated above manufacturer's recommendations

Allow tack coat to break or cure properly before placing asphalt mixtures.

The Contractor shall apply tack coat in a manner which will prevent traffic from driving on the applied tack coat material

Tack coat will not be measured and paid for as a separate quantity but considered subsidiary to the work.

G. Transportation, Placing and Finishing

Set stringline or other fixed controls to ensure proper alignment of pavement centerline, joints and edges.

Verify the depth of each layer at frequent intervals behind the laydown machine, and make adjustments if the compacted thickness does not meet the specified thickness. The average compacted depth will be verified by calculating yield using known bulk specific gravity values from the acceptance tests. Furnish daily calculated yields to CO at the end of each day for the day's production.

Asphalt mixture deliveries shall be scheduled so that placing and compacting is continuous, with minimal stopping and starting of the paver.

Coordinate trucks dispatched from the plant to ensure that all asphalt mixtures delivered to the project is placed and compacted during daylight hours. Provide for reliable two-way radio or cellular phone communication between the project site and the plant.

Do not use or combine asphalt mixes produced from different plants unless they are produced using the same JMF, are materials from the same sources, and have been approved. Construct a separate control section for each plant from which production is intended.

The temperature range of the asphalt mixture when delivered to the project site will be established in the Contractor Quality Control Plan utilizing the approved JMF. Monitor the temperature of the mixture for each load, in the haul vehicles, in the paver hopper, and behind the laydown. Use approved methods and instruments for measuring temperature. Record results on Inspector's Daily Reports. Visually inspect the delivered asphalt mixture for crusting or segregation. Reject material that is crusted, segregated, or which is not within the delivery temperature range established in the Contractor Quality Control Plan.

The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 6 inches. The joint in the top layer shall be at the designed centerline of the pavement. Transverse joints in one layer shall be offset by at least two (2) feet from transverse joints in the previous layer.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be placed using hand tools. Luting shall be performed in such a manner as to prevent segregation.

Unless otherwise permitted by the CO for special conditions and circumstances, only machine methods of placement shall be used.

Immediately after placement, and before the initial roller pass, the surface shall be checked, and any irregularities corrected. Irregularities in alignment and grade along outside edges shall be corrected by the addition or removal of mixture before the edges are rolled.

The newly placed pavement surface shall be free of visible segregation or other irregularities. Inspect the uncompacted mat behind the paver for longitudinal streaks, segregation or other irregularities. Correct as necessary before initial compaction.

If material segregation or irregularities in the mat behind the paver are noted, the Contractor shall review the production, transportation, and placement operations and take corrective action. The Contractor's Quality Control Plan shall fully outline procedures for inspecting the mat during placement, identifying and troubleshooting material segregation or temperature related segregation, and implementing corrective action.

1. Joints, Edges and Cleanup

- (a) Transverse Joints: The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse paving joint. When necessary to form a temporary transverse paving joint, it shall be made by means of placing a bulkhead or by temporarily tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. In both methods, all contact surfaces shall be given a tack coat of asphaltic material before placing any fresh mixture against the joint.

- (b) Longitudinal Joints-Wedge: For placement depths greater than or equal to 1-1/2 inches, use a Notched Wedge plate attachment on the screed such as the Trans Tech notch wedge, or approved equal. The attachment must provide, for the first paver pass, a 1/2" notch at the top of the wedge, followed by a diagonal slope down to the underlying surface where a step is formed equal to the nominal maximum aggregate size. The width of the joint shall be a minimum of 6 inches. The attachment will include a mechanism to provide compaction of the sloped surface of the notched wedge. If no mechanism exists in the attachment, the diagonal shall be compacted by other means satisfactory to the CO. The subsequent paver pass will place mix at a depth equal to the lane being matched, plus the appropriate roll-down, to result in a fully compacted joint meeting the smoothness requirement of these specifications.
- (c) Longitudinal Joints-Confined Edge: For pavement depths less than 1-1/2 inches, use a confined-edge longitudinal joint. This is the most typically constructed longitudinal joint which attempts to confine the outside edge of the first paver pass of the mat as much as possible to create a near vertical edge.

H. Asphalt Pavement Compaction

- 1. Furnish rollers of sufficient size, number and type, to support the production rate and meet compaction requirements.

I. Pavement Uniformity and Roughness

- 1. Uniformity and Smoothness: The finished mat and surfaces of the pavement shall be smooth, dense and uniform in appearance, free from irregularities in contour and texture and shall present a smooth-riding surface.

Construct all pavement surfaces to meet the requirements per Subsection 3.08(A) (1) Straightedge Measurement.

- 2. Opening to Traffic: No vehicular traffic or construction loads shall be permitted on the newly completed pavement until the material has cooled to a temperature of 140°F or less.

3.06 CONTRACTOR QUALITY CONTROL

A. Description

The provisions of FAR Clause 52.246-12 Inspection of Construction shall apply in addition to the provisions of this Subsection. Provide and implement a Quality Control Plan (QCP) that will ensure all materials and workmanship meet contract requirements for the project. Provide qualified personnel and laboratory facilities to support the QCP. Provide laboratory facility accreditations/certification and evidence of qualifications for inspection and testing personnel.

B. Contractor Quality Control Plan

Provide and maintain a detailed Quality Control Plan as described in this Subsection for all items of work, addressing all elements of the work required by that item. The QCP will sufficiently document quality control (QC) processes and duties for all Contractor(s), subcontractor(s) and supplier(s) responsibilities.

C. Submittal Requirements

At the pre-construction conference, the Contractor shall be prepared to discuss the Quality Control Plan, and will provide three copies of the QCP to the CO. At a minimum, be prepared to discuss the QCP structure, individuals performing QC for each organization, qualifications and certifications applicable to the individuals and facilities performing QC sampling and testing, and suppliers and sources of all furnished materials. The Contractor shall not begin work on any items until the QC Plan has been reviewed by the CO.

D. QC Plan Review and Modifications

Review of the QC Plan will be based on the inclusion of the required information. Revisions to the QC Plan may be required prior to work startup for any part of the QC Plan that is determined by the CO to be insufficient. Review of the QC Plan does not imply any warranty by the CO that the QC Plan will result in completed work that complies with the specifications. It remains the responsibility of the Contractor to demonstrate such compliance. The Contractor shall modify the QC Plan as work progresses when circumstances necessitate changes in Quality Control personnel, laboratories, or procedures. In such case, the Contractor shall submit an amended QC Plan to the CO for review a minimum of three calendar days prior to the proposed changes being implemented. The CO may require changes or improvements to the QC Plan for initial review, or if during the progress of the work it becomes evident that the QCP is not resulting in work that conforms to contract requirements; work may be suspended on affected items if the CO determines that the QCP is not adequately being implemented for specification compliance.

The plan shall include the sampling process(es), procedures, and requirements to meet the sampling and testing requirements of Table 3-3, and shall serve as an outline for QC sampling, testing and evaluation of the Control Test Section.

Submit sample copies of all forms to be used for reporting data and information as required by the contract.

E. QC Plan Format and Contents

The QC Plan shall, at a minimum, include and address the elements shown below:

- Scope and Applicable Specifications
- Submittal Requirements
- Quality Control Organization
 - QC Organizational Chart
 - QC Personnel
- Quality Control Laboratories
 - Primary QC Laboratory, with qualification documents

- Alternate QC Laboratories
- Materials Control, as applicable for each item of work
 - Material Types and Source(s)
 - Material Properties & Mix Designs
 - Processing of Materials at the Production Site
 - Material Storage and Handling
 - Materials Certifications
- Quality Control Sampling and Testing
 - Frequency of sampling
 - Testing procedures
 - Random Sampling Plan
 - Sample Identification System and numbering
 - Quality Control Sampling & Testing
 - Split Sample procedures
 - Reporting
 - Sample Storage and Retention
- Production Facilities
 - Production Facilities & Equipment lists with calibration records
 - Production Facility QC Activities, sampling, testing and inspection
 - Production Facility Control Chart(s)
 - Evaluation of test data from the production facility
 - Reporting
- Field Operations
 - Placement Equipment and Procedures
 - Placement QC Sampling, Testing and Inspection process
 - Evaluation of test data from placement operations
 - Reporting

F. Quality Control Personnel Requirements

The Contractor's Quality Control organization shall, at a minimum, consist of the personnel outlined below that meet the described minimum qualifications. Include personnel by name in the QCP.

If changes in QC personnel occur, submit personnel qualifications for review.

1. Quality Control Manager

The Contractor's Quality Control activities shall be administered by a qualified Quality Control Manager (QCM). The QCM must be a full-time employee of the Contractor with full authority to exercise any and all actions necessary for the successful implementation of the QCP, including the authority to stop or to reject work. The QCM shall be available to communicate with the CO at all times.

Principal responsibilities of the QC Manager shall include managing the activities of all QC personnel, communicating on quality issues within the Contractor's organization and with the CO, and ensuring that all requirements outlined in the QCP are met.

2. Quality Control Technician(s)

All Contractor QC sampling, testing, and inspection performed at the production facility or at the project site shall be performed by qualified Quality Control Technicians (QCTs).

G. Quality Control Laboratory Facility Requirements

All Contractor QC testing shall be performed in certified laboratories either accredited through the AASHTO Accreditation Program (AAP), or meeting the requirements of ASTM D 3666 or state approved facilities. Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. This includes providing required AASHTO and ASTM and agency reference documents and ensuring that all required equipment, sampling platforms and tools are properly functioning, calibrated and certified. Provide evidence of all certifications, accreditations and calibrations to the CO.

The CO shall be permitted unrestricted access to inspect and review the Contractor's laboratory facility. The CO will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. Deficiencies shall be grounds for the CO to order an immediate stop to incorporating materials into the work until deficiencies are corrected.

H. Quality Control Inspection

The Contractor shall perform QC inspection of all work required by this contract. At a minimum, schedule pre-work meetings with the CO, production and placement personnel and including subcontractors and suppliers at the following phases of the work: Preparatory (at least 7 days prior to beginning any work element), Start-Up (at beginning of each work type) and Production and Placement (periodically throughout the work).

The minimum frequency for QC inspections shall be as shown in the approved QCP. The results and findings of QC inspections shall be documented on Inspector Daily Reports (IDRs).

I. Quality Control Sampling and Testing Requirements

Perform QC sampling and testing at both the production facility and at the site of field placement. Take samples and test per Table 3-3 for quality assurance acceptance testing, verification (correlation) or other purposes and deliver split samples to the CO immediately after sampling and splitting. All sampling and testing shall be in accordance with applicable AASHTO, ASTM, or agency procedures as designated in the contract. Furnish industry standard containers for all material samples. Provide the CO the opportunity to monitor and witness all sampling, splitting and testing.

J. Quality Control Documentation and Reporting

1. Inspection, Sampling and Testing Reports: Document all QC inspection, sampling and testing activities on Inspectors Daily Report (IDR) forms and/or Test Report Forms

(TRF), as appropriate. Deliver to the CO within one working day of those activities occurring. The QC Manager shall review and evaluate IDRs and TRFs on a daily basis to assure that all work conforms to contract requirements. Include, at a minimum, the following information

- Daily weather or environmental conditions
 - A summary of production or placement activities completed including Equipment used and hours worked
 - Any non-conforming material or workmanship identified.
 - Any corrective actions recommended or taken
 - Discussions with subcontractors or CO personnel
 - Visitors to the production facility or project site
2. Control Charts: Use Control Charts as part of the QCP. Include examples of the Control Charts to be used in the QCP. Plot test results for each subplot tested. Control charts during placement shall at a minimum include: gradations, density, VMA, air voids, VFA, binder content. Update Control Charts within 24 hours of completing tests for each subplot. Post Control Charts in an accessible location and submit to the CO on a daily basis.
 3. Corrective Action: Describe in the QCP what action will be taken when inspection or test results indicate that non-conforming work is being produced. Correct all areas of unacceptable pavement at no additional cost to the Government. Submit corrective plan to the CO for approval.

3.07 ACCEPTANCE SAMPLING AND TESTING – Materials and Placement

- A. General: In addition to performing QC testing during production and placement of asphalt pavement, the contractor shall perform acceptance testing as specified in Table 3-3. Contractor QC test results may be used by the CO for acceptance if through verification (correlation) and validation, the Contractor QC test results are deemed acceptable by the CO. The CO has sole discretion to include Contractor QC test results in the acceptance determination or to use only results from tests performed by the CO or the CO's agent. The CO shall have access at any time to all parts of the production and material storage facilities and to all parts of the project site, to perform inspections and tests, as deemed necessary to ensure the quality of the final product.

Utilize stratified random sampling of each lot produced and placed to assure that all material within the lot has an equal probability of being selected for testing. The CO will provide random numbers as required for each day's sampling, based on the anticipated production for that day. Adjustments in sampling locations and times necessary due to differences between anticipated and actual production quantities will be made by the CO. The CO may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of asphalt which is deemed unfit for use due to contamination, segregation, incomplete coating of aggregate, non-specification temperature, or other indication of defective material. Such rejection may be based on only visual inspection or temperature measurements. Similarly, the CO may at any time, notwithstanding field acceptance for mat or longitudinal joint density, reject and require the Contractor to correct any asphalt pavement

that was placed with unacceptable mat uniformity or paving joints, due to low density, lack of bond, segregation, improper elevation, tearing or other material or workmanship defects.

All samples of PGAB, asphalt mixture and pavement cores shall be split samples and the split portion delivered to the CO. Samples shall be split in accordance with applicable AASHTO or ASTM procedures. Deliver to the CO all core samples taken from the compacted pavement after testing. Protect cores from damage before delivering to the CO. Contractor to fill all core holes by tack coating the periphery of the core hole, then lay in asphalt mix manufactured, polymer modified cold patch mix to a level that will yield a smooth final surface, compact to specification density, and then swab the surface with tack coat.

- B. Lots and Sublots: “The entire quantity of production for each asphalt mixture type will be considered one lot and an individual subplot will be considered 500 tons.
- C. Contractor Furnished Samples: Furnish samples to the CO in industry standard containers for all required samples. Notify the CO in advance of sampling in order to provide the opportunity to observe and witness the sampling and splitting procedures.
- D. Selective Sampling: The CO may sample the work at any time to verify the quality of the work being performed. Work represented by these samples will be removed and replaced at no cost to the Government if, through further evaluation, the tests indicate that the represented work does not conform to contract requirements.
- E. Independent Assurance Sampling: The CO or their authorized agent may sample the work at any time to verify the quality of the sampling and testing and equipment used in the Acceptance determination.

Table 3-3
Sampling, Testing, and Acceptance Requirements during placement

Material or Product	Type of Acceptance (Subsection)	Characteristic	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Asphalt pavement	Action/Suspension – QC & Conformance - Acceptance	Asphalt Content ⁽¹⁾	AASHTO T 308	1 per 500 tons	Behind the paver before compaction	Yes	6 hours	—
		Gradation	AASHTO T 30	"	"	"	"	—
		Air voids	AASHTO T 312 & T 166	"	"	"	"	—
		VMA	AASHTO R 35	"	"	"	"	—
		Core density ⁽²⁾	AASHTO T 166	"	In-place after Compacting	"	24 hours	—
		Core density Long. Joint ⁽⁵⁾	AASHTO T166	"	"	"	"	—
		Core thickness ⁽⁶⁾	ASTM D 3549	"	"	"	Yes	24 hours
Asphalt pavement	Measured and tested for conformance	Placement Temperature	—	First load and as determined by CO thereafter	Hauling vehicle prior to dumping, or windrow before pickup	—	Immediately upon completion of measurement	—
		Maximum specific gravity ⁽³⁾⁽⁴⁾	AASHTO T 209	Minimum 1 per day	Behind the paver before compaction	Yes	24 hours	—
Asphalt Binder	Measured and tested for conformance	Quality	AASHTO M 320	After each delivery and mixing	In line between tank and mixing plant	2 – 1 quart (1 liter) samples	See remarks	Test by Government

(1) Use AASHTO T 308, Method A. Calculate the asphalt binder content by weighing the sample before and after the burn using a calibrated external balance.

(2) Side by side cores will be obtained for core density testing. Submit one core to the CO for verification testing and the other to the Contractor for acceptance testing. Perform specific gravity and thickness tests on the cores and deliver to the CO after testing is completed. Use AASHTO T 166 regardless of the volume of water absorbed. Care should be taken to dry cores to constant mass at 125 ± 5°F, before testing. 6 inch or 4 inch cores are acceptable. Nuclear gauge tests may be substituted for core density testing if that specific gauge has been correlated to at least five (5) cores taken from the project using the same HMA mix, and if the results of that correlation are acceptable to the CO.

- (3) After production paving has begun, use the average maximum specific gravity value (AASHTO T 209) for each day to adjust the percent compaction for the cores that represent that day's paving.
- (4) Do not use the supplemental procedure for mixtures containing porous aggregate (dry back method) of AASHTO T 209).
- (5) The six-inch or four-inch diameter core shall be taken on the centerline of the longitudinal joint. For the notched-wedge joint, the lower specification limit is 92.0 percent of the maximum specific gravity with the cores taken on the wedge portion of the joint with the core centered on the diagonal.
- (6) The core density samples may be used to determine core thickness, minimizing the number of total cores taken. If a properly correlated nuclear gauge is used for density acceptance, the thickness will be determined based on other methods acceptable to the CO. Submit proposed methods to the CO for approval if cores are not taken.

3.08 ACCEPTANCE SAMPLING AND TESTING – Smoothness

A. Measure the completed paved surface after the final lift is placed and compacted, and prior to any surface seal is placed.

1. Straightedge Measurement

Use a 10-foot metal straight edge to measure at right angles and parallel to the centerline. Defective areas are deviations between the surface and the bottom of the straightedge in excess of 0.25 inches, measured between any two contacts of the straightedge, or deviations in excess of 0.25 inches measured at the end of the straightedge. Correct defective areas according to Subsection 3.08(A)(2) Defective Area Correction.

2. Defective Area Correction

Correct defective areas at no additional cost to the Government. Either grind, mill a minimum of one half the pavement depth and fill with an approved asphalt mix, or cut and remove the pavement and repave with an approved asphalt mix. When correction by any other method is proposed, submit a proposal to the CO for approval.

If grinding is proposed, use a diamond blade machine and specify the manufacturer and model of the equipment to be used. Identify the beginning and ending station of each grind location, the grinding depth and lateral extent of grinding. Specify the type of seal to be placed after grinding is completed. Place all seals in a manner acceptable to the CO. Limit grinding depth to 12.5 percent of the design pavement thickness unless it is accompanied by a minimum 1-inch overlay. The CO may take up to 7 days to approve, modify, or reject the proposal. Do not begin corrective work until CO approval is obtained.

After corrections are made, re-measure the pavement surface according to this subsection. The final pavement thickness after any corrective work shall be no less than 90% of the design pavement thickness.

3.09 ACCEPTANCE SAMPLING AND TESTING – THICKNESS

A. Measure the full depth thickness, as specified in Table 3-3, after the final lift of asphalt pavement has been constructed. In addition, obtain cores randomly in parking areas, approach roads and pullouts as directed by the CO.

1. Method of Correction: Correct all areas where the final pavement surface, prior to placement of any corrective layers, is less than 90% of the design pavement thickness. The method of correction to the final surface of the hot asphalt concrete pavement will meet or exceed the structural and roughness requirements for the contract. Obtain approval, in writing from the CO for the proposed method of correction.

(a) Areas in reject due to insufficient pavement thickness will require a hot mix asphalt concrete pavement overlay. Minimal overlay thickness will be twice the nominal maximum aggregate size. Approval and acceptance for the hot mix asphalt concrete overlay and mix design will be in accordance with the contract requirements for the originally specified hot mix asphalt.

3.10 FINAL ACCEPTANCE OF WORK AND ANALYSIS

A. General: Test results from random sampling will be used to determine acceptance as provided for in this Subsection. The materials acceptance parameters and characteristics as noted in Table 3-3 will be accepted based on the conformance tests, materials certifications and by visual acceptance for workmanship and material quality as provided in the contract.

RAP used in mixtures will be monitored for binder grading compliance using random testing of mixtures taken from samples at the paving site behind the paver. The Abson extracted (AASHTO T170) binder high temperature DSR will be compared to the original binder RTFO high temperature DSR. If the mixture Dynamic Shear (DSR), $G^*/\sin \Delta$, is less than a minimum value of 2.20 kPa, production will be suspended and the extent of the problem will be further evaluated. Non-conforming work will be removed and replaced. In lieu of removal and replacement, the Contractor may submit a corrective plan to the CO for approval. The CO has sole discretion to approve or deny corrective plans for non-conforming work.

B. Acceptability of materials and workmanship will be according to the following Specification Limits. If test results fall outside of the Specification Limits described herein, make corrections as necessary to bring the applicable mix or pavement characteristic back into specification. If any individual test result falls outside of the Limits described herein, the material represented by that test result will be subject to rejection and replacement, at no additional cost to the government.

1. Acceptance Specification Limits:

Acceptance will be based upon the average of test results for the Lot for each quality characteristic.

- (a) Asphalt content: The upper and lower specification limits are the approved JMF target value plus or minus 0.4 percent. No single test value shall be beyond +/- 0.7 percent of the JMF target value.
- (b) VMA: The lower specification limit is the value specified for the nominal maximum size aggregate designated. After the JMF has been verified the Contractor's combined coarse and fine bulk specific gravity of aggregate Gsb values shall be used to calculate VMA on field produced asphalt mixtures.
- (c) Mat Density and Notched Wedge Longitudinal Joint Density: The lower specification limit is 92.0 percent and the upper specification limit is 97.5% of the maximum specific gravity (density) determined according to AASHTO T 166 and T 209. No single test value shall be beyond the range of 89.0% to 98%. The percent compaction will be determined using the average maximum specific gravity (AASHTO T 209) from all samples tested each day. The longitudinal joint cores shall be taken on the wedge portion of the joint with the core centered on the diagonal.
- (d) Confined Edge Longitudinal Joint Density: For the confined edge joint, the lower specification limit is 90.0 percent and the upper specification limit is 97.5% of the maximum specific gravity (density) determined according to AASHTO T 166 and T 209. No single core test value shall be beyond the range of 88.0% to 98% of the maximum density. The percent compaction will be determined using the average maximum specific gravity (AASHTO T 209) from all samples tested each day. The six-inch diameter core shall be taken on the centerline of the longitudinal joint.
- (e) Air voids: The upper and lower specification limits are 5.5 and 2.5 percent respectively. No single test value shall be outside the limit of 6.0 and 2.0 percent. Air voids are determined by AASHTO T 269, AASHTO T 209, and AASHTO T 166 of the compacted specimen.
- (f) Pavement Smoothness: In accordance with Subsection 3.08 Acceptance Sampling and Testing - Smoothness.
- (g) Asphalt Binder Grading: CO will determine acceptability based upon sampling and conformance to specification limits for each test property. The CO may test split liquid asphalt samples taken as part of the contractor's required QC sampling and use those results as part of the final acceptance process.
- (h) Gradation: The Allowable deviations (D) in the following table will apply:

Table 3-8
Allowable Deviations -- Gradations

Percent Passing		Allowable Deviation(D)
Minimum	Maximum	
70.1	89.9	4
60.1	70.0	5
55.1	60.0	6
45.1	55.0	7

40.1	45.0	6
30.1	40.0	5
21.1	30.0	4
8.1	21.0	3
0	8.0	2

- (i) Pavement Thickness Allowable Deviations: The lower specification limits (LSL) will be the design pavement thickness for asphalt concrete pavement minus the allowable deviation. The allowable deviation will be 10% of the designed pavement thickness. No single sample shall be beyond 20% of the designed pavement thickness.

END OF SECTION 32 12 16

SECTION 32 16 10 – CURBING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for furnishing and installing all types of curbing including the following: granite curb and granite edging.
- B. The work includes:
 - 1. Furnishing and installing granite curb, granite edging, curb inlets, and curb corners.
 - 2. All associated items and operations required to complete the installations, including surface preparation, concrete support, jointing, and finishing.

1.2 RELATED SECTIONS

- A. Sections which directly relate to the work of this Section include:
 - 1. Section 311100 – CLEARING & GRUBBING
 - 2. Section 310000 – EARTHWORK
 - 3. Section 321216 – ASPHALT PAVEMENT

1.3 REFERENCE STANDARDS

- A. References herein are made in accordance with the following abbreviations and all work under this Section shall conform to the latest editions as applicable.
- B. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete
- C. ANSI/ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- D. ANSI/ASTM D1752 – Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
- E. ASTM C33 – Standard Specification for Concrete Aggregates
- F. ASTM C94 – Specification for Ready-Mixed Concrete
- G. ASTM C150 – Standard Specification for Portland Cement
- H. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete
- I. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- J. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete

1.4 SUBMITTALS

- A. Submit shop drawings and manufacturer's literature for granite and precast curb, edging, corners and inlets indicating size, shape and dimensions, finish, and setting method for Engineer's approval.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Granite and precast curb units shall be adequately protected from damage during transit to the site.
- B. Curbing shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the work.

1.6 SAMPLES

- A. The Contractor shall supply to the site three (3) samples of all curb types for approval prior to ordering materials. Approved sample material may be used in the work upon approval by the Engineer.

PART 2 – PRODUCTS

2.1 GRANITE CURB

- A. Granite curb shall be light gray in color, free from seams and other structural imperfections or flaws which would impair its structural integrity, and of a smooth splitting appearance. Natural color variation characteristic of the deposit from which the curb is obtained will be permitted.
- B. Whenever curbing is sawed, all surfaces that are to be exposed shall be thoroughly cleaned and any iron rust or iron particles removed by sandblasting or other methods approved by the Engineer and any saw mark in excess of 1/8 inch shall be removed.
- C. Dimensions
 - 1. The stones for the several types of granite curb shall be cut to the dimensions and curvature hereinafter needed:

Type	Minimu m Length	Width at Top	Depth	Minimum Width at Bottom
VA-4	6 feet	6 inches	17 to 19 inches	4 inches (for 2/3 length)

- 2. Stones to be set on a radius of 100 feet or less shall be cut to the required curvature, unless otherwise approved and, except for making closures, shall be of the following

minimum lengths:

<u>Radius</u>	<u>Minimum Length</u>
50 feet to 100 feet	6 feet
25 feet to less than 50 feet	4 feet-6 inches
10 feet to less than 25 feet	3 feet

D. Finish

1. Granite curb shall have a top surface free from wind, and shall be peen hammered or sawed to an approximately true plane, and shall have no projections or depressions greater than 1/8 inch. The front and back arris lines shall be pitched straight and true and there shall be no projection on the back surface for 3 inches down from the top which would exceed a batter of 4 inches to 1 foot.
 - a. The front face shall be at right angles to the planes of the top and ends of the curb unit and shall be smooth quarry split, free from drill holes and with no projection of more than 1 inch and no depression of more than 1/2 inch measured from the vertical plane of the face through the arris or pitch line for a distance down from the top of 8 inches. For the remaining distance, there shall be no projection or depression greater than 1 inch measured in the same manner.
 - b. The ends of all stones shall be square with the planes of the top and face of the curb so that when the stones are placed end to end as closely as possible, no space shall show in the joint at the top and face of more than 1/2 inch for the full width of the top and for 8 inches down on the face; after which the end may break back not over 8 inches from the plane of the joint. The arris formed by the intersection of the plane of the joint with the planes of the top and exposed faces shall have no variation from the plane of the top and exposed faces greater than 1/8 inch.

2.2 GRANITE EDGING

- A. Granite shall conform to ASTM C615. Stone shall be hard and durable granite of a uniformly light grayish white color free from seams that would impair the structural integrity.
- B. The stones for the granite edging shall be cut to the following dimensions:

<u>Top Width</u>	<u>Nominal Depth</u>	<u>Minimum Length</u>
4 inches	12 inches	3 feet

- C. The exposed face shall be smooth quarry split to an approximate true plane and still have no projections of more than 1-1/2 inches and no depression greater than 1 inch. The top shall be sawed and shall have no projection or depression greater than 1/4 inch. Any projection not meeting the above shall be dressed off.
- D. The top and bottom lines of the face shall be pitched off to a straight line and shall not show over 1 inch between stone and straight edge when a straightedge is placed along the top and bottom lines.

- E. The ends shall be square to the plane of the face so when placed end to end no space more than 1-1/2 inches shall show except on a radius of 10 feet or less where the finish joint shall be no more than 3/4 inch.
- F. Drill holes not more than 3-1/2 inches or 1/2 inch in depth shall be permitted.
- G. The sides shall not be under the square more than 4 inches or over the square at the back more than 1 inch.
- H. The arris formed by the intersection of the plane of the face with the plane of the end joint shall not vary from the plane of the face more than 1/4 inch.

2.3 CEMENT MORTAR

- A. Cement mortar shall be composed of one part Portland cement and two parts of sand by volume with sufficient water to form a workable mix. Cement shall be Portland cement ASTM C150, Type II.

2.4 TRANSITION SECTIONS

- A. Horizontal transition sections shall be provided at all locations where curb sections change (i.e., vertical to sloped). Vertical transition sections shall also be provided at wheelchair ramps. Vertical transition sections for granite curb shall be made as shown on the Drawings.

PART 3 – EXECUTION

3.1 GENERAL

- A. Trenching, excavation, backfilling, and compaction shall be completed in accordance with Section 310000 – EARTHWORK, except as modified within this Section.
- B. Cement mortar bedding, if required, shall be placed as shown on the Drawings and in accordance with Section 033000 – CAST IN PLACE CONCRETE

3.2 GRANITE CURB AND EDGING INSTALLATION

- A. Excavation shall extend six (6) inches below and behind curb, as shown on the Drawings.
 - 1. The gravel base shall be placed in the excavated area, graded and compacted to above the proposed curb subgrade.
- B. Curbing and curb corners shall be set on additional gravel spread upon the foundation. All spaces under the curb and curb corners shall be filled with gravel thoroughly compacted so that the curb and curb corners will be completely supported throughout their length. The curb shall be set at the line and grade required as shown on the plans unless otherwise directed.

- C. Edging shall be set on a thoroughly compacted base so that the edging will be completely supported throughout their length. Concrete shall be placed to support the edging base as shown on the plans.
- D. Curb, curb corners or edging shall be fitted together as closely as possible.
- E. Immediately after the curb, curb corners, curb inlets, and edging is set, the space between it and the wall of the trench shall be filled with gravel thoroughly tamped to a depth of 6 inches, care being taken not to affect the line or grade of the curb, curb corners, curb inlets and edging. The trench shall continue to be filled with gravel and compacted in 6-inch lifts until grade is achieved. If the curb materials and trench are part of reconstruction work and existing bituminous concrete surface is to remain, then the use of concrete backfill is acceptable, to an elevation suitable to support the pavement patch or section.
- F. The joints between curbstones (both front and back) or edging shall be carefully filled with cement mortar and neatly pointed on the top and front exposed portions. After pointing, the curbstones or edging shall be satisfactorily cleaned of all excess mortar that may have been forced out of the joints.
- G. Transitions from normal curb settings to wheelchair ramps shall be accomplished with transition curb as shown on the drawings. Transitions shall be of the same type curb and similar to that abutting the transition piece and, if on a curve, of the same radius.
- H. The ends of the stone curb at driveways and intersections shall be cut at a bevel or rounded, as shown on the Drawings.
- I. If curb, curb corners, curb inlets, or edging of different quarries is used on the same project, curbing of each particular quarry shall be segregated and set to give uniform appearance.
- J. Procedures for removal and resetting of existing granite curb, and new granite curb, in existing pavements shall include the following:
 - 1. Prior to excavation for existing granite curb removal, the pavement surface shall be saw cut a minimum of one foot from the face of curb.
 - 2. Existing curb shall be carefully excavated, and removed in a manner that protects the curb and existing pavement to remain from damage.
 - 3. Existing granite curb shall be cleaned by sandblasting as required to remove bituminous material, paint and concrete from exposed surfaces prior to resetting in the proposed work.
 - 4. New granite curb shall be set to match the top of existing granite curb remaining in place at abutting sections and, if required, transitioned to the typical section shown on Drawings within the first section of curb. Cement concrete shall be placed along the front face of the curb as shown on the Drawings.

END OF SECTION 32 16 10

SECTION 32 17 23 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide Pavement markings as depicted on the plans and in accordance with this Section and applicable referenced standards as listed in Part 1.2.

1.2 REFERENCE

- A. Reference Standards:
 - 1. MaineDOT Standards Specifications; and
 - 2. American Association of State Highway and Transportation Officials (AASHTO)
 - 3. Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways

1.3 SUBMITTALS

- A. Product Data; and
- B. Manufacturer Instructions.

PART 2 – PRODUCTS

2.1 PAVEMENT MARKINGS

- A. Provide in accordance with MaineDOT Section 627.
- B. General: Alkyd-resin type, ready mixed complying with AASHTO M 248, Type I
- C. Color: White for shoulder striping, parking striping, stop bars, directional arrows; blue for ADA accessible space parking symbols; yellow for lane demarcation.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Apply and install pavement markings in accordance with MUTCD and MaineDOT Standard Specifications Section 627.

END OF SECTION 32 17 23

SECTION 32 92 00 – SEEDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 1. Seeding and over-seeding.
 2. Temporary protective coverings.
 3. Temporary protective fencing.
 4. Protecting and maintaining all meadow turf grass until Final Acceptance.
 5. Cleaning up.

1.3 DEFINITIONS

- A. Applicable specifications and publications, referred to herein, form a part of these Specifications:
 1. Standard Specification: The State of Maine Department of Transportation, Standard Specification for Highways Bridges, latest edition.
 2. ASTM: American Society of Testing Materials
 3. AASHTO: American Association of State Highway and Transportation Officials
 4. AAN: American Association of Nurserymen
 5. AOAC: Association of Official Agricultural Chemists

1.4 SUBMITTALS

- A. Prior to ordering the below listed materials, submit representative samples to Contracting Officer for selection and approval as follows. Do not order material until Contracting Officer's approval has been obtained. Delivered materials shall match the approved samples.

1. Protective fencing materials: Provide three 12 inch square samples for approval.
- B. Submit material specifications and installation instructions where applicable attesting that the following materials meet the requirements specified:
 1. Fertilizer
 2. Seed
 3. Lime
- C. Certificates
 1. A manufacturer's Certificate of Compliance to the specifications shall be submitted by the manufacturers with each shipment of each type of seed. These certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates.
 2. Contractor: Submit certification from the seed supplier that all seed is true to the variety indicated on the packaging.
 3. Furnish the Contracting Officer with duplicate signed copies of a statement from the vendor certifying that the seed mix is of the specified grass varieties, free of weeds, disease or other visual imperfections.
- D. Submittal Schedule
 1. Before installation:
 - a. Manufacturer's Product data
 - b. Test Reports
 - c. Seed Certification
 - d. Protective Fencing

1.5 QUALITY ASSURANCE

- A. Work under this section will be performed by workmen experienced in meadow turf grass installation under the full time supervision of a qualified foreman.
- B. Seed during recommended planting period or as approved by the Contracting Officer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material to the site in original unopened packages, showing weight, manufacturer's name and guaranteed analysis.

- B. Store materials in such a manner that effectiveness and usability will not be diminished or destroyed and shall be uniform in composition, dry, unfrozen and free flowing. The Contracting Officer reserves the right to reject any material which has become caked or otherwise damaged or does not meet specified requirements.

1.7 COORDINATION

- A. Contractor: Submit to the Contracting Officer for approval a progress schedule as specified herein.
- B. Contractor: Coordinate the Work with other trades so as not to interfere with the progress of the Work.

1.8 WARRANTY

- A. Contractor: agrees to repair or replace any or all meadow turf grass and lawn area(s) that fail(s) in materials or workmanship within a period of one year from date of substantial completion or completion thereafter on punch-out list.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Contractor: Make all amendments to the on-site topsoil as described herein.

2.2 TOPSOIL ADDITIVES

- A. Commercial Fertilizer for Meadows: (NOT USED) Complete fertilizer and be a standard product complying with state and federal fertilizer laws. Deliver Fertilizer to the site in the original unopened containers which bear the manufacturer's name and guaranteed statement of analysis. Fertilizer for meadow turf grass areas: Contain not less than 5 percent nitrogen, 10 percent phosphorus, and 5 percent potash by weight of ingredients or as otherwise indicated by topsoil test results. Do not apply fertilizer on meadow surfaces within 100 feet of a stream, shore land or open water body. Supply in unopened bags with the weight, contents, and guaranteed analysis shown thereon or on a securely attached tag.
- B. Commercial Fertilizer for Lawns: CID A-A-1909, Type I, class 2, with 50 percent of the nitrogen in slowly available form, containing at least 10 percent nitrogen, 0 percent phosphoric acid, and 10 percent total available potash in conformity with the Standards of the Association of Official Agricultural Chemists. Do not apply fertilizer on lawn surfaces within 100 feet of a stream, shore land or open water body. Supply in unopened bags with the weight, contents, and guaranteed analysis shown thereon or on a securely attached tag.
- B. Limestone: Dolomitic limestone and contain not less than 85 percent of total carbonates and magnesium and shall be ground to such fineness that 50 percent will pass a 100 mesh sieve and

90 percent will pass through a 20 mesh sieve. Coarser material will be accepted provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve.

- C. Water: The Government will furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Government's water supply is not available or not functioning, the Contractor will be held responsible to furnish adequate supplies at his own cost. All injured or damaged plant material due to the lack of water, or the use of too much water, to be the Contractor's responsibility to correct. Water to be free from impurities injurious to vegetation. Contractor to supply their own hoses and sprinklers.

2.3 SEED

- C. Seed Mixtures: Fresh, clean, new crop seed. Seed may be mixed by an approved method on the site or may be mixed by the dealer. If the seed is mixed on the site, each variety shall be delivered in the original containers bearing the dealer's guaranteed analysis. If seed is mixed by the dealer, the Seeding Contractor shall furnish to the Contracting Officer the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety.

Lawn Seed Mixture: Basis of Design: Maine Coast Low Grow Lawn Seed Mixture as supplied by The Chas. C. Hart Seed Co, Wethersfield, CT or approved equal, having the following salient characteristics:

- 22.5% Garnet Creeping Red Fescue
- 22.5% Reliant IV Hard Fescue
- 22.5% Azay Sheeps Fescue
- 22.5% Azay Blue Sheeps Fescue
- 10.0% TransAm Intermediate Ryegrass

Seeding rate is 10 lbs /1000SF

Meadow Mixture: Basis of Design: New England Conservation/Wildlife Mixture as supplied by New England Wetland Plants, South Hadley MA, or approved equal, having the following salient characteristics:

- | | |
|--------------------------|------------------------|
| Elymus virginicus | Virginia Wild Rye |
| Schizachyrium scoparium | Little Bluestem |
| Andropogon gerardii | Big Bluestem |
| Festuca rubra | Red Fescue |
| Sorghastrum nutans | Indian Grass |
| Panicum virgatum | Switch Grass |
| Chamaecrista fasciculata | Partridge Pea |
| Desmodium canadense | Showy Tick Trefoil |
| Asclepias tuberosa | Butterfly Milkweed |
| Bidens frondosa | Beggar Ticks |
| Eupatorium purpureum | Purple Joe Pye Weed |
| Rudbeckia hirta | Black Eyed Susan |
| Aster pilosus | Heath (or Hairy) Aster |

Solidago juncea

Early Goldenrod

Seeding rate is 1 lb /1500SF

2.4 PROTECTIVE FENCING

- D. Seeded areas adjacent to walks shall be protected by snow fencing or other temporary fencing material.

2.5 TEMPORARY PROTECTIVE COVERINGS

- E. As temporary protective coverings on ground areas subject to erosion, provide one of the following protective measures, as directed by the Contracting Officer:

1. Mulch Materials

- a. Straw

<u>Rate per 1,000 SF</u>
50 lbs.

2. Mesh or Blanket Matting: Matting for erosion control on seeded or hydroseeded slopes, on planted surfaces, drainage swales and on temporary or permanently finished slopes of 3:1 or steeper shall be:

- a. Heavy jute mesh shall be of a uniform open plain weave of unbleached single jute yarn. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one half its normal diameter. The jute mesh shall be furnished in approximately 90 pound rolled strips and shall meet the following requirements:
 - 1. Length – approximately 75 yards. Width – 48” plus or minus 1”. .78 warp ends per width of cloth. 41 weft ends per yard. Weight of cloth to average 1.22 pounds per linear yard with a tolerance of plus or minus 5%.
 - b. Staples shall be of a #11 gauge steel wire formed into a “U” shape 6” long.
 - c. Erosion control matting shall be “Soil Saver” as manufactured by Jim Walls Co., Dallas, TX or “Heavy Duty Jute Mesh” as manufactured by Lewis International Corp., Springfield, NJ, or approved equal.

3. PennMulch: For Seeded Areas as manufactured by Lebanon Turf or approved equal by the Contracting Officer with the following salient characteristics; water absorbing recycled newspaper and polymer pellets with starter fertilizer.

PART 3 - EXECUTION

ACAD-30900

32 92 00 - 5
SEEDING

3.1 EXAMINATION

- A. Examine site conditions and other conditions affecting performance of the Work. Insure the sub-grade is properly graded and at correct levels prior to spreading of topsoil.
- B. Examine specified materials before installation. Reject materials that are damaged or otherwise not as specified and shown on the Drawings. Reject soil amendments that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and approved by the Contracting Officer.
- D. The Contractor shall be responsible for maintenance work on the installed meadow turf grass until an acceptable meadow turf grass is established and accepted in writing.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

B. Topsoil:

- 1. Ensure that Topsoil has been installed as specified in Section 32 94 00 Topsoil.
- 2. After topsoil has been spread, apply dolomitic limestone at a rate of 138 lbs. per 1,000 s.f., (if required by testing results) and P₂O₅ at a rate of 10 pounds per 1,000 s.f. in the form of a 0-46-0 fertilizer. Cultivate to a 3" - 4" depth by use of a rotovator or a disk harrow. Remove all stiff clods, lumps, brush, roots, stumps, litter and other foreign material and stones over one inch (1") in diameter and dispose of legally off the site. Topsoiled areas shall also be free of smaller stones in excessive quantities as determined by the Contracting Officer. Do not overwork the soil.
- 3. Roll the entire surface with a roller weighing approximately one hundred pounds per foot of width. During the rolling, fill all depressions caused by settlement with additional topsoil and then regrade and roll until the surface presents a smooth, even and uniform finish at the required grade. Obtain Contracting Officer's approval of finish grading and rolling of the topsoil prior to seeding.
- 4. All placing, tilling, rolling and finish grading of topsoil shall be performed with agricultural machinery designed for that purpose to prevent over-compaction of the seed bed. No heavy construction equipment shall be allowed to be used for these purposes.
- 5. No subsoil or topsoil shall be handled in any way if it is in a wet or frozen condition.

C. Application of fertilizers:

- 1. Prior to seeding meadow areas, apply a 5-10-5 fertilizer at a rate of 2 pounds per 1,000 s.f. Work into the soil with seed application as described below.

2. On slopes in excess of 3:1, fertilizer and limestone may be applied with a hydroseeder. Submit material specifications or proposed hydroseeder mix to Contracting Officer for approval. If this option is chosen, the surface of the topsoil must be dragged or otherwise scarified to incorporate the limestone/fertilizer mixture into the top one inch (1") of topsoil. Submit method to Contracting Officer for review and approval.

D. The dates for seeding shall be as follows:

1. Spring - April 15 to June 1
2. Autumn - September 1 to October 15.

E. Seeding at any time other than within the above seasons shall be allowed only when ordered by the Contracting Officer or when the Contractor submits a written request for permission to do so and permission is granted. Newly seeded areas, if seeded out of season, must be continuously watered according to good practice if seeding is done between June 1 and September 1. Seeding done outside the dates established above shall be solely at the Contractor's risk.

3.3 SOWING OF SEED

A. Seeding: Seeding shall consist of soil preparation, seeding, raking, rolling, weeding, watering and otherwise providing all labor and materials necessary to secure the establishment of acceptable turf.

B. Sowing of Seed: Immediately before any seed is sown, the ground shall be scarified, or raked lightly until the surface is smooth, friable, and of uniformly fine texture. No seeding shall be done during windy weather. Sow seed in two directions at right angles to each other. Sow seed evenly by use of a cultipacker or approved seeding device in the proportions and at the rate per unit of area heretofore specified. If a cultipacker is not used, cover seed with a thin layer of topsoil by dragging, light raking or other approved method. Roll in both directions with a hand roller weighing approximately one hundred pounds per foot of width and water with a fine spray. Provide protective fencing where required to keep the area undisturbed until the grass is established. Cover area as specified in Section D herein.

C. Hydro-Seeding For Grass Areas: Mix seed with lime, fertilizer and cellulose wood fiber mulch for hydro-seeding in conformance with Section 618.07 of MDOT Standard Specifications for Highways and Bridges.

D. Protective Coverings: Apply Penn Mulch or approved equal with a broadcast spreader at the rate of 80 lbs. per 1000 SF. Sweep and remove all mulch broadcast onto paved surfaces. Water immediately after application at a rate of 0.2 to 0.4 inches of clean water.

3.4 WATERING

A. Watering of Seeded Areas:

1. First Week: The contractor shall provide all labor and arrange for all watering necessary to establish an acceptable meadow turf grass. In the absence of adequate rainfall,

watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least 2 inches.

2. Second and Subsequent Weeks: The Contractor shall water the meadow turf grass and lawn as required to maintain adequate moisture in the upper 5 inches of soil, necessary for the promotion of deep root growth.
3. Watering shall be done in a manner which will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. Contractor: Furnish sufficient watering equipment to apply one complete coverage to the seeded areas in an eight-hour period.

3.5 TEMPORARY PROTECTIVE FENCING

- A. Place temporary protective fencing in locations as directed by the Contracting Officer.

3.6 MAINTENANCE

- A. Maintenance shall begin immediately after each portion of meadow turf grass and lawn areas are installed and shall continue in accordance with the following requirements:
 1. Meadow turf grasses and lawn area: Maintain as long as is required to establish a uniform, thick, well-developed stand of grass until final acceptance.
 2. Mowing for Turf Grasses: Mowing is not required for the first year. Mow only during the month of November or as otherwise directed by the Contracting Officer to a height of 2 inches.
 3. Mowing for Lawn Areas: Mow with sharp mower blades. Mow lawn areas so as to maintain a minimum height of 2 inches and a maximum of 4 inches.
 4. All areas which fail to show a uniform, thick, well-developed stand of grass, for any reason, shall be re-seeded repeatedly until all areas are covered with a satisfactory growth of grass as determined by the Contracting Officer.
 5. All damage from erosion, gullies, washouts, or other causes shall be repaired immediately by filling with topsoil, tamping, re-fertilizing and reseeding at no additional cost to the Government.
- B. Protection:
 1. Meadow turf grass and lawn areas shall be protected against damage with the type fencing specified herein. Any protective devices remaining on the site shall be removed at Substantial Completion of the Contract or as directed by the Contracting Officer.

3.7 STANDARDS FOR COMPLETION

A. Conditions for Completion:

1. Completion of meadow turf grasses and lawn areas is for the entire area. No partial completion will be given unless otherwise approved by the Contracting Officer.
2. Meadow turf grasses and lawn areas: Exhibit a uniform, thick, well- developed stand of grass. Meadow turf grass areas shall have no bare spots in excess of four inches in diameter and bare spots shall comprise no more than two percent of the total area of that meadow turf grass and lawn area.
3. No meadow turf grass or lawn areas shall exhibit signs of damage from erosion, washouts, gullies, or other causes.
4. Pavement surfaces and site improvements adjacent to meadow turf grass and lawn areas shall be clean and free of spills or over-spray from placing or handling of topsoil and seeding operations.

B. Inspection and Completion:

1. Upon written request of the Contractor, the Contracting Officer to inspect all meadow turf grass areas to determine completion of Contract work. This request must be submitted at least 10 days prior to the anticipated inspection date.
2. Upon written request of the Contractor, the Contracting Officer to inspect all grass areas to determine completion of Contract work. This request must be submitted at least five days prior to the anticipated inspection date.
3. If the meadow turf grass and lawn areas are deemed complete to the Contracting Officer, a meeting will be arranged with Contractor and Government to review the meadow turf grass and lawn work. A final inspection is a part of this meeting to insure completion and any punch list items.
4. Contractor: Following the completion of meadow turf grasses and lawn areas, provide the Government with access to all grass areas as required for the Government's maintenance work.

C. Cleanup:

1. Contractor: Following the completion of meadow turf grasses and lawn areas, immediately remove from the site all materials and equipment not required for any other planting or maintenance work. Store materials and equipment remaining on site locations which do not interfere with the Government's maintenance of completed meadow turf grasses, lawn areas or other construction operations.

2. The Contractor is responsible for keeping all paving, building surfaces, signs, posts, and all site improvements clean during placement of topsoil and seeding operations. Clean up spills and over-sprays immediately. Completion shall not be granted until this condition is met.

END OF SECTION 32 92 00

SECTION 32 93 00 - PLANTING

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. Preparation of Backfill Mix
 - 2. Furnish and install trees, shrubs, groundcovers
 - 3. Maintenance.

1.3 DEFINITIONS

- A. Applicable specifications and publications, referred to herein, form a part of these Specifications:
 - 1. Standard Specification: The State of Maine Department of Transportation, Standard Specification for Highways Bridges, latest edition.
 - 2. ASTM: American Society of Testing Materials
 - 3. AASHTO: American Association of State Highway and Transportation Officials
 - 4. AAN: American Association of Nurserymen
 - 5. AOAC: Association of Official Agricultural Chemists
- B. All work shall conform to the Drawings and Specifications and comply with applicable codes and regulations.
- C. All areas to be planted to be inspected by the Contractor before starting work and any defects such as incorrect grading, etc., to be reported to the Contracting Officer prior to beginning this work and subsequently corrected to the satisfaction of the Contracting Officer. The commencement of Work by the Contractor indicates his acceptance of the areas to be planted, and he is to assume full responsibility for the work of this section.
- D. Contractor: Remove from site all waste material resulting from planting.

1.4 SUBMITTALS

- A. Prior to ordering the below listed materials, submit representative samples to Contracting Officer for selection and approval as follows. Do not order material until Contracting Officer's approval has been obtained. Delivered materials to match the approved samples.
1. Pine Bark Mulch: Submit one (1) cubic foot sample.
 2. Peat: Submit one (1) cubic foot sample.
 3. Compost: Submit Certificate of Compliance listing analysis.
 4. Anti-desiccant: Submit manufacturer.
 5. Fertilizer: Submit Certificate of Compliance listing analysis.
 6. Tree Stakes and Webbing: 1 Stake with approved stain (if applicable) and 3 foot length of webbing.
 7. Tree Stakes and Webbing: Product label and manufacturers certificate(s). Deer Fencing package including nesting, poles, sod staples and ties

1.6 QUALITY ASSURANCE

- A. Plant names shall comply with nomenclature of Hortus, latest edition. Sizing and grading shall be in accordance with ANSI Z60.1-86.
- B. Notify Contracting Officer in writing at least 15 days before plant delivery. All plant materials shall be available for inspection at the nursery or collection source before plants are dug. Approval at plant source shall not be considered final acceptance.

1.7 PRODUCT HANDLING

- A. Delivery:
1. Packaged Materials: Deliver in original, unopened containers showing weight, analysis, and manufacturer.
 2. Plant Material: Before digging deciduous trees and shrubs in leaf and evergreen trees for shipping, apply anti-desiccant. Carefully pack plants to prevent breaking, damage to bark, branches, and root systems, and root ball cracking. Provide adequate ventilation. Protect roots and balls from sun, drying wind, and frost. Do not drop plants from vehicles. Legibly label plants with correct botanical name and common name.
 3. Storage: Place plants not planted on the day of arrival in shaded storage, protected from wind and freezing. Open bundles and separate plants. Heel in bare root plants immediately on delivery and protect roots by puddling or other means to prevent drying. Cover root balls with moist sawdust, wood chips, shredded bark, peat moss, or other approved mulching material. Leave container grown plants in containers until planting. Keep all plants moist.

4. Store packaged materials in dry locations away from contaminants. Separate anti-desiccants and pesticides from other landscape materials.

1.8 COORDINATION

- A. Contractor: Submit to the Contracting Officer for approval a progress schedule as specified herein.
- B. Contractor: Coordinate the Work with other trades so as not to interfere with the progress of the Work.

1.9 GUARANTEE

- A. Plants to be guaranteed for a period of two (2) years after inspection from the date of substantial completion or completion thereafter on punch-out list and to be alive and in satisfactory condition with each plant to show at least 90% healthy growth and to have the natural character of a plant of its species in accordance with the American Nurseryman's Association Standards. The Contractor is responsible for all necessary maintenance including watering on a regular basis to keep the plant in a healthy and thriving condition for the entire guarantee period. At the end of the one year guarantee and maintenance period for one year, each plant shall show at least 90% healthy growth and to have the natural character of a plant of its species in accordance with the American Nurseryman's Association Standards.
- B. At the end of the guarantee period, inspection will be made. Any plant required under this contract that is dead or unsatisfactory to be removed from the site.
- C. All replacements to be plants of the same kind and size specified in the PLANT LIST. The cost to be borne by the contractor, except for possible replacements due to vandalism or neglect on the part of others. Furnish plants, stake and wrapped if necessary, and mulch as required.
- D. Contractor: Provide a physical handbook or maintenance instructions for all plant material under his direction. This handbook to contain all necessary maintenance information, which will enable the GOVERNMENT to maintain new plantings in a vigorous condition. Before planting work is completed, one handbook copy is to be submitted to the Contracting Officer for approval. Upon the approved completion of the punch-out list of the planting work, one handbook copy to be furnished to the Government for future reference. The Contracting Officer may require re-submittals to the Government for maintenance instructions if it is determined that the information provided is not sufficient to allow for proper maintenance.

PART 2 - PRODUCTS

2.1 SOIL ADDITIVES

- A. Commercial fertilizer, peat, humus or other additives to be used to counteract soil deficiencies as recommended by the soil analysis and as directed by the Contracting Officer.

1. Commercial fertilizer to be a product complying with the State and United States Fertilizer Laws. Deliver to the site in the original unopened containers which to bear the manufacturer's Certificate of Compliance covering analysis which shall be furnished to the Contracting Officer. At least 50% by weight of the nitrogen content will be derived from organic materials. A minimum of 35% of the nitrogen will be water insoluble. Fertilizer to contain not less than percentage of weight of ingredients as follows or as recommended by soil analysis:

	Nitrogen	Phosphorus	Potash
For deciduous (dry)	10%	6%	4%
trees & shrubs (water soluble)	16%	19%	16%
For evergreen (dry)	7%	7%	7%
trees & shrubs (water soluble)	21%	7%	7%

- B. Humus will be natural humus, reed peat, or sedge peat. It to be free from excessive amounts of zinc, low in wood content, free from hard lumps and in a shredded or granular form and to pass through a 1/2 inch mesh screen. According to the methods of testing of A.O.A.C., latest edition, the acidity range to be approximately 5.5 pH to 7.6 pH and the organic content to be not less than 60% as determined by drying at 105 degrees C. The minimum water absorbing ability to be 200% by weight on an oven-dry basis.
- C. Peat Moss to be composed of the partly decomposed stems and leaves of any or several species of sphagnum moss. It is to be free from wood, decomposed colloidal residue, and other foreign matter. It is to have an acidity range of 3.5 ph to 5.5 pH as determined in accordance with the methods of testing of A.O.A.C., latest edition. Its water absorbing ability to be a minimum of 1,100% by weight on an oven-dry basis.
- D. Compost to be well-rotted, unleached, stable manure not less than eight months and not more than two years old. It to be free from sawdust, shavings, or refuse of any kind and to not contain over 25% straw. The contractor to furnish information as to kind of disinfectant or chemicals, if any, that may have been used in storage of the manure.
- E. Bone meal to be fine ground, steam-cooked, packing house bone with a minimum analysis of 23% phosphoric acid and 1.0% of nitrogen.
- F. Leaf mold to be a highly organic dark brown to black spongy residue resulting from the well aerated composting of deciduous tree parts, free of plants and their roots, debris and other extraneous matter and to be uncontaminated by foreign matter and substances harmful to plant growth. The organic matter to not be less than 85% by weight as determined by the loss on ignition of oven-dried samples. Test samples to be oven-dried to a constant weight at a temperature of 16 degrees C. The inorganic residue after ignition to not be finer textured than 4% by weight passing the number 200 sieve with washing.
- G. Sulfur for adjustment of loam pH to be commercial or flour sulfur, unadulterated, and to be delivered in containers with the name of the manufacturer, material, analysis, and net weight appearing on each container.

- H. Dolomitic limestone for adjustment of loam pH to contain not less than 85% of total carbonates and to be ground to such fineness that 40% will pass through 100-mesh sieve and 95% will pass through a 20-mesh sieve. Coarser materials will be accepted provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve.

2.2 PLANT MATERIALS

- A. The contractor will furnish and install all plants shown on the Drawings, as specified, and in quantities listed on the Plant List. No substitutions will be permitted without the written approval of Contracting Officer. In case of conflict between the Planting Plan and the Plant List, Contractor to supply the plant material necessary to complete the Work as shown on the Drawings. All plants to be nursery grown unless specifically authorized to be collected.
- B. Plants to be in accordance with the U.S.A. Standard for Nursery Stock of the American Association of Nurserymen, Latest edition. All specified plants are to be northern grown.
- C. All trees and shrubs to conform to the trade classification of "heavy specimen" and will exhibit distinctive character and form.
- D. All Plants to be typical of their species or variety and to have a normal habit of growth and be legibly tagged with the proper name. Only plant stock within the hardiness Zone 1 through 5, as established by the Arnold Arboretum, Jamaica Plain, Massachusetts, will be accepted. The contractor's suppliers must certify in writing that the stock has actually been grown under Zone 5 or hardier conditions. Plants not so certified will not be accepted.
- E. The root system of each shall be well provided with fibrous roots. All parts to be moist and show active green cambium when cut. They to be sound, healthy and vigorous, well branched, and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae.
- F. All plants must be moved with the root systems as solid units with balls of earth firmly wrapped with untreated eight-ounce burlap, firmly held in place by a stout cord or wire. The diameter and depth of the balls of earth must be sufficient to encompass the fibrous and root feeding system necessary for the healthy development of the plant. No plant to be accepted when the ball of earth surrounding its roots has been badly cracked or broken prior to or during the process of planting or after the burlap, staves, ropes or platform required in connection with its transplanting have been removed. The plants and rootballs to remain intact during all operations. All plants that cannot be planted at once must be heeled in by setting in the ground and covering the rootballs with soil and then watering them.
- G. Take caliper measurement four feet above ground for deciduous trees. Evergreen trees to be of specified height with spread in proportion to height, as designated in A.A.II. U.S.A. STANDARD FOR NURSERY STOCK, latest edition, and to be well branched to the ground. The trunk of each tree to be a single trunk, unless listed as multi-stemmed in the plant list, growing from a single crown of roots. No part of the trunk to be conspicuously crooked as compared with normal trees of the same variety. The trunk to be free from sun scald, frost cracks, or wounds resulting from abrasions, fire, or other causes. No pruning wounds to be present having a diameter exceeding two inches and such wounds must show vigorous bark on all edges. Plants shall not be pruned prior to delivery. Pruning wounds over 3/4" in diameter must be completely callused over. Evergreen trees shall be branched to within one foot of the ground.

- H. At least 50% of the plants furnished for each size range shown on the plants to be at or above the average between the maximum and minimum size specified. If a nursery supplies material at a specific size (not a range), then the larger size of the specified range to be furnished.
- I. Plants delivered by truck and plants requiring storage on site to be properly wrapped and covered to prevent wind-drying and desiccation of branches, leaves or buds. Plant balls should be firmly bound, unbroken and reasonably moist to indicate watering prior to delivery and during storage. Tree trunks should be free from fresh scars and damage in handling. No trees with double-leaders or twin-heads to be accepted without the written approval of the Contracting Officer. The contractor to reject such plants at time of delivery by the nursery/supplier unless such plants were selected by the Contracting Officer as indicated by tags and seals. No plant material from cold storage will be accepted unless pre-selected by the Contracting Officer.
- J. Plant material which is to be planted after the specified seasons for planting shall be dug during the normal season for digging of the particular plant material and be stored and maintained in good health until planting. The contractor shall assume all costs for maintaining plant material while it is being stored.
- K. All plants to be free from plant diseases and insect pests, and to comply with all applicable State and Federal laws with respect to inspection for plant diseases and infestations.
- L. All plant materials shall be available for inspection in the nursery or collecting fields before it is dug. The contractor to provide a list of suppliers in sufficient time to allow the Contracting Officer to inspect nurseries on a timely basis. Approval to move nursery Materials shall not be considered as final acceptance.
- M. All planting stock to conform to the laws of The State of Maine and to be inspected before removal from the nursery, by authorized Federal, State or other authorities as may be required in the area where the nursery is located. The invoice or order for each shipment of plants to contain the project name and quantity and variety of plant material delivered. An inspection certificate to certify that the plants are free of disease and insect pests of all kinds shall accompany each shipment. Disease certificates and delivery slips to be given to the Contracting Officer upon arrival of the plant material at the point of delivery.
- N. Plants to be dug with care and skill. Special precautions to be taken to avoid any unnecessary injury to or removal of fibrous roots. Each species or variety to be handled and packed in the approved manner for that particular plant. All precautions to be taken to insure the arrival of plants at the project site in good condition for successful growth.
- O. Balled and Burlapped Plants Rootball: Firm and composed of the original, undisturbed soil in which the plant has been grown. The plant shall be handled in such a manner that the soil in the ball will not drop away from the roots and will not cause stripping of the small, fibrous roots. The ball shall be wrapped with burlap or other approved material and tightly laced to hold the desired shape. No balled plants will be accepted if the ball is cracked or broken. A substitute for burlap may be approved provided it can be demonstrated that the material is tight enough to retain the soil ball securely. Any synthetic material used to wrap the rootball, which will not readily disintegrate in the ground, shall be removed or extensively cut to allow the roots to grow through freely.

- P. Container Grown Plants: Well established in the container in which they are sold, and shall have sufficient roots to hold earth intact after removal, without being in a root bound condition. Plant shall remain in container until planted.
- Q. Shrubs and Small Plants: All shrubs and small plants, unless otherwise designated, shall be well-formed and bushy with well-spaced side branches, and shall have a crown and stem(s) typical of the species and variety.
- R. All soil in rootballs, containers, bare root stock and native sods shall be free from weeds, non native seeds and non native or noxious insects.
- S. Requests for plant substitutions shall be made at least 14 days before the plants are to be delivered and such requests shall list at least 5 major nursery sources contacted for confirmation of unavailability.
- T. The contractor to notify the Contracting Officer not less than 5 days in advance of delivery of plants.

2.3 TREE STAKING

- A. Stakes: "Universal Ground Anchor" or approved equal with the following salient characteristics, sound cedar, fir or other suitable wood 2" x 2" or 2" x 4", as required, pointed at one end and stained at the discretion of the Contracting Officer. Tree anchors, if required, to be malleable iron.
- B. Tree-stake webbing: Color: olive drab or black as manufactured by Eaton Brothers Corporation, PO Box 68, Hamburg NY 14875. or "ADJ-A-TYE" heavy-duty poly chain lock, color: olive drab or black, as distributed by A.M. Leonard Inc, 241 Fox Drive, Piqua OH 45356-0816 or approved equal with the following salient characteristics: ¾" wide polypropylene with a 900 lb. Breaking strength..

2.4 DEER FENCING

- A. Temporary deer Fencing consisting of black polypropylene netting (7' height), poles, sod staples and ties. Basis of design Deer Fence Kit as supplied by A.M. Leonard (<https://www.amleo.com/deer-fencing-kit>)

2.5 WATERING

- A. The Government will furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Government's water supply is not available or not functioning, the Contractor will be held responsible to furnish adequate supplies at his own cost. All injured or damaged plant material due to the lack of water, or the use of too much water, to be the Contractor's responsibility to correct. Water to be free from impurities injurious to vegetation. Contractor to supply their own hoses and sprinklers.

2.6 ANTI-DESICCANT

- A. Anti-desiccant: “Wilt-Pruf”, available from Nursery Specialty Products, Inc., New York, NY, or approved equal, delivered in the manufacturer’s container and used according to the manufacturer's instructions and per Contracting Officer’s approval with the following salient characteristics: Provide a natural product for the purpose of preventing desiccation to plant material derived from the resin of the pine tree which is called a polyterpene polymer or more specifically a beta-pinene polymer which is a film forming short chain of polymer component. Anti-desiccant to contain two sub-units in the polymer for a molecular weight of 275. Anti-desiccant to be non-toxic and suitable for food crops.

2.7 MULCH

- A. Mulch: Consist of the outer bark of evergreen trees and a minimum of hardwood bark, and shall be aged for a period of at least 6 months, and not longer than 2 years. The bark must be partially decomposed and dark brown in color, free of dirt and materials deleterious to plant life. No chunks 3 inches or more in size, and thicker than 1/4 inch shall be left on the site.

2.8 TREE WOUND DRESSING

- A. Tree Wound Dressing: Non-toxic product for aesthetic purposes only specifically designed for tree wounds.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine site conditions and other conditions affecting performance of the Work. Ensure the sub-grade is properly graded and at correct levels prior to spreading of topsoil, or if the topsoil has been spread, is at the proper depths and finish grades.
- B. Examine specified materials before installation. Reject plant materials that are damaged or otherwise not as specified and shown on the Drawings. Reject soil amendments that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and approved by the Contracting Officer.

3.2 PLANTING

- A. Planting of any plant material includes: Coordination with the nursery, shipment from the nursery, the digging of the holes, provision of the soil additives and loam, furnishing the plants of specified size with roots in the specified manner, the labor of planting and mulching and guying and staking where called for, and the removal of all excess or debris material created as a result of the work.
- B. Coordination with Existing Conditions: Prior to excavating for any plants, and before installation of location stakes, the contractor shall review all existing conditions below grade. Underground obstructions may exist in the form of project-installed improvements and/or pre-

existing conditions. The contractor to be liable for any damages resulting from his failure to ascertain subsurface conditions before proceeding with the work.

C. Planting:

1. Location for all plants to be staked on the ground by the contractor for approval by the Contracting Officer before any plant pits are dug. The contractor shall move stakes as necessary to obtain the Contracting Officer's approval. Once the staking is approved and all the trees have arrived, the contractor to place all the trees at the staked locations for the Contracting Officer's secondary approval. The contractor shall move trees as required by the Contracting Officer. Then each plant location to be marked by outlining the rootball with a light application of lime. At this point the contractor to begin excavating the planting pits. Once all the trees are placed in the planting pits, the Contracting Officer to make a final inspection of the pits. Before beginning any backfilling, the contractor shall, if necessary, rotate plants and/or correct plant pits as required by the Contracting Officer. Once final approval has been given by the Contracting Officer, the contractor can proceed with the backfilling.
2. At least ten (10) days prior to the expected planting date, the contractor shall request, in writing, that the Contracting Officer provide a representative to select and tag stock to be planted under this Section. The contractor shall pay for transportation and overnight accommodations, if necessary, for the Contracting Officer's representative during the period of time required to select and tag the plant material.
3. Plants to be selected by the Contracting Officer's representative at the place of growth for conformity to specification requirements as to quality, size, and variety. Such approval to not impair the right of inspection and rejection upon delivery at the site or during the progress of the work. Cost of replacement to be borne by the contractor.
4. Delivery and Temporary Storage: Plants shall be delivered in a moist, vigorous condition, free from dead wood, bruises, or other root or branch injuries. Insofar as is practical, plant material shall be planted on the day of delivery. All unplanted material shall be protected at all times from sun and drying winds. Plants that are not planted immediately shall have their root balls well watered and covered with approved mulching materials. No plants shall remain unplanted for longer than 3 days. Plants shall not be bound with wire or rope at any time so as to damage bark, break branches, or cause any injury.
5. Planting Dates: Unless otherwise specified, planting shall be done after the frost leaves the ground until July 1, and from September 15 to November 1.
6. Maintain at all times during the planting operations one or more stockpiles of approved planting mix.
5. Plant pits to be excavated with vertical sides. Holes for trees to be at least two feet greater in diameter than the ball and one foot deeper than the ball.
7. Loam, organic material and fertilizer mix for use as planting mix shall be thoroughly premixed in the following proportions unless directed otherwise:
 - a. one cubic yard of accepted loam
 - b. 2 to 3 cubic feet of well rotted cow manure

- c. 4 cubic feet of sphagnum peat moss
 - d. 10 pounds of fertilizer (minimum 35% water insoluble (WIN))
 - e. 12 pounds of dolomitic limestone.
8. All plant roots and earth balls must be damp and thoroughly protected from sun and wind from the beginning of the digging operation, during transportation and through final planting. The plants shall be planted in the center of the holes and at the same depth as they previously grew. Remove burlap, rope, from sides and tops of root balls. Do not pull burlap out from under root balls. If a wire basket is present, cut and remove all wire keeping the rootball intact. Cleanly cut off broken or frayed roots. Backfill topsoil in layers of not more than 6 inches and water each layer sufficiently before the next layer is placed. Use enough backfill material to bring the surface to finished grade when settled. Form a saucer around each tree to a height of 4 inches.
9. Shrub, perennial and groundcover beds: Score and spread roots on container grown plants on 4 equal areas on sides of roots/soil, scarify and spread roots on bottom of plant. Dig to a depth of one foot (1') below final grade or as shown on the drawings. Supply sufficient planting soil mix to provide one foot (1') deep beds. Water thoroughly after planting.
- D. All plants to be flooded with water twice within the first 24 hours of the time of planting and all plants during the maintenance period to be watered at least twice each week. At each watering the soil around each tree or shrub to be thoroughly saturated. If sufficient moisture is retained in the soil, as determined by the Contracting Officer, the required watering may be reduced. Trees will require a minimum of ten gallons of water each.
- E. Mulch material to be placed over entire saucer areas of individual trees to a depth of two inches, not later than one week after planting. No mulch shall be placed within 2" of the trunk. No mulch to be applied prior to the first watering of plant materials.
- F. Pruning: Prune plant material after the plant has been completely planted. Make all large pruning cuts, 1/2 inch diameter and larger on the trunk and main stem, so as not to interfere with the branch collar. Make all pruning cuts less than 1/4 inch diameter with a sharp pair of hand pruners as close to the main stem as possible without damaging the cambium or bud. Remove all sucker growth, water sprouts, crossing or rubbing branches, dead or dying limbs and tips, broken branches, diseased or insect infested limbs and crotches to prevent storm damage. Questionable weak limb and branch removal that may disfigure the tree or shrub should be left for final approval by the Contracting Officer. Pinaceae species transplanted during the candle stage should have candles reduced from 1/2 to 2/3 inch. Treatment of all cuts and wounds with a non-toxic tree wound dressing is optional. Never cut a leader.
- G. Apply Anti-desiccant to all plants prior to being dug at the nursery and/or as directed by the Contracting Officer once the plants have been delivered to the site.
- H. If planting is done after lawn preparation or installation, proper protection of lawn areas shall be provided and any damage resulting from planting operations shall be repaired immediately at no cost to the GOVERNMENT.

- I. In the event that underground construction work, rock or obstructions are encountered in any plant pit or bed excavation work to be done under this Contract, alternate locations may be selected by the Contracting Officer.
- J. Absolutely no debris may be left on site. Excavated material shall be removed as directed by the Contracting Officer. Repair any damage to the site or structures to restore them to their original condition as directed by the Contracting Officer, at no cost to the GOVERNMENT.

3.3 FERTILIZATION

- A. Initial fertilization to consist of the use of dry fertilizer, water-soluble fertilizer or a combination of both.
- B. When not included in the planting mix, dry fertilizer, including fertilizer for acid-loving plants, shall be uniformly spread about the plants at the following rate:
 - 1. Trees: 1-1/2 pounds per inch of caliper.
- C. Water-soluble fertilizer to be dissolved in water at 2 times the rate recommended by the manufacturer. The thoroughly mixed solution to be applied at the time of initial planting after the water used for back fill soaking has leached away. Care to be taken to prevent any water from washing plant saucers away either during the original watering or while applying water-soluble fertilizer.
- D. The fertilizer solution to be applied at the following rates:
 - 1. Plants above 6 feet and up to 12 feet to receive 12 quarts
 - 2. Plants above 12 feet to receive 16 quarts.
- E. Unless otherwise approved, re-fertilization to be by a water-soluble fertilizer applied in conjunction with watering or by itself. No re-fertilization will be allowed between September 20 and plant dormancy and between frozen ground and March 21.
- F. All plants to be fertilized at least once between April 1 and October 15 with water-soluble fertilizer mixed and applied as herein specified or as directed when applied with a watering.
- G. When the contractor's guarantee period extends Spring to Spring, all plants shall receive an additional application of fertilizer in the spring prior to final acceptance.

3.4 DEER FENCING

- A. Install temporary deer fencing around plant beds as designated on plan and as directed by C.O.R. Provide access to inside of enclosure to allow for maintenance of plants and plant bed.

3.5 MAINTENANCE

- A. Maintenance shall begin immediately after each plant is planted and shall continue in accordance with the following requirements:
1. All plants shall be watered at least twice each week during the maintenance period. At each watering, the soil around each tree or shrub shall be thoroughly saturated. If sufficient moisture is retained in the soil, as directed by the Contracting Officer, the required watering may be reduced. Trees will require a minimum of ten gallons of water each.
 2. All plants shall remain plumb. Any plants that settle out of plumb shall be promptly reset.
 3. Individual plant pits shall be kept free of weeds and mulch and shall be replaced as required to maintain a 2" layer of mulch. Individual pits to be neat in appearance and maintained to the lines originally laid out.
 4. Contractor: Replace all plants that die during the maintenance period as directed by the Contracting Officer.
 5. Acts of vandalism, vehicle accidents or fire, if unrelated to construction operations and which cause damage in excess of five trees in one location, will be reasons for consideration of extra payment for approved replacement. Excessive damage due to heavy insect infestations, if all reasonable precautions are taken by the contractor, will also be reason for consideration of extra payment for approved replacements.
 6. Spraying for both insect pests and diseases shall be included during the maintenance period as required and as directed by the Contracting Officer.
 7. The Contracting Officer may order or the Contractor may request the use of a suitable insecticide or fungicide when it is determined that infestations of insects or plant disease require the use of such material. No pesticides, insecticides or fungicides may be used without the expressed written permission of the Contracting Officer.
- B. All herbicides, insecticides, and fungicides to be applied as prescribed by their manufacturer and in accordance with National Park Service, State of Maine, and any local laws. The Contractor to either possess from the State of Maine the proper registrations and permits for application of such materials or have the applications made by an approved, qualified firm holding such registrations and permits. Copies of all permits in connection with such materials to be furnished to the Government. No pesticides, insecticides or fungicides may be used without the expressed written permission of the Contracting Officer.
- C. Keep clean sidewalks and other paved areas during the planting and maintenance operations.
- B. Maintenance shall consist of keeping the plants in a healthy growing condition, including watering, weeding, cultivating, re-mulching, removal of dead material, resetting plants plumb and to proper grades and maintaining the planting saucer for a period of one year following substantial completion.

- C. If a substantial number of plants are sickly and dead at the time of inspection for punch-out list items, acceptance will not be granted, and it is the contractor's responsibility for maintenance of all the plants to be extended until replacements are made. All dead and unsatisfactory plants to be promptly removed from the project. Replacements to conform in all respects to the specifications for new plants and to be planted in the same manner.

3.6 GUARANTEE PERIOD TWO (2) YEAR MAINTENANCE

- A. The Contractor is authorized to provide all necessary maintenance they deem necessary including watering, pruning, and disease control for the guarantee period to assure the plantings remain in the condition as specified in 3.5 B. The Government will not be watering or maintaining the plant material for the duration of the two (2) year Guarantee period.
- B. Upon request of the Contractor in writing at the end of the two (2) year guarantee period, the Contracting Officer will inspect the plant material with the Contractor to determine which plant(s) need replacement. Each plant to show at least 90% healthy growth and to have the natural character of a plant of its species in accordance with the American Nurseryman's Association Standards and remain plumb. Any plant or plants which, in the opinion of the Contracting Officer do not clearly depict 90% healthy growth shall be replaced as specified herein at no cost to the Government.

3.7 STANDARDS FOR COMPLETION

A. Conditions for Completion:

- 1. Each plant to show at least 90% healthy growth and to have the natural character of a plant of its species in accordance with the American Nurseryman's Association Standards. The plants will be replaced live during the normal planting season, until the plants live through one year. Contractor: Promptly notify the Contracting Officer of any removals and/or replacements.

B. Inspection and Completion:

- 1. Upon request of the Contractor in writing, The Contracting Officer to inspect the plant material to determine completion of Contract work. The request must be submitted at least 10 days prior to the anticipated inspection date.
- 2. If the planting are deemed complete to the Contracting Officer, a meeting will be arranged with Contractor and Government to review the planting work. A final inspection is a part of this meeting to insure completion and any punch list items.

C. Cleanup:

- 1. Contractor: Following the completion of planting operations, immediately remove from the site all materials and equipment not required for any other planting or maintenance work. Store materials and equipment remaining on site in locations which do not interfere with the Government's maintenance of completed planting or other construction operations.

2. The Contractor is responsible for keeping all paving, building surfaces, signs, posts, and all site improvements clean during planting operations. Clean up spills etc. immediately. Completion of the Work shall not be granted until this condition is met.

END OF SECTION 32 93 00

SECTION 32 94 00 - TOPSOIL

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. Loam Borrow

1.3 DEFINITIONS

- A. Applicable specifications and publications, referred to herein, form a part of these Specifications:

- 1. Standard Specification: The State of Maine Department of Transportation, Standard Specification for Highways Bridges, latest edition.
- 2. ASTM: American Society of Testing Materials
- 3. AASHTO: American Association of State Highway and Transportation Officials
- 4. AAN: American Association of Nurserymen
- 5. AOAC: Association of Official Agricultural Chemists

1.4 SUBMITTALS

- A. As specified in Division 1 Section 01 33 23.
- B. Prior to commencing with the Work, submit representative of on-site and imported topsoil samples to Contracting Officer for selection and approval as follows. Do not order imported topsoil material until Contracting Officer's approval has been obtained. Delivered materials to match the approved samples.
 - 1. On site and Imported topsoil: Provide a one (1) cubic foot representative sample from each proposed source for testing and approval as directed herein. Deliver samples to a State University Agricultural Extension Service or other approved soil testing laboratory

prior to any loaming, having testing report sent directly to the Contracting Officer, and pay all costs. Report to cover soil textural classification (percentages of sand, silt, and clay) and include additive recommendations.

2. Mechanical and chemical (pH soluble salts) analysis to be by a public extension service agency or a certified private testing laboratory in accordance with the current standards of the "Association of Official Agriculture Chemicals".
3. Report to be submitted at least one month before any spreading of topsoil. Test soil for nitrate nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Manganese, Ferric Iron, Sulfate, Soluble Salts (1:2 soil-water ratio) and show acidity (pH) (1:1 soil water ratio) of the soil.
4. Contractor: Submit proposed source(s) of imported topsoil to the Contracting Officer for on-site inspection and approval during the growing season. The topsoil must be in its original location or have been stockpiled for a period of not less than one year for use on this project to be considered for acceptance by the Contracting Officer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store excavated topsoil on site as shown on the Drawings or as directed by the Contracting Officer for reuse in final topsoil placement and grading. Do not place topsoil in a frozen, wet or muddy condition.
- B. Use all on-site stockpiled topsoil after approved amendments have been incorporated before importing topsoil. Do not deliver or place topsoil in frozen, wet, or muddy condition.

PART 2 - PRODUCTS

2.1 ON-SITE TOPSOIL

- A. Stripped and stockpiled as specified in Section 31 20 00 Earth Moving. Topsoil to be free from weeds, sod, clods and stones larger than 1 inch, toxic substances, litter, or other deleterious material. Screen on-site topsoil for oversized material removal prior to reuse on the project. Test soil as specified herein and apply and incorporate additives as per results of the soil tests and as specified herein under Section 2.2 IMPORTED TOPSOIL. Re-test as required and as approved by the Contracting Officer.

2.2 IMPORTED TOPSOIL

- A. If needed, topsoil shall be sourced from an approved location determined by the Contracting Officer, which provides STA lab tested organic amendments in the topsoil to meet the conditions listed below. All imported topsoil is to match the desired in situ material. At least ten (10) days prior to topsoil delivery, notify Contracting Officer of the source(s) from which topsoil is to be furnished. Topsoil shall be a natural, friable soil representative of productive soils and shall meet the following conditions:

1. Loam to be a "fine sandy Loam" or a "sandy loam" determined by mechanical analysis and based on the "U.S.D.A. Classification System".
 2. Loam to mean that portion or the soil profile defined technically as the "A" horizon by the Soil Science Society of America. It will be of uniform composition, without admixture of subsoil. Soil texture to match in-situ material. It is to be obtained from the top twelve inches (12") of naturally well-drained areas which have never been stripped before and have a history of satisfactory vegetative growth.
 3. It will be free of stones greater than one (1) inch, lumps, plants and their roots, debris and other extraneous matter over one (1) inch in diameter or excess quantities of smaller pieces of the same materials as determined by the Contracting Officer.
 4. Shall be free of weed and non-native seeds. Contractor shall be responsible for weed removal prior to and following germination of grass seed for maintenance period.
 5. It will not contain toxic substances harmful to plant growth.
 6. Physical Contaminants: Man made inert material shall be less than 1%.
 7. Have a true pH value of 6.0 to 7.5. The amount of either sulphur or limestone required to adjust loam to the proper pH range shall be determined by the Contracting Officer on the basis of soil tests and as specified herein.
 8. C:N Ratio: Carbon to nitrogen ratio shall be less than 15:1
 9. Bioassay: Percent seedling emergence and relative seedling vigor shall be greater than 80% of the control
- B. Weed Free Material Source: Do not import into the project limits rock, sand, gravel, earth, subsoil, or other natural materials from a Contractor-selected non-commercial materials source, that have not been certified free of non-native, invasive plant species. Materials imported into the project limits which do not include a noxious weed free certification may be rejected and ordered by the CO to be removed from the project limits. The NPS has the discretion of requesting inspection of certified materials by a third party and rejecting the use of the source if non-native plants or seeds thereof are found to be present. Topsoil to be brought into the project area as needed, extent will be determined by soils analysis tests.
- C. Contractor: Make any additions to or amendments of topsoil as required to remedy any deficiencies identified in the testing reports as specified herein and as directed by the Contracting Officer at no additional cost to the Government

2.4 SOIL ADDITIVES

- D. Commercial fertilizer, peat, humus or other additives to be used to counteract soil deficiencies as recommended by the soil analysis and as specified in Division 32 Section 32 93 00 Planting and Division 32 Section 32 92 00 Meadow Turf Grass and Lawns. Topsoil conditions are different between Planting and Meadow Turf Grass and Lawns. Contractor to understand and review with the Contracting Officer the different areas for topsoil and their requirements as noted in the subsequent specification sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine site conditions and other conditions affecting performance of the Work. Insure the sub-grade is properly graded and at correct levels prior to spreading of topsoil.
- B. Examine specified materials before installation. Reject soil amendments that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and approved by the Contracting Officer.

3.2 PREPARATION OF SUBGRADE

- A. After Contracting Officer's acceptance of sub-grade work, provide additional grading as maybe necessary to bring the sub-grade to a true, smooth slope parallel and except where otherwise indicated, six (6) inches below grade for all areas to receive topsoil. Furnish and install grade stakes on a 50 ft. grid and sufficiently spaced to insure correct line and grade of sub-grade and finished grade. Scarify compacted sub-grade to a 2 inch depth to bond topsoil to subsoil. Place topsoil to a minimum compacted depth of six inches. Spread evenly, hand raking areas inaccessible to machine grading. Immediately before placing topsoil, rake or otherwise loosen the surface of the sub-grade. In areas that have been severely compacted, as determined by the Contracting Officer, scarify to a depth of twelve inches by approved method. Sub-grade shall be inspected and approved by the Contracting Officer before placing of topsoil.

3.3 PLACING TOPSOIL

- A. After topsoil has been spread, prepare it carefully by scarifying or harrowing and hand raking as determined by the Contracting Officer. Remove all large stiff clods, brush, roots, stumps, litter and other foreign material and stones over one inch in diameter and dispose of legally off-site. Topsoiled areas shall also be free of smaller stones in excessive quantities as determined by the Contracting Officer. Roll the whole surface with a hand or mechanical roller weighing approximately one hundred pounds per foot of width. During the rolling fill all depressions caused by settlement with additional topsoil and then re-grade and roll until the surface presents a smooth, even and uniform finish and is up to the required grade.

3.3 TOPSOIL ADDITIVES

- A. Applying Fertilizers and pH adjustment: Apply no fertilizer or pH adjustment material without Contracting Officer's prior consent and testing results as per Division 32 Section 32 93 00 Planting and Division 32 Section 32 92 00 Lawns.

END OF SECTION 32 94 00

DIVISION 33 – UTILITIES

SECTION 33 10 00 – WATER UTILITIES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for the proposed water utilities including water system piping, fittings, appurtenances, and services.
- B. The work includes:
 - 1. Furnishing and installation of water distribution pipe, valves and valve boxes, hydrants, pipe fittings, anchors, thrust restraints, and required accessories and connections to existing water systems.
 - 2. Resetting existing hydrants and valve boxes to grade.
 - 3. Relocation of existing hydrants, valves, and other appurtenances as required.
 - 4. Furnishing and installing meter pit, backflow prevention assembly, pressure-reducing valves, and other related appurtenances.
 - 5. Disinfecting and testing of the water system.
- C. Work within 10 feet of the building and other dedicated systems on the site shall comply with Maine State Plumbing Code.

1.2 RELATED SECTIONS

- A. Sections which directly relate to the work of this section include Appendix A – Town of Bar Harbor Water Department Water Distribution Systems.

1.3 STANDARDS

- A. AWWA – American Water Works Association
- B. NFPA – National Fire Protection Association
- C. Town of Bar Harbor Water Department Water Distribution Systems – All Sections

1.4 COORDINATION WITH THE MUNICIPALITY

- A. The municipal water department shall be notified prior to starting construction of any portion of the municipal water system.
- B. The closing of valves necessary for making connections with existing municipal system will be done by the local Water Department employees, assisted by the Contractor. Sufficient notice shall be given the Water Department of planned connection. No allowance will be made for any delay in closing of valves. A 48-hour notice shall be given to residents or businesses affected by the shut-down, and shall be done by the Contractor under the direction of the Contracting Officer. The Water Department may require the work to be done at night during the low-water use time period.
- C. Contractor shall be responsible for furnishing and installing water pipes, fittings, valves, hydrants and other necessary equipment in accordance with the requirements of the municipal

water and fire departments. Prior to ordering materials, the Contractor to obtain the latest copy of the municipal water department's standards and specifications and shall notify the Contracting Officer immediately if any discrepancies are found between those requirements and the Contract Documents.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings or descriptive literature, or both, showing dimensions, joints, and other details of all materials to be furnished. Shop Drawings shall be submitted to the Contracting Officer for approval prior to ordering materials.

B. As-Built Drawings

1. Submit As-Built Drawings upon completion and acceptance of work.
2. As-Built Drawings shall be complete and shall indicate the true measurements and locations, horizontal and vertical of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each gate valve box from fixed permanent objects or a survey point with a spatial location (northing/easting) as referenced to the project horizontal datum. As-Built Drawings shall also contain any additional information required by the municipality and as specified under these Contract Documents, and shall be stamped with the seal of a licensed land surveyor and licensed professional engineer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Storage of pipe, fittings, valves, hydrants and other water line appurtenances on the site shall be in accordance with the manufacturer's recommendations, subject to the approval of the Contracting Officer.
- B. Care shall be taken in loading, transporting, and unloading of the water utilities materials to prevent injury to the pipe, fittings, valves, hydrants, and other water line appurtenances. Pipe, valves, or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to pipe and fitting coatings shall be repaired as directed by the Contracting Officer.
- C. Pipe, fittings, valves, hydrants, and other water system appurtenances which are defective from any cause, including damage caused by handling, and determined by the Contracting Officer as unrepairable, shall not be used and shall be replaced at no cost to the National Park Service.
- D. Pipe and all water system appurtenances that are damaged or disturbed through any cause prior to acceptance of the work shall be repaired, realigned, or replaced as required by the Contracting Officer at no additional cost to the National Park Service.

1.7 LICENSED FIRE PROTECTION SPRINKLER SYSTEM CONTRACTORS

- A. Fire protection and fire control systems, including both overhead and underground water mains, fire hydrants, and hydrant mains, shall be installed by contractors and personnel

appropriately licensed in the State of Maine for installation of such systems.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The drawings are diagrammatic only and are intended to indicate the extent, but not all details, of the system which shall be constructed. All materials are not shown; but the Contractor shall furnish and install all materials required for the complete system.
- B. All products shall be in conformance with PART 2 – PRODUCTS of the Town of Bar Harbor Water Department Water Distribution Systems

PART 3 - EXECUTION

3.01 GENERAL

- A. All water pipes, fittings, valves, hydrants, and other appurtenances shall be installed at the locations as shown on the Drawings.
 - 1. The proposed location and vertical alignment may be altered to avoid conflicts with existing and proposed utilities, as approved by the Contracting Officer.
- B. Contractor shall verify the location, size, invert and type of existing pipes at all points of connection prior to ordering new utility materials.
- C. Execution of work under this section shall conform to PART 3 – EXECUTION of the Town of Bar Harbor Water Department Water Distribution Systems.

END OF SECTION 33 10 00

SECTION 33 39 00 - SANITARY UTILITY SEWERAGE STRUCTURES

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This Section specifies requirements for sanitary utility sewerage structures for a gravity flow sewerage system.
- B. The work includes furnishing and installing all pipe, fittings manholes, structures and appurtenances required for the proposed system to convey sewage by gravity flow conditions.
- C. Work and materials shall be performed in accordance with the State Plumbing Code. Work within 10 feet of the building or those dedicated systems within the site shall conform to Maine State Plumbing Code.

1.02 SUBMITTALS

- A. Materials List and Shop Drawings
 - 1. Materials list of materials proposed.
 - 2. Shop drawings for all material and structures prior to ordering materials.
- B. As-Built Drawings
 - 1. Submit As-Built Drawings upon completion and acceptance of work.
 - 2. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each manhole from fixed permanent objects or a survey point with a spatial location (northing/easting) as referenced to the project horizontal datum. As-Built Drawings shall also contain any additional information required under these Contract Documents and shall be stamped with the seal of a licensed land surveyor and licensed professional engineer.

1.03 INSPECTION

- A. The manufacturer/supplier is responsible for the provisions and all test requirements specified in ASTM D3034 for SDR 35 gravity pipe and ASTM D2241 for PVC pressure rated sewer pipe. In addition, all PVC pipe may be inspected at the plant for compliance with these specifications by an independent testing laboratory selected and paid by the National Park Service. The Contractor shall require the manufacturer's cooperation in these inspections.
- B. Inspection of the pipe may also be made after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though pipe samples may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the site at once.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be adequately protected from damage during transit. Pipes shall not be dropped.
- B. All pipe and other appurtenances shall be inspected before placement in the work and any found to be defective from any cause, including damage caused by handling, and determined by the Contracting Officer to be unrepairable, shall be replaced at no cost to the National Park Service.
- C. Storage and handling of pipes, manholes and other sewer system appurtenances shall be in accordance with the manufacturer's recommendations, subject to the approval of the Contracting Officer.

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE (PVC)

- A. Pipe and Fittings: Polyvinyl chloride pipe and fittings (4 inches to 15 inches) shall be Type PSM polyvinyl chloride (PVC) SDR 35 with full diameter dimensions conforming to the specifications for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, ASTM D3034.
- B. Joints: PVC pipe shall have an integral wall bell and spigot push-on joint with elastomeric gaskets secured in place in the bell of the pipe. The bell shall consist of an integral wall section with a solid cross section elastomeric gasket, factory assembled, securely locked in place to prevent displacement during assembly. Elastomeric gaskets shall conform to ASTM D3212.
- C. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an “assembly stripe” imprinted thereon to which the bell end of the mated pipe will extend upon proper joining of the two pipes.

2.02 MANHOLES

- A. Precast Concrete Units:
 - 1. Structure: 4 foot minimum inside diameter precast concrete units (4,000 psi minimum compressive strength) with eccentric cone section tapering to 30-inch diameter, or flat top, and one pour monolithic base section conforming to ASTM C478. All units to be designed for HS-20 loading.
 - 2. Precast Unit Joint: Preformed butyl rubber section joint conforming to ASTM C990.
 - 3. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
- B. Masonry Units:
 - 1. Brick shall conform to ASTM C32, Grade SM for construction of inverts and adjusting manholes to grade.
 - 2. Concrete block shall be solid block and conforming to ASTM C139.

3. Mortar shall be in conformance with ASTM C270, Type M. The mortar shall be composed of Portland cement hydrated lime, and sand, in the proportions of 1 part cement to 1/4 part hydrated lime, to 3-1/2 parts sand, by volume.
 4. Cement shall be Type I or II Portland cement conforming to ASTM C150. Where masonry is exposed to salt water, Type II shall be used.
 5. Hydrated lime shall be Type S conforming to ASTM C207.
 6. Sand for masonry mortar shall conform to the gradation requirements of ASTM C144.
- C. Manhole Frame and Cover: Grey iron casting conforming to ASTM A48, heavy duty, with the word SEWER embossed on cover. Letter size shall be three inches. Frame and cover shall have a minimum clear opening of 30 inches.
- D. Pipe Connections: Flexible sleeve or rubber gaskets.
- E. Steps: Steps for steel reinforced copolymer polypropylene step with at least a 14-inch wide stepping surface conforming to ASTM C478.

2.03 BITUMASTIC COATINGS

- A. The entire exterior surface of all masonry and concrete (whether precast or cast-in-place) structures associated with sewerage systems, such as manholes, grease traps, holding tanks, tight tanks, septic tanks, aeration tanks, pump stations, valve pits, etc., shall receive two coats of bitumastic waterproofing. Total thickness of waterproofing shall be a thickness of 14 mils (dry) and shall be applied per manufacturer's recommendations.

PART 3 – EXECUTION

3.01 EXCAVATION AND BACKFILLING

- A. The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of Section 310000, EARTHWORK and the details shown on the Drawings.

3.02 PIPE INSTALLATION

- A. All sewer pipe shall be laid accurately to the lines and grades shown in the Drawings and in conformance with pipe manufacturer's recommended procedures.
- B. Notch under pipe bells and joints, where applicable, to provide for uniform bearing under entire length of pipe.
- C. Laying Pipe: Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a prepared trench. Pipe shall be laid with bells upgrade unless otherwise approved by the Contracting Officer. Do not permanently support pipes on bells.
1. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash. Extreme care shall be taken to keep the bells of the pipe free from dirt and rocks so that

- joints may be properly lubricated and assembled. No pipe shall be trimmed or chipped to fit.
2. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
 3. All piping shall be laid in the dry with the spigot ends pointing in the direction of flow. Installation shall proceed from the downstream to upstream in all cases.
- D. Pipe Extension: Where an existing pipe is to be extended, the same type of pipe shall be used, unless otherwise approved by the Contracting Officer.
- E. Full Lengths of Pipe: Only full lengths of pipe shall be used in the installation except that partial lengths of pipe may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
- F. Pipe Entrances to Structures: All pipe entering structures shall be cut flush with the inside face of the structure, and the cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges, or imperfections that will impede or affect the hydraulic characteristics of the sewage flow. The method of cutting and finishing shall be subject to the approval of the Contracting Officer.
- G. Protection During Construction: The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk.
1. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary water-tight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe has been eliminated.
- H. Water Pipe - Sewer Pipe Separation: When a sewer pipe crosses above or below a water pipe, the Contractor shall comply with the following procedures:
1. Relation to Water Mains
 - a. *Horizontal Separation:* Whenever possible sewers shall be laid at a minimum at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:
 - 1.) it is laid in a separate trench, or if
 - 2.) it is laid in the same trench with the water mains located at one side on a bench of undistributed earth, and if
 - 3.) in either case the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.
 - b. *Vertical Separation:* Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.
 - c. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint

cement lined ductile iron pipe or equal based on watertightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure watertightness or both pipes shall be encased in concrete.

- I. Sewer Pipes-Laser Installation: Sewer pipes shall be laid to required grades by use of a laser and target system, unless otherwise specifically approved in writing by Contracting Officer.

3.03 PIPE JOINTS

- A. All joints shall be made water-tight.
- B. Pipe shall be jointed in strict accordance with the pipe manufacturer's instruction. Jointing of all pipe shall be done entirely in the trench.
 - 1. Lubricant for jointing of PVC pipe shall be applied as specified by the pipe manufacturer. Use only lubricant supplied by the pipe manufacturer.
 - 2. PVC pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, shall only be used at the direction of the manufacturer.
 - 3. Field-cut pipe ends shall be cut square and the pipe surface beveled to the size and shape of a factory-finished beveled end. All sharp edges shall be rounded off.
- C. Jointing of ductile iron and cast iron pipe shall be in accordance with Section 331000, WATER UTILITIES.
- D. Jointing of concrete pipe and reinforced concrete pipe shall be in accordance with Section 33 40 00, STORM DRAINAGE UTILITIES.

3.04 MANHOLES

- A. General Requirements: All manholes shall be built in accordance with the Details and in the locations shown on the Drawings.
 - 1. Structures shall be constructed of brick masonry, precast solid concrete block, cast-in-place concrete, or precast concrete.
 - 2. All masonry shall be installed by personnel experienced and skilled in this work, and any person not deemed to be such by the Contracting Officer shall be removed and replaced by a person so qualified.
 - 3. Manholes shall be constructed as soon as the pipe laying reaches the location of the manhole. Should the Contractor continue pipe laying without making provision for completion of the manhole, the Contracting Officer shall have the authority to stop the pipe laying operations until the manhole is completed.
 - 4. The Contractor shall accurately locate each manhole and set accurate templates to conform to the required line and grade. Any manhole which is mislocated or oriented improperly shall be removed and rebuilt in its proper location, alignment, and orientation at no additional cost to the National Park Service.
- B. Foundations: All manholes shall be constructed on a 12-inch layer of compacted bedding material. The excavation shall be dewatered to provide a dry condition while placing bedding material and setting the base.

- C. Masonry: All brick or concrete block shall be thoroughly wetted before laying.
 - 1. The first course of masonry shall be embedded in the concrete foundation immediately after the foundation has been poured.
 - 2. All masonry shall be laid in the flat position in a full bed of mortar, and all vertical and horizontal joints shall be filled solid with mortar. Vertical joints on each succeeding course shall be staggered. Joints shall be not less than 3/8 inch wide or more than 1/2 inch wide. Joints on the inside of the structure shall be neatly struck and pointed.
 - 3. The exterior and interior surface of the walls shall be plastered with a one-half inch (1/2 in.) coat of 1:2 cement mortar.
- D. Invert: Brick invert channels shall be constructed in all manholes to provide a smooth channel for sewage flow through the structure, and shall correspond in shape to the lower half of the pipe. At changes in directions, the inverts shall be laid out in curves of the longest possible radii tangent to the centerline of the sewer pipes at the manhole side. Shelves shall be constructed to the elevation of the highest pipe crown and sloped to drain toward the flow channel.
 - 1. Special care shall be taken in laying brick inverts. Joints shall not exceed three-sixteenth inch (3/16 in.) in thickness and each brick shall be carefully laid in full cement mortar joints on bottom, side and end in one operation. No grouting or working in of mortar after laying of the brick will be permitted. Bricks forming the shaped inverts in manholes shall be laid on edge.
 - 2. Invert channels shall be built for future extensions where shown on the Drawings and where directed by the Contracting Officer.
- E. Steps: Steps shall be installed in all manholes, spaced twelve inches (12 in.) on center vertically and set securely in place during the construction of the masonry wall. Precast sections shall be arranged such that internal steps are in alignment.
- F. Precast Manholes: Precast manholes shall be installed only after shop drawings have been approved.
 - 1. The top grade of the precast concrete cone section shall be set sufficiently below finished grade to permit a maximum of five and a minimum of two courses (laid in the flat position) of eight inch (8 in.) brick to be used as risers to adjust the grade of the manhole frame. Manhole frames shall be set on a grout pad to make a water-tight fit.
 - 2. Grout fill lifting holes on all manhole sections.

3.05 CONNECTIONS TO EXISTING FACILITIES

- A. General Requirements: The Contractor shall make all required connections of the proposed sewer into existing sewer system, where and as shown on the Drawings and as required by the Contracting Officer.
- B. Contractor shall verify the location, size, invert and type of existing pipes at all points of connection prior to ordering new utility materials.
- C. Compliance with Requirements of National Park Service: Connections into existing sewer facilities shall be performed in accordance with the requirements of the National Park Service of the facility. The Contractor shall comply with all such requirements, including securing of all required permits, and paying the costs thereof. The costs of making the

connections in accordance with the requirements of the National Park Service for existing facility shall be included in the Contract Sum.

3.06 MANHOLE CONNECTIONS

- A. Manhole pipe connections for precast manhole bases shall be flexible boot cast into the manhole wall. The stainless-steel clamp shall be protected from corrosion with a bitumastic coating.
- B. Sewer manholes shall be constructed with drop connections when the proposed invert of the connection is at least 2 feet (2 ft.) above the manhole invert. Drop connections for differences of less than 2 feet (2 ft.) shall also be provided if required by the governing authority.

3.07 SERVICE CONNECTIONS

- A. General Requirements: The Contractor shall make all required connections of the building sewer service pipes into the sewer system. Work shall include making the service pipe connections into the sewer system pipes or into the manholes located ten feet (10 ft.) outside of the proposed building lines. If stubs are constructed for later connection to the building pipes, the ends shall be sealed with watertight plugs.
- B. Coordination with Building Contractor: The Contractor shall coordinate the work with the work of the building contractor to determine the exact location and elevation of the point of entry into the building.
- C. Connection into Sewer System: Sewer service pipe connections to the pipe of the sewer system shall be made with fittings supplied by the pipe manufacturer.
 - 1. The Contractor shall install 45 degree wye branch or 90 degree tee fittings in the sewer pipes at all locations where building sewer service pipe connections are shown on the Drawings. Connections of the sewer service pipes shall be made into the wye branches or tees by means of 45 degree bends. The connections shall be made thoroughly watertight and concrete shall be placed under each connection to bear on undisturbed earth and firmly support the connection. Sewer chimneys shall be encased in concrete unless directed otherwise by the Contracting Officer.

3.08 LEAKAGE TESTS

- A. General Requirements: The Contractor shall test the completed sewer system, including manholes and service connections, for leakage by infiltration, exfiltration, or low-pressure air exfiltration tests. Manhole structures may be tested by a low-pressure air vacuum test. The tests shall be conducted as approved by the Contracting Officer. The Contractor shall furnish all necessary equipment, materials and labor for performing the tests.
 - 1. The Contractor shall notify the Contracting Officer at least 48 hours prior to the start of testing. Testing shall only be performed in the presence of the Contracting Officer.

2. Sections of pipe tested for infiltration and exfiltration prior to completion of the Contract shall be subject to additional leakage tests, if warranted, in the opinion of the Contracting Officer, prior to acceptance of the Work.
- B. Infiltration and Exfiltration Testing: The test length intervals for either type of leakage test shall be approved by the Contracting Officer, but in no event shall they exceed one thousand feet (1,000 ft.). Where sewer pipe is laid on steep grades, the length to be tested by exfiltration at any one time shall be limited by the maximum allowable internal pressure on the pipe and joints at the lower end of the line. The maximum internal pressure at the lowest end shall not exceed 25 feet of water or 10.8 psi.
1. The test period, wherein the measurements are taken, shall not be less than four (4) hours in either type of test.
 2. Depending on field conditions, the following tests for leakage shall be employed:
 - a. *Infiltration Test:* The test may be used only when ground water levels are at least five feet (5 ft.) above the top of the pipe for the entire length of the section to be tested during the entire period of the test. Ground water levels may be measured in an open trench or in standpipes previously placed in backfilled trenches during the backfilling operations. When standpipes are installed in the backfill for ground water measurement, the lower ends shall be satisfactorily embedded in a mass of crushed stone or gravel to maintain free percolation and drainage. Infiltration through joints shall be measured by using a watertight weir or any other approved device for volumetric measurement installed at the lower end of the section under test.
 - b. *Exfiltration Test:* This test consists of filling the pipe with water to provide a head of at least five feet (5 ft.) above the top of the pipe or five feet (5 ft.) above ground water, whichever is higher, at the highest point of the pipe section under test, and then measuring the loss of water from the line by the amount which must be added to maintain the original level. In this test, the pipe must remain filled with water for at least twenty-four (24) hours prior to the taking of measurements. Exfiltration shall be measured by the drop of water level in a closed-end standpipe or in one of the sewer manholes available for convenient measuring. When a standpipe and plug arrangement is used in the upper manhole of a section under test, a positive method of releasing entrapped air in the sewer shall be installed prior to taking measurements.
 - c. *Leakage Requirements:* The total leakage of any section tested shall not exceed the rate of 50 gallons per day per mile per inch of nominal pipe diameter. For purposes of determining the maximum allowable leakage, manholes shall be considered as sections of 48-inch diameter pipe, five feet (5 ft.) long, and the leakage allowance shall be 2.25 gallons per manhole per 24 hours.
- C. Low-Pressure Air Exfiltration Testing
1. The sewer pipes and service pipes shall be tested for leakage by the use of low-pressure air as approved by the Contracting Officer. The test length shall not exceed one length of pipe between two manholes. Air test procedures may be dangerous and the Contractor shall take all necessary precautions to prevent blowouts.
 - a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.
 - b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 - c. All air used shall pass through a single control panel.

- d. Three individual hoses shall be used for the following connections:
 - 1.) from control panel to pneumatic plugs for inflation;
 - 2.) from control panel to sealed line for introducing the low pressure air;
 - 3.) from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
- 2. The following testing procedures shall be explicitly followed:
 - a. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
 - 3. After the pipe has been backfilled and cleaned, pneumatic plugs shall be placed in the line at each manhole and inflated to 25 psi. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psi greater than the average back pressure of any ground water that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize.
 - a. After the stabilization period (3.5 psi minimum pressure in the pipe), the portion of pipe tested shall be acceptable if the time required in minutes for the pressure to decrease from 3.5 to 3.0 psi (greater than the average back pressure of any ground water that may be over the pipe) is not less than the time indicated in the following table:

Pipe Size (in.)	Time (sec.)
4	0.190L
6	0.427L
8	0.760L
10	1.187L
12	1.709L
15	2.671L

Where L = length of pipe being tested

- D. Vacuum Testing of Manholes: New sewer manholes shall be vacuum tested in accordance with procedure and standards in ASTM C1244.
- E. Correction of Defective Work: If leakage exceeds the specified amount, the Contractor shall make the necessary repairs or replacements required to permanently reduce the leakage to within the specified limit, and the tests shall be repeated until the leakage requirement is met.
- F. Compliance with Agency Requirements: In the event of conflict between the leakage test requirements specified herein with the leakage test requirements of agencies having jurisdiction over all or any portion of the sewer system installed under this Contract, the more restrictive requirements shall govern.

3.09 PIPE DEFLECTION MEASUREMENT

- A. In accordance with ASTM D3034, no less than 30 days after completion of the PVC sewer pipe installation, the Contractor shall test the pipeline for deflection using a 'go/no-go' deflection mandrel having a minimum of nine evenly spaced arms or prongs. The 'go/no-

go' gauge shall be hand pulled through all sections of the pipeline by the Contractor. The Contractor shall submit drawings of the 'go/no-go' gauge to the Contracting Officer for approval prior to testing. Complete dimensions of the gauge for each diameter of pipe to be tested shall be in accordance with ASTM D3034.

- B. Any section of pipe found to exceed 7.5 percent (7.5%) deflection shall be deemed a failed pipe and shall be excavated and replaced by the Contractor at his own expense.

3.10 CLEANING AND REPAIR

- A. The Contractor shall clean the entire sewer system of all debris and obstructions. This shall include removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing sewers, storm drains, and or streams.
- B. All work of cleaning and repair shall be performed at no additional cost to the National Park Service.

3.11 FINAL INSPECTION

- A. Upon completion of the work, and before final acceptance by the Contracting Officer, the entire sewer system shall be subjected to a final inspection in the presence of the Contracting Officer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, leakage tests and other requirements have been met.

END OF SECTION 33 39 00

SECTION 33 40 00 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section specifies requirements for furnishing and installing the site storm drainage utilities system, as indicated on the Drawings and as specified herein.
- B. The work shall include but not be limited to the following:
 - 1. Construction of the site storm drainage system, including underdrains, headwalls, flared end sections, underground stormwater detention facilities, and all appurtenances necessary to make a complete functioning system.
 - 2. Connection of building drains from a point ten feet (10 ft.) outside building or structure foundations.
 - 3. Construction of 'Dedicated Drainage Systems' on the site shall conform to the Maine State Plumbing Code.
- C. Work performed under this Section shall be subject to the General Conditions, Supplementary Conditions and Division 01 General Requirements of the Contract Documents.

1.02 REFERENCE STANDARDS

- A. References herein are made to the following Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - A48 Standard Specification for Gray Iron Castings
 - A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - C32 Standard Specification for Sewer and Manhole Brick
 - C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - C62 Standard Specification for Building Brick
 - C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
 - C139 Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
 - C144 Standard Specification for Aggregate for Masonry Mortar
 - C150 Standard Specification for Portland Cement
 - C207 Standard Specification for Hydrated Lime for Masonry Purposes
 - C270 Standard Specification for Mortar for Unit Masonry

- C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- C478 Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
- C990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- D2665 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
- D3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- D4884 Standard Test Method for Strength of Sewn or Bonded Seams of Geotextiles
- F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F667 Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings
- F2418 Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers
- 2. American Association of State Highway and Transportation Officials (AASHTO):
 - M 274-87 Standard Specification for Steel Sheet, Aluminum Coated (Type 2), for Corrugated Steel Pipe
 - M 36 Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains
 - M 252-09 Standard Specification for Corrugated Polyethylene Drainage Pipe
 - M 294-17 Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in)
- 3. American National Standards Institute (ANSI):
 - A21.50 Thickness Design of Ductile Iron Pipe
 - A21.51 Ductile-Iron Pipe, Centrifugally Cast
- 4. American Water Works Association (AWWA):
 - C150 Thickness Design of Ductile Iron Pipe
 - C151 Ductile-Iron Pipe, Centrifugally Cast

1.03 SUBMITTALS

- A. Shop drawings or descriptive literature, or both, showing dimensions, joint and other details of all materials proposed for the work. Shop drawings shall be submitted to the Contracting Officer for approval prior to ordering material.
- B. As-Built Drawings

1. The Contractor shall take measurements during construction of:
 - a. Horizontal location of all drainage structures. Horizontal location shall be by survey location using the same coordinate system as the Project, or three (3) (minimum) ties to nearby permanent structures.
 - b. Elevations of all inverts using Project Benchmarks.
2. As-Built Drawings shall be submitted to the Contracting Officer upon completion of the work.
3. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new drainage system construction. As-Built drawings shall include a minimum of three (3) ties showing the distance to each catch basin and manhole from fixed permanent objects or a survey point with a spatial location (northing/easting) as referenced to the project horizontal datum. As-Built Drawings shall also contain any additional information required by the municipality and shall be stamped with the seal of a licensed Land Surveyor or licensed Professional Engineer.

1.04 QUALITY ASSURANCE

- A. WORK SHALL COMPLY WITH THE MAINE STATE PLUMBING CODE.

1.05 COORDINATION AND VERIFICATION

- A. Coordinate the work with the termination of storm drain connections at buildings and connections to municipal systems, and trenching operations.
- B. Prior to ordering materials, the Contractor shall field verify the location, elevations and size of all, existing pipe utility lines to remain, and proposed utility connections to existing utility systems; any conflicts shall be reported to the Contracting Officer for resolution.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be adequately protected from damage during transit. Pipes shall not be dropped.
 1. All pipe and other appurtenances shall be inspected prior to installation and any found to be defective from any cause, including damage caused by handling, and determined by the Contracting Officer to be unrepairable, shall be replaced at no cost to the National Park Service.
 2. Storage and handling of pipes, manholes, catch basins, oil-grit separators, treatment units and other system appurtenances shall be in accordance with the manufacturer's recommendations.

1.07 INSPECTION

- A. The manufacturer/supplier is responsible for the provision of all test requirements specified for each type of pipe. In addition, any pipe may be inspected at the plant for compliance with these specifications by an independent testing laboratory selected and paid by the

National Park Service. The Contractor shall require the manufacturer's cooperation in these inspections.

- B. Inspection of the pipe may also be made after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though pipe samples may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the site at once by the Contractor.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials for storm drainage utilities system shall be new and unused.

2.02 REINFORCED CONCRETE PIPE (RCP)

- A. RCP shall comply with the requirements of ASTM C76. All pipe 18 inches and smaller shall be Class V. All other pipe shall be Class III unless indicated otherwise on the Drawings.
 - 1. Joints for the RCP shall be the tongue and groove or bell and spigot type with rubber gasket conforming to ASTM C443.
 - 2. Flared end pipe sections shall be constructed in conformance with ASTM C76, Class V requirements, and shall be supplied by the same manufacturer as the pipe.

2.03 HIGH DENSITY CORRUGATED POLYETHYLENE (HDPE) PIPE

- A. HDPE pipe and fittings shall be smooth interior, and meet the requirements of ASTM D3350. Four-inch through 10-inch diameter HDPE pipe shall meet the requirements of AASHTO M 252. Twelve-inch through 60-inch diameter HDPE pipe shall meet the requirements of AASHTO M 294, Types S.
- B. Standard Fitting connections shall be fabricated to sizes shown on the Drawings.
- C. Pipe joints and fittings shall conform to the requirements of AASHTO M 252 or AASHTO M 294. Pipe joints shall be Bell and Spigot soil tight joints and gaskets shall meet the requirements of ASTM F477. Fittings shall also be soil tight and gasketed.
- D. Where indicated on the Drawings, HDPE pipe shall be slotted or perforated by the manufacturer prior to delivery to the job site. Coupling bands shall conform to the manufacturer's specifications. Couplers shall cover not less than one corrugation on each section of pipe.

2.04 POLYVINYL CHLORIDE (PVC) PIPE

- A. PVC pipe and fittings shall comply with the requirements of ASTM D3034, rated SDR 35; and ASTM D2665 for Schedule 40 and Schedule 80 pipe and fittings. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D3034 classification.

2.05 DUCTILE IRON (DI) PIPE

- A. DI pipe shall be designed in accordance with ANSI A21.50/AWWA C150 and manufactured in accordance with ANSI A21.51/AWWA C151.
- B. DI pipe shall be thickness Class 52, furnished in 18-foot or 20-foot nominal lengths.

2.06 DRAIN MANHOLES

- A. Precast Concrete
 - 1. Manholes shall be 48-inch minimum inside diameter, precast concrete units, 4,000 psi minimum compressive strength, with eccentric cone section tapering to 24-inch diameter and monolithic base section meeting the requirements of ASTM C478. All structures shall be designed for HS-20 loading and shall be sufficient diameter to accept the pipe penetrations indicated on the Drawings.
 - 2. Precast unit joint seals shall be preformed butyl rubber O-ring type seals meeting the requirements of ASTM C990.
 - 3. Openings for pipe and materials to be embedded in the walls of the manholes sections for joint seals shall be cast in the sections at the required locations during manufacture. Sections with incorrectly cast and patched pipe openings will be rejected.
 - 4. Openings shall be cast into the manhole sections to receive entering pipes during manufacture. The openings shall be sized to provide a uniform 2-inch maximum annular space between the outside of the pipe wall and the opening in the riser for RCP. The openings shall be sized to accommodate flexible boot connections for all other pipe materials.
 - 5. Manhole pipe openings shall be solidly filled with non-shrink mortar for RCP.
 - 6. Manhole pipe connections for all other pipe materials shall be flexible boots.
- B. Unit Masonry Construction:
 - 1. Brick shall be sewer brick conforming to ASTM C32, Grade MS or approved equal.
 - 2. Concrete block shall be solid block conforming to ASTM C139.
 - 3. Mortar shall conform to ASTM C270, Type M. Mortar shall be composed of Portland cement, hydrated lime, and sand in the proportions of 1 part cement to 1/4 part hydrated lime to 3-1/2 parts sand by volume.
 - 4. Cement shall be Type I or II Portland cement conforming to ASTM C150. Where masonry is exposed to salt water, Type II shall be used.
 - 5. Hydrated lime shall be Type S conforming to ASTM C207.
 - 6. Sand for masonry mortar shall conform to the gradation requirements of ASTM C144.
- C. Steps for manholes shall be steel reinforced copolymer polypropylene plastic steps with at least a 14-inch wide stepping surface conforming to ASTM C478 and ASTM A615.

2.07 DRAIN MANHOLE FRAMES AND COVERS

- A. Manhole frame and cover shall be grey iron casting conforming to ASTM A48, heavy duty, with the word "DRAIN" embossed on the cover. Letter size shall be three inches (3 in.). Frame and cover shall have a minimum clear opening of 24 inches and have a minimum weight of 475 pounds.

2.08 CATCH BASINS AND DROP INLET

- A. Precast catch basins and drop inlets shall be manufactured in accordance with ASTM C478, (4,000 psi minimum compressive strength) to the diameters and depths shown on the Drawings. All structures shall be designed for HS-20 loading. Precast unit joints shall be sealed with butyl rubber in accordance with ASTM C990.
- B. Where required for hood, a slot and opening shall be cast in the catch basin wall for mounting the cast iron hood over the outlet pipe.
- C. Openings at top of concrete structures where curb inlets are indicated shall be 24 inches by 27 inches.
- D. When approved by the Contracting Officer, catch basins and drop inlets may be constructed with brick or concrete block walls and poured reinforced concrete bases as an alternative to precast concrete units.
 - 1. Brick and concrete block and other materials shall as specified under Drain Manholes.

2.09 CATCH BASIN FRAMES AND GRATES

- A. Catch basin frame and grates shall be cast iron, conforming to ASTM A48, Class 30. Where located in accessible ways, grate openings shall meet the requirements of federal, state, and local regulations adopted under the Americans with Disabilities Act (ADA).

2.10 AREA DRAINS

- A. Area drains shall be PVC drain basins (manufactured with custom pipe inlets formed into the drain structure, with inverts and orientations per plan) with cast ductile iron grate. Where located in accessible ways, grate openings shall meet the requirements of federal, state, and local regulations adopted under the Americans with Disabilities Act (ADA). Note, any Area Drain that is exposed above the ground surface shall be mounded with earth or stone per the details, or painted or wrapped with a material of a dark color as identified by Contracting Officer.

PART 3 - EXECUTION

3.01 GENERAL

- A. Contractor shall verify the location, size invert and type of existing pipes at all points of connection prior to ordering new utility materials.
- B. All pipe shall be laid accurately to the lines and grades indicated on the Drawings and in conformance with the pipe manufacturer's recommendations.
- C. As soon as the trench is excavated to the normal grade of the bottom of the trench, the Contractor shall immediately place the bedding material in the trench. The pipe shall be firmly bedded in the compacted bedding material accurately to the lines and grades shown on the Drawings.
- D. Laying Pipe
 - 1. Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a prepared trench. Pipe shall be laid with bells upgrade unless otherwise approved by the Contracting Officer.
 - 2. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash. Extreme care shall be taken to keep the bells of the pipe free from dirt and rocks so that joints may be properly lubricated and assembled. No pipe shall be trimmed or chipped to fit.
 - 3. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
 - 4. Bedding shall be notched under pipe bells and joints where required to provide for uniform bearing under entire length of pipe.
- E. Optimum moisture content of bedding material shall be maintained to allow required compaction density.
- F. Where an existing pipe is to be extended, the same type of pipe shall be used, unless otherwise approved by the Contracting Officer.
- G. Only full lengths of pipe shall be used in the installation except that partial lengths of pipe may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
- H. All pipes entering drainage structures shall be cut flush with the inside face of the structure, and the cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that would impede the hydraulic characteristics of the stormwater flow. The method of cutting and finishing shall be subject to the approval of the Contracting Officer.

- I. The Contractor shall protect the installation at all times during construction. Movement of construction equipment, vehicles, and loads over and adjacent to any pipe shall be performed at the Contractor's risk.
- J. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary watertight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.

3.02 RELATIONSHIP TO WATER MAINS

- A. When a drain pipe crosses above or below a water pipe, the following procedures shall be utilized:
 - 1. *Horizontal Separation:* Whenever possible drains shall be laid at a minimum of 5 feet horizontally from any existing or proposed water main. Should local conditions prevent a lateral separation of 5 feet, a drain may be laid closer than 5 feet to a water main if:
 - a. It is laid in a separate trench, or if
 - b. It is laid in the same trench with the water mains located at one side on a bench of undistributed earth, and if
 - c. In either case the elevation of the top (crown) of the drain is at least 12 inches below the bottom (invert) of the water main.
 - 2. *Vertical Separation:* Whenever drains must cross under water mains, the drain shall be laid at such an elevation that the top of the pipe is at least 12 inches below the bottom of the water main. When the elevation of the drain cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the drain. One full length of water main should be centered over the drain so that both joints will be as far from the sewer as possible.
 - 3. When it is impossible to obtain the horizontal and vertical separation stipulated above, both the water main and drain shall be constructed of mechanical-joint cement lined ductile iron pipe or other equal based on water tightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure water tightness.

3.03 EXCAVATION AND BACKFILLING FOR PIPES

- A. The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of Section 310000 – EARTHWORK, the details shown on the Drawings and the following.
- B. Embedment materials are those used for bedding, haunching and initial backfill around pipes as illustrated on the Drawings.
 - 1. All embedment materials should be free from lumps of frozen soil or ice when placed. Embedment materials should be placed and compacted at optimum moisture content
- C. Trench Bedding: Material must be provided to insure proper line and grade is maintained. Unsuitable or unstable materials shall be undercut and replaced with a suitable bedding material, placed in 6 inch lifts. Other methods of stabilization, such as geotextiles may be appropriate and their use must be approved by the Contracting Officer.

1. Provide a stable and uniform bedding for the pipe and any protruding features of its joints and/or fittings. The middle of the bedding equal to 1/3 of the pipe outside diameter should be loosely placed, with the remainder compacted to a minimum of 95 percent Modified Proctor Density.
- D. Haunching: Proper haunching provides a major portion of the pipe's strength and stability. Exercise care to insure placement and compaction of the embedment material in the haunches. For larger diameter pipes (pipes greater than 30 inch diameter), embedment materials should be worked under the haunches by hand. Haunching materials shall be placed and compacted in 6 inch maximum lifts, compacted to 95 percent Modified Proctor Density.
- E. Initial Backfill: The initial backfill shall be from the springline to 24 inches above the pipe to provide protection for the pipe from construction operations during placement of the final backfill and protect the pipe from stones or cobbles in the final backfill. Compact initial backfill per Section 310000 - EARTHWORK.
 1. Flooding or jetting as a procedure for compaction are not allowed.
- F. Final Backfill: The final backfill should be the same material as the proposed embankment or surface finishes. Generally, the excavated material may be used as final backfill. Placement should be as specified for the embankment. In lieu of a specification, the final backfill should be placed in 12 inch maximum lifts and compacted to a minimum 95 percent modified proctor density to prevent excessive settlement at the surface. Compaction should be performed at optimum moisture content.
- G. Vehicular and Construction Loads: During construction, avoid heavy equipment loads (greater than 40,000 lbs. per axle) over the pipe. Additional temporary cover should be placed over the pipe for heavy construction load crossings. Hydrohammers or hoe-pak compactors may not be used over the pipe until at least 48 inches of cover have been provided.

3.04 PRECAST DRAIN MANHOLES, CATCH BASINS, AND DROP INLETS

- A. Drain Manholes, Catch Basins, and Drop Inlets shall be constructed at the locations and to the lines, grades, dimensions and design shown on Drawings or as required by the Contracting Officer.
- B. Precast Concrete Units shall be installed in a manner that ensures watertight construction. All leaks in precast concrete structures shall be sealed. If required, precast concrete structures shall be repaired or replaced to obtain watertight construction.
- C. Stubs shall be short pieces of pipe cut from the bell ends of the pipe. Stubs shall be plugged with brick masonry unless otherwise approved by the Contracting Officer.
- D. Drain Manhole inverts shall conform accurately to the size of the adjoining pipes.
 1. Drain Manhole inverts shall be constructed of 3,500 psi concrete as shown the Drawings.
 2. Inverts shall be laid out in smooth diameter curves of the longest possible radius to provide uniform flow channels.

- 3. Invert shelves shall be graded with a 1-inch drop per one foot length sloped from the manhole walls.
- E. Drain Manhole steps shall be accurately positioned and embedded in the concrete when the section is cast. Precast reinforced concrete manhole sections shall be set vertical, with sections and steps in true alignment.
- F. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose, or with mortar. The mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch, hammered into the holes until it is dense and an excess of paste appears on the surface, and finished smooth and flush with the adjoining surfaces.
- G. Precast sections shall be level and plumb with approved joint seals. Water shall not be permitted to rise over newly made joints until after inspection and acceptance. All joints shall be watertight.
- H. Openings which have to be cut in the sections in the field shall be carefully made to prevent damage to the riser. Damaged risers will be rejected and shall be replaced at no additional cost to the National Park Service.

3.05 CHANGE IN TYPE STRUCTURES

- A. Where indicated on the Drawings, existing subsurface drain structures shall be converted to the new structure types in the following manner:
 - 1. Catch Basins to Manholes
 - a. Fill basin sump with 3,000 psi concrete and create new inverts at the elevations and sizes indicated and in accordance with specifications and details for new drain manholes.
 - b. Provide and adjust to grade new drain manhole frame and cover.
 - c. Stockpile existing frame and grade per Contracting Officer's directions.
 - 2. Manholes to Catch Basins or Drain Inlets
 - a. Where a sump is indicated on the Drawings, replace existing manhole structure with new precast concrete catch basin structure.
 - b. Where a sump is not indicated on the Drawings, replace existing frame and cover with new frame and grate and adjust to grade per these specifications and details for new catch basins.
 - c. Stockpile existing manhole frame and cover per Contracting Officer's directions.

3.06 BRICK MASONRY

- A. Brick masonry structures shall be watertight. all leaks in brick masonry structures shall be sealed. all brick masonry shall be laid by skilled workmen.
- B. All beds on which masonry is to be laid shall be cleaned and wetted properly. Brick shall be wetted as required to be damp, but free of any surface water when placed in the work. Bed joints shall be formed of a thick layer of mortar which shall be smoothed or furrowed slightly. Head joints shall be formed by applying a full coat of mortar on the entire brick end, or on the entire side, and then by shoving the mortar covered end or side of the brick tightly against the

bricks laid previously. The practice of buttering at the corners of the brick and then throwing the mortar in the empty joints will not be permitted. Dry or butt joints will not be permitted. Joints shall be uniform in thickness and approximately 1/4 inch thick.

- C. Brickwork shall be constructed accurately to the required structure dimensions and tapered at the top to the dimensions of the flanges of the cast-iron frames, as shown on the Drawings.
- D. Joints on the inside face of walls shall be tooled slightly concave with an approved jointer when the mortar is thumbprint hard. The mortar shall be compressed with complete contact along the edges to seal the surface of the joints.
- E. All castings to be embedded in the brickwork shall be accurately set and built-in as the work progresses.
- F. Water shall not be allowed to flow against brickwork or to rise on the masonry for 60 hours after it has been laid, and any brick masonry damaged in this manner shall be replaced as directed at no additional cost to the National Park Service. Adequate precautions shall be taken in freezing weather to protect the masonry from damage by frost.

3.07 CONCRETE MASONRY UNITS

- A. Concrete masonry units shall be soaked in water before laying. As circular concrete block walls are laid-up, the horizontal joints and keyways shall be flushed full with mortar. As rectangular blocks are laid-up, all horizontal and vertical joints shall be flushed full with mortar. Plastering of the outside of block structures will not be required. No structure shall be backfilled until all mortar has completely set.

3.08 MANHOLE STEPS

- A. Steps shall be installed into the precast walls during manufacture.
- B. Steps in brick masonry and concrete units shall be installed as the masonry courses are laid.

3.09 CASTINGS

- A. Cast-iron frames for grates and covers shall be well bedded in cement mortar and accurately set to the proposed grades.
- B. All voids between the bottom flange and the structure shall be completely filled to make a watertight fit. A ring of mortar, at least one-inch (1 in.) thick and pitched to shed water away from the frame shall be placed over and around the outside of the bottom flange. The mortar shall extend to the outer edge of the masonry all around its circumference and shall be finished smooth. No visible leakage will be permitted.
- C. Structures within the limits of bituminous concrete pavement shall be temporarily set at the elevation of the bottom of the binder course. After the binder course has been compacted,

the structures shall be set at their final grade. Backfill necessary around such structures after the binder course has been completed shall be made with 3,500 psi concrete.

3.10 CONNECTIONS TO EXISTING FACILITIES

- A. The Contractor shall make all required connections of the proposed drainage system into existing drainage system, as indicated on the Drawings.
- B. Connections into existing drainage system facilities shall be performed in accordance with the requirements of the National Park Service. The Contractor shall comply with all such requirements, including securing of all required permits, and paying the costs thereof.

3.11 MANHOLE CONNECTIONS

- A. Manhole pipe connections for precast manhole bases shall be a tapered hole filled with non-shrink waterproof grout for RCP. Manhole connections shall be flexible boot cast into the manhole wall for HDPE, PVC, and DIP. The stainless-steel clamp shall be protected from corrosion with a bitumastic coating.

3.12 ROOF DRAIN OR SIMILAR CONNECTIONS

- A. The Contractor shall make all required connections of the building drainage pipes into the site drainage system at locations and at distances from the buildings as indicated on the Drawings. If stubs are constructed for later connection to the building pipes, the ends shall be sealed with watertight plugs and marked with 2 x 4 risers for later location.
- B. The Contractor shall coordinate the sitework with the building work to determine the exact location and elevation of the points of entry into buildings.
- C. Roof drain connections to the site drainage system shall be made with fittings supplied by the pipe manufacturer.

3.13 CLEANING

- A. The Contractor shall clean the entire drainage system of all debris and obstructions. Cleaning shall include removal of all formwork from structures, concrete and mortar droppings, construction debris, and dirt. The system shall be thoroughly flushed clean, and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing drains, storm recharge chambers, storm drains and/or streams.

3.14 TESTING

- A. Testing shall be done with a mandrel with a minimum length that is greater than the pipe diameter, and a minimum diameter of 90 percent of the pipe diameter. If the mandrel

cannot be pulled through the pipe after seven (7) days of completed trench backfill, the pipe line shall be deemed unacceptable and the pipe lines shall be removed and replaced.

- B. The Contractor shall make all necessary repairs or replacements required to permanently provide an open and structurally sound drainage system capable of supporting the anticipated loading from all sources throughout the year.

3.15 FINAL INSPECTION

- A. Upon completion of the work, and before final acceptance by the Contracting Officer, the entire drainage system shall be subjected to a final inspection in the presence of the Contracting Officer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, mandrel tests, and other requirements have been met.

END OF SECTION 33 40 00

SECTION 33 40 20 - WARNING AND TRACER TAPE

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. This Section covers the furnishing, handling, and installation of warning and tracer tape above all utilities and drain lines installed on the project.

1.2 SUBMITTALS

- A. In accordance with requirements of General Specifications, submit the following:
 - 1. One set of manufacturer's literature on the materials, colors and printing specified herein, shall be submitted to the Contracting Officer for review.

1.3 LAWS AND REGULATIONS

- A. Work shall be accomplished in accordance with regulations of local, county, state and federal agencies or utility company standards as they apply.

PART 2 – PRODUCT

2.1 TAPE

- A. Warning and tracer tape shall be at least 6 inches wide.
- B. Tracer tape for non-ferrous pipe or conduit shall be constructed of a metallic core bonded to plastic layers. The metallic tracer tape shall be a minimum 5-mil thick and shall be located at a depth as indicated on the drawings.
- C. Warning tape for ferrous pipe or conduit shall consist of multiple bonded plastic layers. The non-metallic tracer tape shall elongate at least 500% before breaking.
- D. The tape shall bear the wording (or approved equal with salient characteristics): 'BURIED DRAIN LINE BELOW' (with 'DRAIN' replaced by 'WATER', 'SEWER', 'ELECTRICAL', 'GAS', 'TELEPHONE', or 'CHEMICAL' as appropriate), continuously repeated every 30 inches.
- E. Tape colors shall be as follows as recommended by the American Public Works Association (APWA):

Electric	Red
Gas and Oil	Yellow
Communications	Orange
Water	Blue
Sewer and Drain	Green

Chemical

Red (not APWA)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Warning and tracer tape shall be installed above all pipe or conduit it is to identify at depths as indicated on the Drawings, or in accordance with local, state or federal regulations.
- B. Follow the manufacturer's recommendations for installation.

END OF SECTION 33 40 20

Appendix A

BAR HARBOR WATER DISTRIBUTION SYSTEMS

SECTION 3 - WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. General: This section includes:

1. Water main relocation or special crossings where encountered.
2. Water service relocation where encountered at-grade.
3. Materials required for repair of water services which are damaged in course of work.
4. Yard hydrant and service piping.
5. Ductile iron water main.
6. CTS PE water main.
7. CTS PE well line.
8. Water line fittings and adapters.
9. Water services to buildings.
10. Water wedge valves.
11. Corporation stops.
12. Saddles for large corporation stops.
13. Curb stops.
14. Valve boxes.
15. Hydrants.
16. DR 11 HDPE water main.
17. Tapping sleeve.

18. Temporary water service.

1.02 RELATED SECTIONS

A. Section 2 - Earthwork.

1.03 PERFORMANCE REQUIREMENTS

A. Water Main Pressure Ratings: Not less than 1.5 times the sustained working pressure of the lowest elevation of the test section.

1.04 QUALITY ASSURANCE

A. For water line work, comply with all requirements of the Owner. All materials and workmanship are subject to approval by the Owner.

B. Perform all water line relocation work in accordance with Department of Health and Human Services standards, where more stringent than local requirements.

C. All work including temporary water service shall comply with American Water Works Association and NSF/ANSI Standards for Drinking Water.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare hydrants for transport as follows:

1. Ensure that hydrants are dry and internally protected against rust and corrosion.

2. Protect against damage to threaded ends, flange faces, and weld ends.

3. Set in best position for handling.

B. Storage: Use the following precautions for hydrants during storage:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support off the ground or pavement in watertight enclosures.

C. Use the following precautions for pipes during storage:

1. All materials shall be kept safe from damage. Materials shall be kept free from dirt and foreign materials at all times.
2. Store gaskets in cool location out of direct sunlight. Gaskets should not come in contact with petroleum products.
3. Protect from moisture and dirt.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate relocation of water main with Owner as necessary.

PART 2 - PRODUCTS

2.01 BURIED PIPES AND TUBES

- A. All piping, fittings, valves, coating, gaskets and appurtenances that will come into contact with potable water shall have ANSI/NSF Standard 61 Certification.
- B. General: Provide fittings and other required piping accessories of same type and class of material as conduit, or of material having equal or superior physical and chemical properties.
- C. Ductile-Iron Pipe: AWWA C151, thickness Class 52.
 1. Lining: AWWA C104, cement mortar, seal coated.
 2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
 3. Mechanical-Joint-Type or Push-On Type Pipe: AWWA C111, rubber gaskets, ductile iron glands, and stainless steel bolts and nuts.
 4. Exterior Coating: Bituminous.
- D. Copper Tube:
 1. ASTM B 88 (ASTM B 88M), seamless water tube, Type K annealed temper.

E. CTS PE Plastic Pipe for Water Service:

1. ASTM D 2737, of PE compound.
2. Minimum pressure rating 200 psi.
3. Include marking “NSF-pw” according to NSF 14.
4. Conform with AWWA C 901.
5. Provide longest coil length available to minimize the number of joints.
6. Insert stiffeners are required at all compression connections for leak-free installation.
7. Provide compression fittings.
8. Provide tracer wire over all non-metallic pipes.

F. Extra High Molecular Weight Polyethylene Pipe (EHMW PE):

1. ASTM D 1248 Type III, Class C, Category 5, Grade P34 polyethylene pipe material.
4. Pressure rating as follows:

<u>SDR/DR</u>	<u>PSI</u>
9.0	200
11.0	160

5. Include blue stripe marking “NSFpw” approved for potable water use according to NSF-14.
6. Pipe density 0.955 g/cm³ per ASTM D 1505.
7. Melt index 0.10 g/10 min per ASTM D 1238.
8. Flexural modulus 133,000 psi per ASTM D 790.
9. Tensile strength 3200-3500 psi per ASTM D 638.

10. Hydrostatic design basis 800 psi at 140°F.
11. Resistance to distortion up to 180°F.
12. Protection from ultraviolet sunlight degradation by adding 2 to 3% finely divided carbon black compound.
13. Above ground service rated.
14. Chemical corrosion resistant at all pH ranges.
15. Provide tracer wire over all non-metallic pipes.
16. Equal to CPChem Performance Pipe EMHW PW 3408 by Chevron Chemical Co., Bensenville, Illinois.

2.02 PIPE AND TUBE FITTINGS

- A. Ductile Iron Pipe Fittings: AWWA C110, ductile iron, 250 psig (1725 kPa) minimum pressure rating.
- B. Copper Fittings: Mueller compression type IPS connections, or equal. Pack joints shall not be allowed.
- C. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300, as required for system operating pressure.
- D. Molded, PE Plastic Fittings: PE resin, Butt-fusion type, made to match PE pipe ASTM, pressure ratings, SDR, dimensions and class.

2.03 JOINING MATERIALS

- A. Ductile Iron Pipe and PVC Pipe: The following materials apply:
 1. Mechanical Joints: Meets or exceeds AWWA C-219, NSF 61, NSF 372, ductile iron casting, high strength stainless steel bolts, washers and nuts, and rubber gaskets.
- B. Gaskets: EPDM Rubber.
- C. End Rings: Ductile Iron Casting ASTM A536, Grade 60-40-18.

- D. Center Ring: Ductile Cast Iron Casting ASTM A536 Grade 65-45-12 with handle.
- E. Grip Chain: Gripping Teeth: Size 4.0” – 12” (AISI 420 LB or AISI 440C).
- F. Bridge: AISI 304 Stainless Steel.
- G. Spherical Spacers: AISI 304 Stainless Steel.
- H. Coating: 100% fusion bonded epoxy.
- I. Bolts, Washers and Nuts: AISI 304 Stainless Steel.
- J. Equal to: Hymax Grip Coupling.
- K. Products with set screw grips not allowed.

2.04 VALVES

A. Tapping water mains:

1. CC x CPPJ for tapping into ductile iron water mains or electrofusion coupling for HDPE water mains.
2. Ball valve with PTFE coated bronze ball.
3. Meeting NSF 61.
4. 300 psi rating at maximum working pressure.
5. Insert stiffeners of stainless steel construction required at all connections to flexible tubing.
6. Size to match water service lines.

B. Saddles for Large Service Lines for Ductile Iron water mains:

1. Service lines greater than 1” Ø shall be connected to the water main with a service saddle.
2. Corporation stop shall be threaded into saddle.

3. Saddle shall be double strap style. (Single strap saddles shall be unacceptable).
4. Body shall be ductile iron, Grade 65-45-12, meeting ASTM A-536.
5. Threads shall be FEP or CC (AWWA).
6. Finish shall be shop coat paint.
7. Fasteners shall be 304 stainless steel.
8. Gaskets shall be virgin NBR rated for water service.
9. Straps shall be 304 stainless steel.
10. Smith-Blair, or equal.

C. Saddles for Large Service Lines for HDPE water mains:

Provide electrofusion saddles manufactured in accordance with ASTM F-1055 and conform with the following material requirements:

1. Pre-Blended resin 4710 which complies with ASTM D3350.
2. Resin must be acceptable for use with potable water and comply with NSF Standard 61.
3. CC threads.

D. Curb Stop, Service Box, and Rod:

1. CPPJ X CPPJ fittings.
2. Ball valve with PTFE coated ball.
3. Meeting AWWA C-800 and NSF 61.
4. 300 psi rating at maximum working pressure.
5. Body shall be heavy duty lead free brass.
6. Requires two O-ring seals in precision grooves.

7. Insert stiffeners of stainless steel construction required at all connections to flexible tubing.
8. Curb stop equal to Mueller Series 300.
9. Service box shall be 1" I.D. #40 black steel with top having N.P.I. threads for 1" screw-on cover, Erie Style with 5' to 6' slide-type riser.
10. Foot pieces shall be heavy duty, Ford style or equal cast iron design. Foot piece shall have arch to fit over 2" ball valve curb stops.
11. Service rod shall be 1/2" minimum diameter 304 stainless steel, and minimum of three feet in length.
12. The curb stop attachment point shall be a brass or stainless steel cotter pin.
13. The rod yoke shall be an integral part of the rod and the wrench flat shall have a minimum thickness of 1/4" tapered to 1/10" and a width of 5/8" or 1/2".
14. Caps shall be 1" extra heavy with brass pentagon plug and coarse "rope" thread to fit 1" service box.
15. All caps shall have the word "WATER" clearly cast in top and be constructed of a magnetic material.
16. Clow, or approved equal.

E. Resilient Wedge Valves:

1. Comply with AWWA C515.
2. Acceptable manufacturers are American Flow, Clow, Mueller, or AVK.
3. Working pressure 250 psi.
4. Test pressure 400 psi.
5. Wedge shall be ductile iron encapsulated in urethane rubber bonded permanently to meet ASTM D429.

6. Stems shall be epoxy coated stainless steel with integral thrust collar.
7. Two O-ring seals shall be provided above thrust collar and be replaceable with valve fully open under rated working pressure.
8. Two thrust washers shall be located above and below stem collar to reduce torque.
9. Actuator stem nut shall be ductile iron.
10. Actuator nut shall be held onto valve with removable nut. Stainless steel punchout pins or hex nuts shall not be acceptable.
11. All bolts shall be Type 18-8 stainless steel.
12. Valve type shall be MJ x MJ or MJ x Tapping unless other connection type required in-field.
13. UL and FM approved.

F. Valve Boxes:

1. Ductile iron, two piece sliding type with bell-type base.
2. Top flange and minimum 5 1/4" inside diameter.
3. Box cover shall be 2" drop-type cover to fit 5 1/4" opening.
4. Variable length bottom section and 2' top section.
5. Lettering "WATER".
6. Interior and exterior of all components shall be coated with bituminous.

2.05 HYDRANTS

- A. Equal to Clow Eddy F-2641. (Non-self draining)
- B. Meeting AWWA C-502-85.
- C. Body shall be cast iron with ductile iron cap nut.

- D. Breakoff flange at bottom.
- E. Compression type hydrant with main valve closing under water pressure.
- F. Rising stem to indicate open/close position.
- G. Valve opening 5 1/4”.
- H. O-ring seals at stem.
- I. Plugged drain required.
- J. Two hose nozzles at 2 1/2” with NSF threads. Confirm nozzle size with local fire department and water company.
- K. One pumper nozzle with 5” Storz connection shall be provided in front of hydrant. Confirm nozzle size with Town of Bar Harbor.
- L. Galvanized chain on nozzles.
- M. Opens left.
- N. Exterior finish: Red alkyd-gloss enamel paint.
- O. Valves to comply with above wedge valve specification.
- P. All fasteners shall be 304 SS and all interior rubber components shall be EPDM Rubber.
- Q. Check valve shall be ductile iron ASTM Standard A536 with NSF approved fusion bonded epoxy coating (interior/exterior).

2.06 TAPPING SLEEVE

- A. Tapping sleeve shall be 316 SS with full circumferential seal, rated for 250 psi.

2.07 YARD HYDRANT

- A. Eclipse #2 Post Hydrant with 2” inlet and 2 3/16” valve opening and 1 1/2” outlet, or equal. (Hydrant must be non-self draining).

2.08 ANCHORAGES

- A. Clamps, Straps, and Washers: Stainless steel.
- B. Rods: Stainless steel.
- C. Rod Couplings: Stainless steel.
- D. Bolts: Stainless steel.
- E. Washers: Stainless steel.
- F. Pipe Lubricant: Suitable for use in potable water supply.

2.09 LIVE INSERTION TAPPING VALVES

- A. Valve shall be equal to Romac Quickvalve insertion valve.
- B. Comply with AWWA.
- C. Tapping sleeve shall provide 360° seal around pipe under working pressure up to 150 psi without interruption in water service. Sleeve shall be constructed of ASTM A-36 steel with epoxy coating 10-12 mils.
 - 1. Flange: a special flange shall be used that mates with installation equipment and insertion valve.
 - 2. Neck: the neck shall be manufactured to precision tolerances that assure proper alignment, support and sealing of the Quikvalve insert.
 - 3. Bolts and nuts: 304SS bolts with SDC nuts.
 - 4. Gaskets: SBR for potable water in accordance with ASTM D2000 Standards. Gaskets shall provide a positive 360° seal on the pipe and assure a tight, durable and resilient seal at the pipe sleeve-valve insert junction.
 - 5. Coating: sleeve shall be lined and coated with fusion bonded epoxy meeting AWWA-C213 and ANSI/NSF 61 Standards.
 - 6. Armors: heavy gauge 304 SS armor plates are used to bridge the gap between sleeve halves.

7. Lugs: configured to properly align the sleeve halves during installation, provide a bolting surface, and assure a 360° seal.

D. The valve assembly is a water control device and shutoff when installed in a valve tapping sleeve. The valve is installed in an open position under water pressure without any interruption of service. The valve shall provide full unobstructed full flow waterway after installation.

1. Insert: ductile iron casting coated with SBR rubber for potable water service with 55 durometer.

2. Valve stem and nut: AWWA C-500-80.

3. Flange: ASTM A-36 steel flange is used to hold the valve assembly together and act as a seal against the valve sleeve flange.

4. Gasket: SBR rubber for potable water service, ASTM D2000, 70 durometer. The gasket acts as the sealing interface between the valve flange and sleeve flange.

5. Bolts and nuts: 304 SS.

2.10 SEASONAL METER ENCLOSURE

A. Jumbo Plastic 18" x 12" or as required by Town.

B. By F.W. Webb or Maine Water Works.

2.11 METER PITS AND ENCLOSURES

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

- B. Structures: Portland-cement design mix, 3000 psi minimum at 28 days, with 0.45 maximum water-cement ratio.
 - 1. Reinforced Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615, Grade 60 (ASTM A 615M, Grade 400), deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland-cement design mix, 3000 psi minimum, with 0.45 maximum water-cement ratio.
- D. Precast Concrete Structures: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasket joints meeting AASHTO H-20 loading.
- E. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
- F. Base Section: Minimum thickness for floor slab, as shown on plans, and minimum thickness for walls and base riser section, as shown on plans, and having a separate base slab or base section with integral floor.
- G. Riser Sections: Minimum thickness, as shown on plans, 48-inch minimum diameter, or as shown on plans, and lengths to provide depth indicated.
- H. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
- I. Sealants: ASTM C 443 butyl rubber, two rings sealant around each joint for watertight connection.
- J. Steps: Provide steps for manholes greater than four feet deep.
 - 1. ASTM C 478 individual steps or ladder.
 - 2. Aluminum alloy 6061-T6 or copolymer polypropylene plastic with 1/2" Grade 60 reinforcing bar meeting ASTM D4101 Type II and ASTM A 615.
 - 3. Meet all OSHA requirements.

4. Minimum width 14”.
5. Maximum spacing 12” on center.
6. Coat with bitumastic paint where cast in concrete.

K. Pipe Penetrations:

1. Non-pressure pipes and drains: Flexible manhole sleeves equal to CP series manufactured by Interpace Corp. size to fit diameter and type of pipe without use of gaskets.
2. Pressure pipes: Flexible Manhole sleeves as above or, thermoplastic pipe sleeve equal to "Link-Seal Century Line" model CS100 by Thunderline Corp. with sleeve seal equal to "Link-Seal" by Thunderline Corp.
3. As specified on drawings if in conflict with above.

2.12 PROTECTIVE COATINGS

- A. Include factory or field applied protective coatings to structures and appurtenances according to the following:
1. Coating: Two coats, coal-tar epoxy, bitumastic, or Conseal coating, each coat 15 mil minimum thickness, except where otherwise indicated.
 2. Structures: On exterior surface, bitumastic, PPS 922 superseal or equal.

2.13 RISER RINGS TO GRADE

- A. Provide reinforced riser rings to grade.
- B. Use number of rings required to achieve grade elevation.
- C. Seal all joints with bitumastic sealant.
- D. Ring inside diameter shall be twenty-four inches.

2.14 WATERTIGHT FRAME AND COVER

- A. Fully machined bolted cover with Stainless Steel bolts.
- B. Two rings for watertight seal, as follows:
 - 1. Elastomer sealing ring.
 - 2. Rubber seating ring fastened by 6 bolts and clamping claws.
- C. Ductile Iron construction meeting Class D400 EN124, H20, and AASHTO loading criteria.
- D. Minimum clear frame opening: 24”.
- E. Frame height: 4”.
- G. Equal to Pamtight Ductile Iron frame and cover.

2.15 FROST BARRIERS

- A. Frost Barrier: U.V. Resistant, high grade polyethylene, minimum 6 mils thick.

2.16 MORTAR MATERIALS

- A. For mortar mix: Conform to requirements of ASTM C 270, Type S using Portland cement.
- B. Portland Cement: Natural color ASTM C 150, Type I, except Type III may be used for cold weather construction.
- C. Hydrated Lime: ASTM C270, Type S.

2.17 ABOVE GRADE ENCLOSURES

- A. Prefabricated above grade enclosures equipped with heat, gravity drainage, and removable access panels.
- B. Equal to Hot Box.
- C. Coordinate location with Water Department.

PART 3 - EXECUTION

3.01 PIPE

- A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation for all buried pipes.
- B. Remove unstable, soft, and unsuitable materials at trench bottom upon which pipes are to be laid and filled with compacted select backfill.
- C. Bedding for ductile iron pipe shall be gravel or native material as approved by Owner from 6 inches below to 6 inches above pipe.
- D. Ductile-Iron Pipe: Install with cement mortar lined mechanical joint and retainer glands or push on joint fittings and rubber gaskets in accordance with AWWA C600.
- E. Clean interior of pipe thoroughly prior to installation. Utilize plugs to minimize entry of foreign materials into pipe.
- F. Torque wrenches required to tighten all mechanical joint fittings with applied torque conforming to pipe and fitting manufacturer's requirements.
- G. Piping shall be carefully lowered into the excavation. Suitable excavated material shall be placed to maintain equal depth on both sides of the pipe and to prevent movement of the pipe from its proper alignment.
- H. All damage resulting from inadequate bracing or shoring will be the responsibility of the Contractor, who shall make all necessary repairs at his/her own expense.
- I. The Contractor shall use extra caution to avoid disturbing any water service connections. Any disruption of water service shall be immediately reported to the Water Department and the property Owner.
- J. Property owners whose driveways will be blocked shall be notified 24 hours in advance of the excavation. Driveways shall not be blocked at night without the expressed consent of the property owner.

- K. Pipe shall be laid directly on the trench bottom. Prior to lowering pipe into trench, the trench bottom shall be made flat and cut true and even to grade so as to provide continuous contact of the trench bottom with the pipe.
- L. No pipe shall be laid, in wet trench conditions, on frozen trench bottom, or when Owner determines weather conditions are unsuitable for proper installation.

3.02 EXISTING WATER MAIN CONNECTION

- A. Tap water main location indicated in coordination with requirements of Water Department.
- B. Install tapping sleeve and tapping valve in accordance with manufacturer's instructions. Position flanged outlet for wedge valve.
- C. Coordinate connection of all services with Owner.

3.03 INSTALLATION OF FUSION WELDED PE PIPE

- A. Joints between plain ends of polyethylene pipe shall be made by butt fusion when possible.
- B. Pipe Manufacturer's fusion procedures shall be followed at all times as well as the recommendations of the Fusion Machine Manufacturer.
- C. Wall thicknesses of the adjoining pipes shall have the same DR at the point of fusion.
- D. When saddle connections are fusion welded, the Manufacturer's recommended saddle fusion procedures shall be used.
- E. If mechanical fittings are utilized for transitions between pipe materials, repairs, joining pipe sections, saddle connections, or at other locations, the recommendation of the Mechanical Fitting Manufacturer must be followed. These procedures may differ from other pipe materials.
- F. On each day butt fusions are to be made, the first fusion of the day shall be a trial fusion. The trial fusion shall be allowed to cool completely, then fusion test straps shall be cut out.
- G. The test strap shall be 12" or 30 times the wall thickness in length (minimum) and 1" or 1.5 times the wall thickness in width (minimum).

- H. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely, and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.
- I. Socket and Saddle fusions shall be tested by a bent strap test as described by the Pipe Manufacturer. The pipe Manufacturer shall provide visual guidelines for inspecting the butt, saddle, and socket fusion joints.
- J. Pressure testing shall be conducted in accordance with the Manufacturer's recommended procedure and AWWA Standards. Pressure testing shall use water as the test media. Pneumatic testing is prohibited.

3.04 INSTALLATION OF SURFACE FUSION WELDED PIPE

- A. Lay pipes on ground surface in approximate location shown on Drawings.
- B. Provide gradual pipe bends with long radius curvature and no sharp bends or kinks in lines.
- C. Provide casings for pipes to cross under traveled areas and roadways where required by Town.

3.05 PLACEMENT OF WATER LINE THRUST BLOCKS

- A. Concrete shall be poured in place or precast:
 - 1. Poured in place thrust blocks shall be constructed by pouring concrete between the fitting and the undisturbed wall of the trench. Care shall be exercised to ensure that the concrete is placed clear of joint accessories, bolts, nuts, and flanges.
- B. Thrust blocks are required whenever the pipe:
 - 1. Changes direction at tees, bends, crosses, and tapping sleeves.
 - 2. Changes sizes as at reducers.
 - 3. Stops as at dead ends.

3.06 HYDRANTS

- A. Install fire hydrants in approved locations and to requirements of Town of Bar Harbor.
- B. Clean hydrants prior to installation.
- C. Support hydrant to maintain vertical position utilizing 24" x 24" concrete paver block.

3.07 FLUSHING AND DISINFECTION

- A. General: At completion of water distribution line installation but prior to connection to existing water supply, flush and disinfect in conformance with AWWA C651-05, the Maine Department of Health and Human Services, and Water Department requirements.
- B. Initial flushing shall be conducted to remove dirt, sediment and debris from the line. Ductile iron pipe shall be flushed at a rate of 2.5 FPS and PVC pipe shall be flushed at a rate of 3.0 FPS in accordance with AWWA C605-94.
- C. Disinfect the lines using one of two methods in accordance with AWWA C651-99:
 - 1. Slug method – Apply 100 mg/l slug dose of free chlorine throughout the entire line length for a minimum of three hours. Time begins when the 100 mg/l dose reaches the end of the line. Over a three hour period, the free chlorine level in the line may not fall below 50 mg/l.
 - 2. Continuous Feed Method – Apply a 1% chlorine bleach solution to the lines to provide a free chlorine level of at least 25 mg/l at the end of the line. After 24 hours, the residual at the end of the line must not be below 10 mg/l.
- D. During the disinfection process, flush all valves and hydrants to ensure adequate chlorine contact.
- E. The disinfection test fails and must be repeated if any of the above residual target levels are not met.

- F. Final flushing of the line must be completed within 24 hours after the required contact period to remove chlorine to a residual of 1 mg/l or less.
- G. Bacteriologic Test: Two samples for coliform testing must be conducted 24 hours apart from a location every 1200 LF along the pipe and also at the end of the new line. Sampling must begin no less than 16 hours after the completion of flushing.
- H. Bacteriological samples must be analyzed by a Maine Certified Laboratory.
- I. If bacteria tests fail, lines must be reflashed, disinfected, and resampled until the tests pass. All retest shall be paid for by the contractor.

3.08 TESTING

- A. Notify Owner at least 48 hours prior to testing.
- B. Hydrostatic testing of completed lines shall be at least 1.5 times the working pressure for 2 hours, but shall be no less than 200 psi.
- C. Leakage shall be less than the allowable quantities as defined in AWWA 1977 (600-77) Section 4 as shown below:

Allowable Leakage per 1000 ft of Pipeline – gph

Avg. Test pressure psi	Nominal Pipe Diameters – in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

3.09 TEMPORARY WATER

- A. The contractor may, at their discretion, provide temporary water in order to facilitate construction of the new work.
- B. The cost of providing temporary water is incidental to the project.
- C. Products delivered under this specification shall be manufactured only from water distribution pipe and couplings conforming to ASTM 2241. Pipe, couplings, and locking splines shall be completely non-metallic to eliminate corrosion problems.
- D. Pipe and couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 1254-B, as defined in ASTM D1784. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4°F, in accordance with the requirements of ASTM D2837.
- E. Copies of agency approval reports or product listings shall be provided to the Owner. Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with NSF 14 for PVC coupled components and NSF 61 for Integral Bell and glass fiber reinforced plastic components.
- F. Nominal outside diameters and wall thicknesses of thrust-restrained pipe shall conform to the requirements of ASTM 2241. Thrust-restrained pipe shall be furnished in 2” through 16” sizes, in Class 100 (SDR41) through (DR13.5). Pipe shall be furnished in standard lengths of 20 feet.
- G. Pipe shall be joined using non-metallic couplings or Integral Bells to form a restrained system with maximum reliability and interchangeability. High-strength, flexible thermoplastic splines shall be inserted into mating, precision-machined grooves in the pipe, coupling and bell to provide full 360° restraint with evenly distributed loading. Temporary waterline service connection shall be installed using IPS service saddles compatible with standard AWWA Copper service connections.
- H. Couplings shall be designed for use at or above the rated pressure of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the leakage test requirements of ASTM D3139.

- I. All flushing and disinfection requirements must be followed prior to placing temporary water on-line.

3.10 METER OR BACKFLOW PITS

- A. Primarily due to considerations for access, safety and gravity drainage, it is preferred that meters or backflow prevention devices not be installed in pits. Where pit installations are proposed, they shall follow the guidelines as provided in Appendix D.
- B. They must be watertight with watertight manholes or access doors extending a minimum of 6 inches above grade and located to allow natural light into the pit during testing/maintenance.

3.11 INSTALLATION OF STRUCTURES

- A. Place bases on compacted bedding material so precast structure is plumb and pipe inverts are at proper elevations.
- B. Place riser and top sections in the appropriate height combinations.
- C. Plug all lifting holes inside and out with non-shrink grout.
- D. Follow manufacturer's instructions for sealing joints between precast sections. Provide two rings of 1-inch diameter butyl rubber sealant.
- E. Point joints inside and out with butyl caulk.
- F. Set frames and covers to 1/2" below final pavement grade in paved areas. Set 2" below finish grade in unpaved roads or set at 6" above grade in cross country areas or lawns.
- G. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
- H. Use two rings of 1-inch diameter butyl rubber sealant between frame and riser rings.
- I. Provide downward force to frame so as to compress the joint and provide a watertight seal and prevent future settlement.

- J. Point compressed joint with butyl rubber caulk sealant.
- K. Set frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.
- L. Install seals at each joint if specified.
- M. Install cover seal if specified.

3.12 ABOVE GRADE ENCLOSURES

- A. Provide prefabricated above grade enclosures that provide heat, gravity drainage and removable access panels for servicing and testing. As an alternate, wood frame, fiberglass, steel, masonry or precast concrete structures may be utilized. All enclosures shall be designed:
 - 1. With a floor elevation that is at least 6 inches above finished grade.

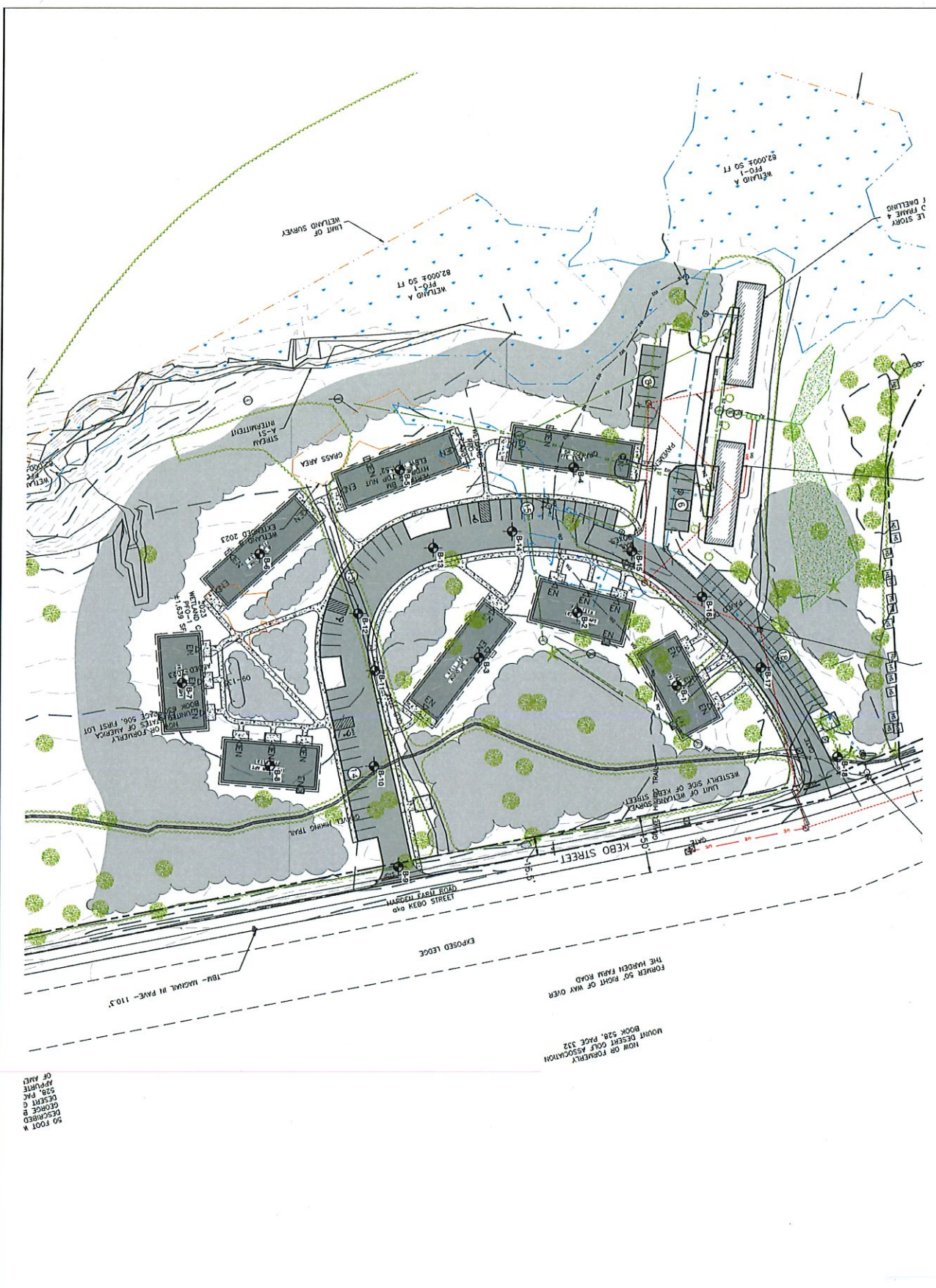
3.13 BACKFLOW TESTING

- A. The backflow assembly must be tested upon installation by a certified tester. Results must be submitted to the Water Department along with any applicable record drawings.
- B. The assembly must be tested annually with results submitted to the Water Department.

END OF SECTION

Appendix B

BORING LOGS



50 FOOT W
DESCRIBED
DESERT B
RANGE C
ACREAGE
528.00
OF ABLU

HOW OR FORMERLY
MOUNT DESERT GOLF ASSOCIATION
BOOK 528, PAGE 332

FORMER 50' RIGHT OF WAY OVER
THE HARVEY FARM ROAD

EXPOSED LEDGE

KEBO STREET

GREEN FARM ROAD
AND KEBO STREET

WETLAND A
82,000± SQ FT

WETLAND B
82,000± SQ FT

WETLAND C
82,000± SQ FT

WETLAND D
82,000± SQ FT

WETLAND E
82,000± SQ FT

WETLAND F
82,000± SQ FT

WETLAND G
82,000± SQ FT

WETLAND H
82,000± SQ FT

WETLAND I
82,000± SQ FT

WETLAND J
82,000± SQ FT

WETLAND K
82,000± SQ FT

WETLAND L
82,000± SQ FT

WETLAND M
82,000± SQ FT

WETLAND N
82,000± SQ FT

WETLAND O
82,000± SQ FT

WETLAND P
82,000± SQ FT

WETLAND Q
82,000± SQ FT

WETLAND R
82,000± SQ FT

WETLAND S
82,000± SQ FT

WETLAND T
82,000± SQ FT

WETLAND U
82,000± SQ FT

WETLAND V
82,000± SQ FT

WETLAND W
82,000± SQ FT

WETLAND X
82,000± SQ FT

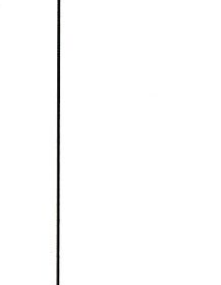
WETLAND Y
82,000± SQ FT

WETLAND Z
82,000± SQ FT

SW COLE
S.W. COLE ENGINEERING & DESIGN, INC.
1000 WEST 10TH AVENUE, SUITE 100
DENVER, CO 80202
PROPOSED HARVEY FARM HOUSING
KEBO STREET
DAN HARVEY, OWNER

Job No.: 23-0889
Date: 02/06/2024
Scale: 1" = 40'
Sheet: 1

- LEGEND**
- APPROXIMATE BURNING LOCATION
- NOTES**
1. DEVELOPMENT LOCATION PLAN WAS PREPARED FROM A DEVELOPMENT LOCATION PLAN PROVIDED FROM A REGISTERED PROFESSIONAL ENGINEER.
 2. THE BURNING LOCATIONS WERE SELECTED AND ESTABLISHED IN THE FIELD BY S.W. COLE ENGINEERING, INC. USING A WAPPING ORANGE CROSS GPS RECEIVER.
 3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE GEOTECHNICAL REPORT.
 4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE DEVELOPMENTS IN RELATION TO THE GEOTECHNICAL REPORT.
- AND IS NOT TO BE USED FOR CONSTRUCTION.





BORING LOG

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/26/2024
DATE FINISH: 1/26/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 10.0 **LOGGED BY:** Alex Allen
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
 ▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
 ▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
 ▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
 V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/12	2-1-4-8		0.3	Forest Duff Medium dense, brown SILT and SAND	
			2D		2-4	24/24	12-12-15-18	q _p =9+ ksf	2.0	Hard, brown silty CLAY	
	5		3D		5-7	24/24	5-7-12-15	q _p =9+ ksf			
									8.6	Probable Glacial Till	

Refusal at 10.0 feet
(Probable Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-1



BORING LOG

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 15.7 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
 Water Level: ▽ At time of Drilling, ▽ At Completion of Drilling, ▽ After Drilling
 D = Split Spoon Sample, U = Thin Walled Tube Sample, R = Rock Core Sample, V = Field Vane Shear
 Pen. = Penetration Length, Rec. = Recovery Length, bpf = Blows per Foot, mpf = Minute per Foot
 WOR = Weight of Rods, WOH = Weight of Hammer, RQD = Rock Quality Designation, PID = Photolization Detector
 S_v = Field Vane Shear Strength, kips/sq.ft., q_u = Unconfined Compressive Strength, kips/sq.ft., Ø = Friction Angle (Estimated), N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blow Count or RQD				
			1D		0-2	24/20	2-2-7-9		0.5		Forest Duff
											Loose, brown SILT and SAND
			2D		2-4	24/24	10-15-21-22	q _p =9+ ksf	1.5		Hard to very stiff, brown silty CLAY
	5		3D		5-7	24/24	8-13-16-23	q _p =9+ ksf			
	10		4D		10-12	24/24	5-6-6-8	q _p =5-6 ksf			
	15		5D		15-15.7	8/7	17-50/2"		14.0		Very dense, brown gravelly silty SAND with occasional cobbles (Glacial Till)

Refusal at 15.7 feet (Probable Bedrock)

BORING / WELL 10-12-2022 23-0859.GPJ SWCE TEMPLATE.GDT 2/7/24

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-2



BORING LOG

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 11.7 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
 At time of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
 At Completion of Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
 After Drilling V = Field Vane Shear mpf = Minute per Foot PID = Photolization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/22	1-2-5-7		0.5	Forest Duff	
									1.5	Loose, brown SILT and SAND	
			2D		2-4	24/24	8-12-16-19	q _p =9+ ksf		Hard, brown silty CLAY	
	5		3D		5-7	24/24	6-8-11-15	q _p =9+ ksf			
	10		4D		10-11.7	20/18	15-33-35-50/2"		10.0	Very dense, brown gravelly silty SAND with occasional cobbles (Glacial Till)	

Refusal at 11.7 feet
(Probable Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-3



BORING LOG

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/26/2024
DATE FINISH: 1/26/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 13.9 **LOGGED BY:** Alex Allen
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Probable perched water observed at ground surface

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
 At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
 At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
 After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
V = Field Vane Shear mpf = Minute per Foot PID = Photolionization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/24	1-2-5-8		0.5	Forest Duff Medium dense, brown SILT and SAND	
			2D		2-4	24/24	9-12-15-16	q _p =9+ ksf	2.0	Hard, brown silty CLAY	
	5		3D		5-7	24/24	5-8-10-13	q _p =9+ ksf			
	10		4D		10-12	24/24	4-4-5-13	q _p =5-6 ksf	10.0	Very stiff, brown silty CLAY, some fine sand	
									11.5	Medium dense, brown gravelly silty SAND (Glacial Till)	

Refusal at 13.9 feet
(Probable Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-4



BORING LOG

BORING NO.: B-5
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 22.0 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Soils wet below 20 feet +/-

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
 ▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
 ▼ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
 ▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
 V = Field Vane Shear mpf = Minute per Foot PID = Photolonization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/18	1-2-1-4		0.5	Forest Duff Medium dense, brown SILT and SAND	
			2D		2-4	24/24	6-9-12-15	q _p =9+ ksf	2.0	Hard, brown silty CLAY	
	5		3D		5-7	24/24	5-7-10-15	q _p =9+ ksf		... with trace gravel	
	10		4D		10-12	24/24	4-5-6-6	q _p =4-5 ksf		... with some sand	
	15		5D		15-17	24/24	3-3-3-4	q _p =2 ksf ID 30014B w =27.1 % W _L =34 W _p =19	15.0	Stiff, gray clayey SILT	
	20		6D		20-22	24/15	12-35-14-50		20.0	Dense, brown gravelly sandy SILT (Glacial Till)	
									21.8	Probable Bedrock	

Refusal at 22.0 feet
(Probable Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-5

BORING / WELL 10-12-2022 23-0859.GPJ_SWCE TEMPLATE.GDT 2/7/24



BORING LOG

BORING NO.: B-7
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 12.6 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Probable perched water observed at ground surface

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
 At time of Drilling
 At Completion of Drilling
 After Drilling
D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
V = Field Vane Shear mpf = Minute per Foot PID = Photolization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/21	1-3-5-6		0.5	Forest Duff	
									1.3	Loose, brown SILT and SAND	
			2D		2-4	24/24	8-12-17-18	q _p =9+ ksf		Hard to very stiff, brown silty CLAY	
	5		3D		5-7	24/22	6-8-10-17	q _p =7-8 ksf			
	10		4D		10-12	24/14	17-35-42-37		6.5	Very dense, brown gravelly SAND and SILT with occasional cobbles (Glacial Till)	

Refusal at 12.6 feet
(Probable Bedrock)

BORING / WELL 10-12-2022 23-0859.GPJ SWCE TEMPLATE.GDT 2/7/24

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-7



BORING LOG

BORING NO.: B- 8
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 12.2 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
 Water Level: At time of Drilling, At Completion of Drilling, After Drilling
 D = Split Spoon Sample, U = Thin Walled Tube Sample, R = Rock Core Sample, V = Field Vane Shear
 Pen. = Penetration Length, Rec. = Recovery Length, bpf = Blows per Foot, mpf = Minute per Foot
 WOR = Weight of Rods, WOH = Weight of Hammer, RQD = Rock Quality Designation, PID = Photoionization Detector
 S_v = Field Vane Shear Strength, kips/sq.ft., q_u = Unconfined Compressive Strength, kips/sq.ft., Ø = Friction Angle (Estimated), N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/22	1-1-3-6		0.5	Forest Duff	
									1.5	Loose, brown SILT and SAND	
			2D		2-4	24/24	8-11-15-19	q _p =9+ ksf		Hard, brown silty CLAY	
	5		3D		5-7	24/24	7-9-12-16	q _p =9+ ksf		... with trace gravel	
	10		4D		10-12	24/17	20-43-34-39	ID 30012B w = 8 %	9.3	Very dense, brown gravelly SAND and SILT with occasional cobbles (Glacial Till)	

Refusal at 12.2 feet
(Probable Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 8

BORING / WELL 10-12-2022 23-0859.GPJ SWCE TEMPLATE.GDT 2/7/24



BORING LOG

BORING NO.: B-9
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 7.0 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
 At time of Drilling
 At Completion of Drilling
 After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION				Field / Lab Test Data	Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)					
			1D	X	0-2	24/20	2-2-3-6		0.3		Forest Duff Loose, brown SILT and SAND
			2D	X	2-4	24/24	7-9-13-22	q _p =9+ ksf	1.5		Hard, brown silty CLAY
	5		3D	X	5-7	24/10	20-35-37-34		4.5		Very dense, brown gravelly SAND and SILT with occasional cobbles (Glacial Till)

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-9



BORING LOG

BORING NO.: B-10
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 7.0 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
 Water Level: At time of Drilling, At Completion of Drilling, After Drilling
 D = Split Spoon Sample, U = Thin Walled Tube Sample, R = Rock Core Sample, V = Field Vane Shear
 Pen. = Penetration Length, Rec. = Recovery Length, bpf = Blows per Foot, mpf = Minute per Foot
 WOR = Weight of Rods, WOH = Weight of Hammer, RQD = Rock Quality Designation, PID = Photolonization Detector
 S_v = Field Vane Shear Strength, kips/sq.ft., q_u = Unconfined Compressive Strength, kips/sq.ft., Ø = Friction Angle (Estimated), N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/22	1-1-3-6		0.6	Forest Duff	
			2D		2-4	24/24	7-12-14-19	q _p =9+ ksf	1.5	Loose, brown SILT and SAND	
	5		3D		5-7	24/24	7-11-20-24	q _p =9+ ksf		Hard, brown silty CLAY	
										... with some sand, trace gravel	

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-10



BORING LOG

BORING NO.: B-11
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 7.0 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
∇ At time of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
∇ At Completion of Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
∇ After Drilling V = Field Vane Shear mpf = Minute per Foot PID = Photolization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
5			1D	[Stratification symbols]	0-2	24/20	2-2-4-6		0.5	Forest Duff	
									1.5	Loose, brown SILT and SAND	
			2D		2-4	24/24	10-16-20-27	q _p =9+ ksf		Hard, brown silty CLAY	
			3D		5-7	24/24	8-11-16-24	q _p =9+ ksf			

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-11



BORING LOG

BORING NO.: B-12
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 7.0 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
 Water Level
 ▽ At time of Drilling
 ▼ At Completion of Drilling
 ▾ After Drilling
 D = Split Spoon Sample
 U = Thin Walled Tube Sample
 R = Rock Core Sample
 V = Field Vane Shear
 Pen. = Penetration Length
 Rec. = Recovery Length
 bpf = Blows per Foot
 mpf = Minute per Foot
 WOR = Weight of Rods
 WOH = Weight of Hammer
 RQD = Rock Quality Designation
 PID = Photolionization Detector
 S_v = Field Vane Shear Strength, kips/sq.ft.
 q_u = Unconfined Compressive Strength, kips/sq.ft.
 Ø = Friction Angle (Estimated)
 N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/22	1-2-3-7		0.4		Forest Duff Loose, brown SILT and SAND
			2D		2-4	24/24	12-13-16-17	q _p =9+ ksf	1.5		Hard, brown silty CLAY
	5		3D		5-7	24/24	8-9-15-20	q _p =9+ ksf			

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-12



BORING LOG

BORING NO.: B-13
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/25/2024
DATE FINISH: 1/25/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 7.0 **LOGGED BY:** Nate Strout
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Probable perched water observed at ground surface

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
∇ At time of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
∇ At Completion of Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
∇ After Drilling V = Field Vane Shear mpf = Minute per Foot PID = Photolization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/18	1-1-5-7		0.5	Forest Duff Loose, brown and gray SILT and SAND	
			2D		2-4	24/24	9-14-18-22	q _p =9+ ksf	1.5	Hard, brown silty CLAY	
	5		3D		5-7	24/24	6-9-13-19	q _p =9+ ksf			

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-13



BORING LOG

BORING NO.: B-15
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/26/2024
DATE FINISH: 1/26/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 7.0 **LOGGED BY:** Alex Allen
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
At time of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
At Completion of Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
After Drilling V = Field Vane Shear mpf = Minute per Foot PID = Photolonization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD			
			1D		0-2	24/8	18-12-14-17		0.3	Bituminous Pavement (3 inches)
			2D		2-4	24/22	21-11-12-17	ID 30013B w=9.6 % q _p =9+ ksf	2.0	Medium dense, brown sandy silty GRAVEL with occasional cobbles (Base/Subbase) Hard, brown silty CLAY
	5		3D		5-7	24/24	9-10-16-20	q _p =9+ ksf		

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-15



BORING LOG

BORING NO.: B-16
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/26/2024
DATE FINISH: 1/26/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 7.0 **LOGGED BY:** Alex Allen
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
 Water Level
 ▽ At time of Drilling
 ▼ At Completion of Drilling
 ▾ After Drilling
 D = Split Spoon Sample
 U = Thin Walled Tube Sample
 R = Rock Core Sample
 V = Field Vane Shear
 Pen. = Penetration Length
 Rec. = Recovery Length
 bpf = Blows per Foot
 mpf = Minute per Foot
 WOR = Weight of Rods
 WOH = Weight of Hammer
 RQD = Rock Quality Designation
 PID = Photoionization Detector
 S_v = Field Vane Shear Strength, kips/sq.ft.
 q_u = Unconfined Compressive Strength, kips/sq.ft.
 Ø = Friction Angle (Estimated)
 N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/6	20-10-10-16		0.3	Bituminous Pavement (3 inches)	
			2D		2-4	24/22	8-9-11-15	q _p =9+ ksf	2.0	Medium dense, brown silty GRAVEL and SAND with occasional cobbles (Base/Subbase) Hard, brown silty CLAY, some fine sand	
	5		3D		5-7	24/24	10-23-31-37		5.0	Very dense, brown gravelly silty SAND (Glacial Till)	

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-16



BORING LOG

BORING NO.: B-17
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/26/2024
DATE FINISH: 1/26/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 7.0 **LOGGED BY:** Alex Allen
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A / N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No free water observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
 ▽ At time of Drilling
 ▼ At Completion of Drilling
 ▾ After Drilling

D = Split Spoon Sample
 U = Thin Walled Tube Sample
 R = Rock Core Sample
 V = Field Vane Shear

Pen. = Penetration Length
 Rec. = Recovery Length
 bpf = Blows per Foot
 mpf = Minute per Foot

WOR = Weight of Rods
 WOH = Weight of Hammer
 RQD = Rock Quality Designation
 PID = Photolonization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
 q_u = Unconfined Compressive Strength, kips/sq.ft.
 Ø = Friction Angle (Estimated)
 N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD			
			1D		0-2	24/6	9-11-9-16		0.3	Bituminous Pavement (3 inches)
			2D		2-4	24/0	12-7-11-12			Medium dense, brown silty GRAVEL and SAND with occasional cobbles (Base/Subbase)
	5		3D		5-7	24/24	6-8-14-19	q _p =9+ ksf	2.5	Hard, brown silty CLAY

Bottom of Exploration at 7.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-17



BORING LOG

BORING NO.: B-18
SHEET: 1 of 1
PROJECT NO.: 23-0859
DATE START: 1/26/2024
DATE FINISH: 1/26/2024

CLIENT: Hedefine Engineering & Design, Inc.
PROJECT: Proposed Harden Farm Housing
LOCATION: Kebo Street, Bar Harbor, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** N/A **TOTAL DEPTH (FT):** 13.6 **LOGGED BY:** Alex Allen
DRILLING CO.: Seaboard Drilling, LLC **DRILLER:** Ryan Hackett **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:** N/A
HAMMER CORRECTION FACTOR: 1.47 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Probable perched water observed at ground surface

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
 Water Level: ▽ At time of Drilling, ▽ At Completion of Drilling, ▽ After Drilling
 D = Split Spoon Sample, U = Thin Walled Tube Sample, R = Rock Core Sample, V = Field Vane Shear
 Pen. = Penetration Length, Rec. = Recovery Length, bpf = Blows per Foot, mpf = Minute per Foot
 WOR = Weight of Rods, WOH = Weight of Hammer, RQD = Rock Quality Designation, PID = Photoionization Detector
 S_v = Field Vane Shear Strength, kips/sq.ft., q_u = Unconfined Compressive Strength, kips/sq.ft., Ø = Friction Angle (Estimated), N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/10	9-1-1-2				
			2D		2-4	24/10	6-10-14-20	q _p =9+ ksf	2.0		Loose, brown silty gravelly SAND (Fill) Hard, brown silty CLAY, some fine sand
	5		3D		5-7	24/24	7-11-14-20	q _p =9+ ksf			
	10		4D		10-11.4	17/20	4-7-50/5"		8.9		Medium dense brown, gravelly silty SAND with occasional cobbles (Glacial Till)

Refusal at 13.6 feet
(Probable Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-18

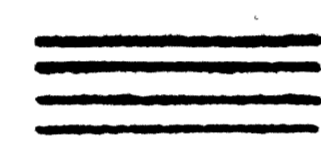
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Appendix C

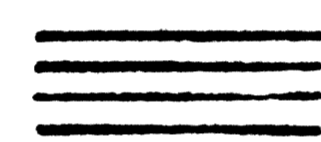
**HARDEN FARM
AS BUILT DRAWING 1962**



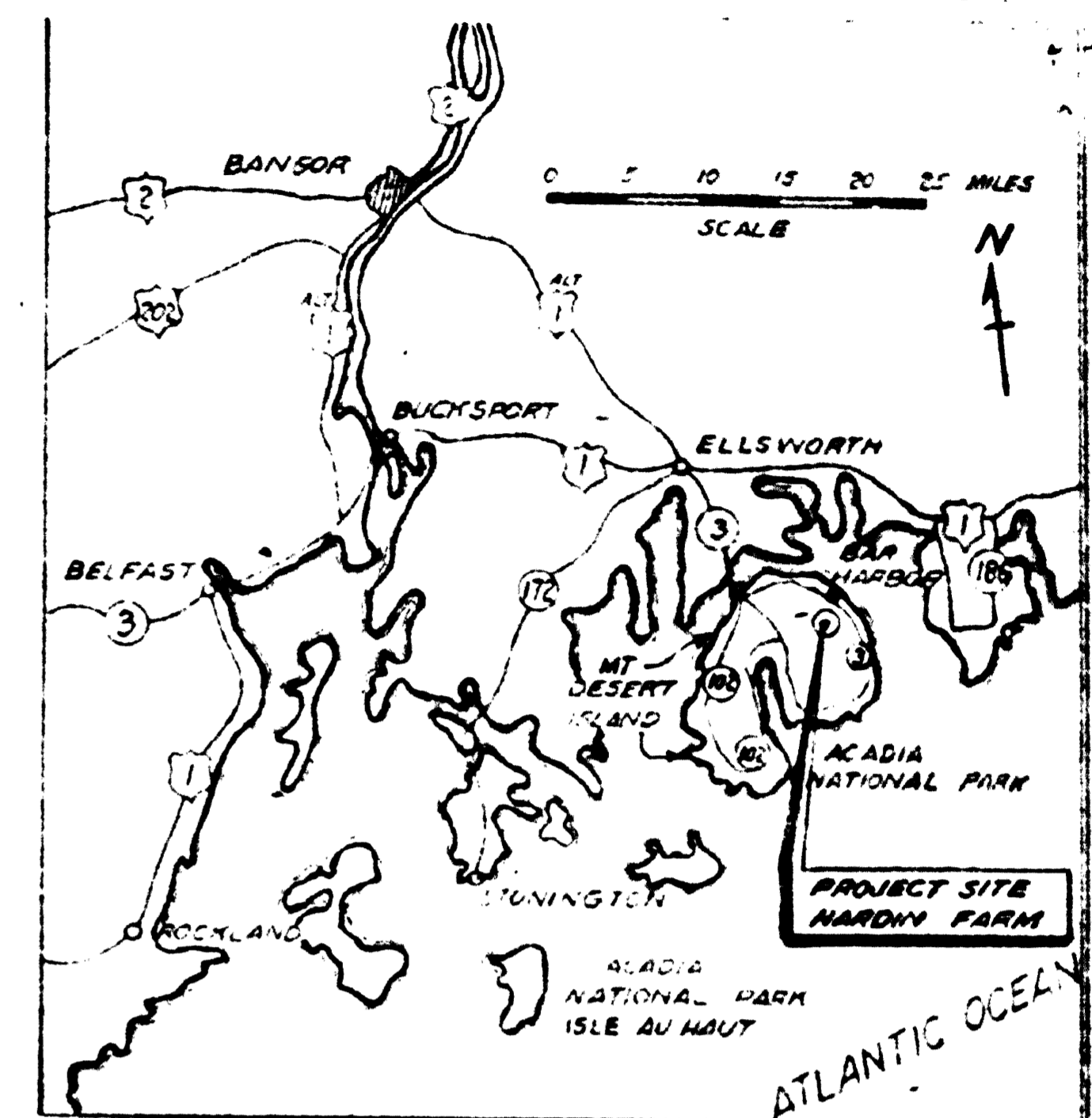
ACADIA NATIONAL PARK MAINE



ROADS & UTILITIES



HARDIN FARM RESIDENTIAL AREA

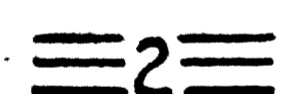


VICINITY MAP

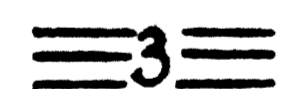
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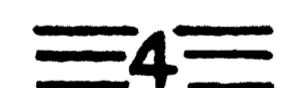
COVER SHEET



SITE PLAN & ROAD DETAILS



UTILITIES DETAILS



ROADS & UTILITIES LAYOUT

EASTERN OFFICE
DIVISION OF DESIGN & CONSTRUCTION
PHILADELPHIA, PENNSYLVANIA

MANCOCK COUNTY

AS BUILT DRAWING

A CHANGED TO AS BUILT DRAWING 10/63 G.O.

DESIGNED BY
NO. NP-ACA 3048
ACT'G. DIR.
GEORGE PALMER REG. DIR.
OCT. 4, 1962
DATE

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
DESIGN AND CONSTRUCTION
EASTERN

ROADS AND UTILITIES
HARDIN FARM RESIDENTIAL AREA
ACADIA NATIONAL PARK 2, MAINE



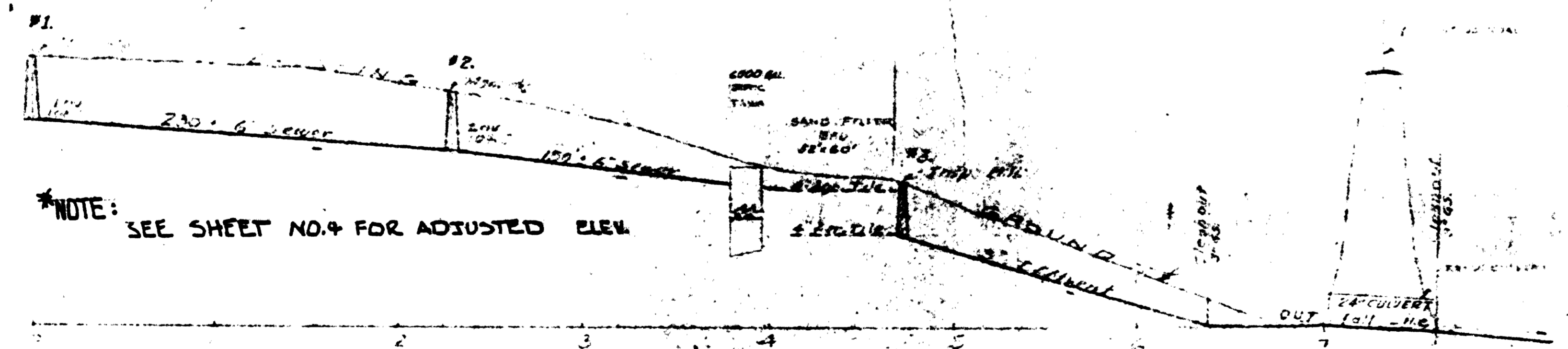
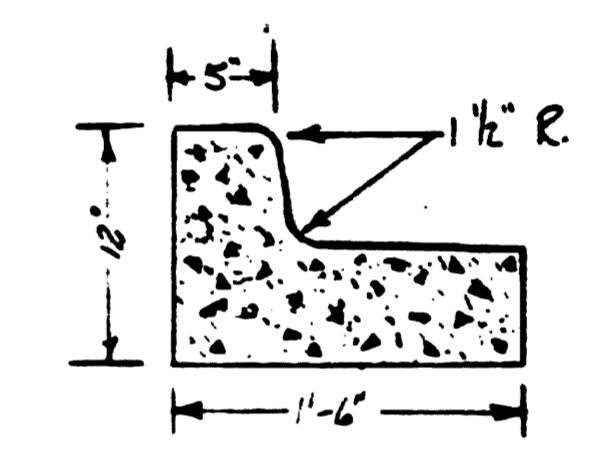
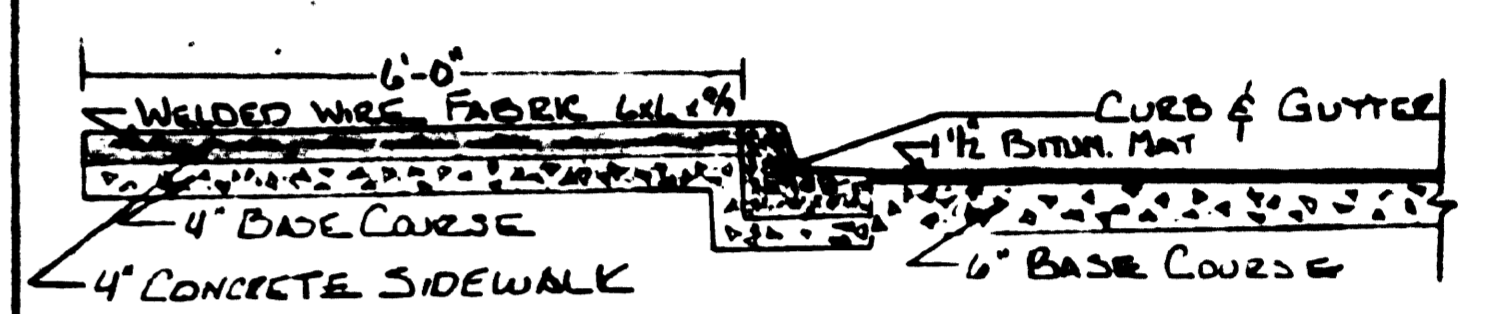
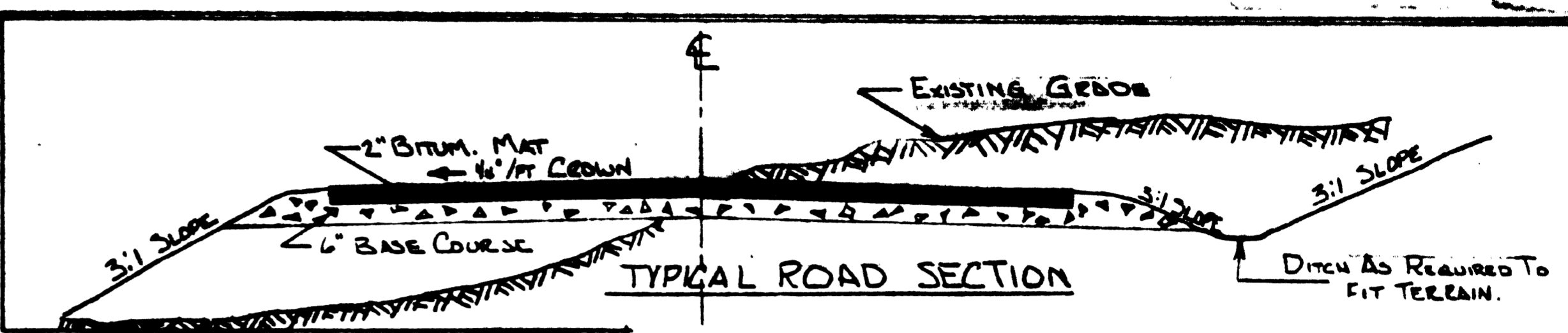
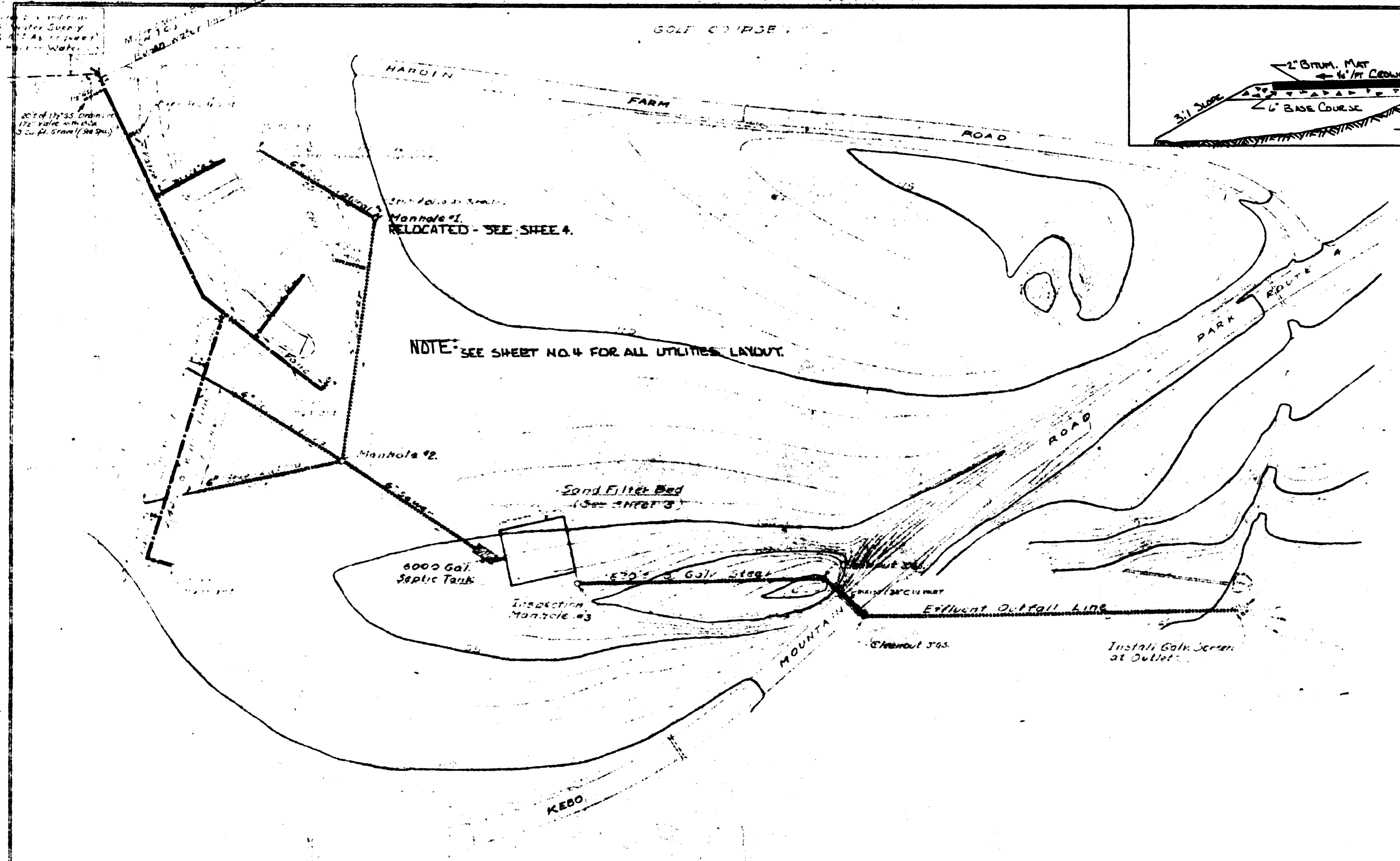
ORIENTATION

PREPARED BY
V. SALADY
DESIGNED BY
F. BOHNSON
DRAWN BY
R.C.



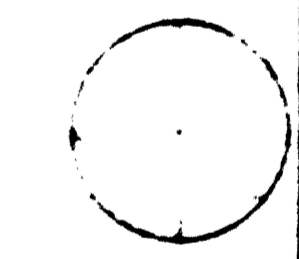
NORTHEAST
NO. NP-ACA 3048
SHEET 1 OF 4
NP-ACA
3101-A
NOV. 2

20' of 1 1/2" SS. Ordin. 17 1/2' Valve with 2 1/2" 3" Cu. Ft. Gravel (20 Sp.)



PROFILE OF SANITARY SEWER

AS BUILT DRAWING



ORIENTATION

PREPARED BY: W. P. ...
CHECKED BY: ...

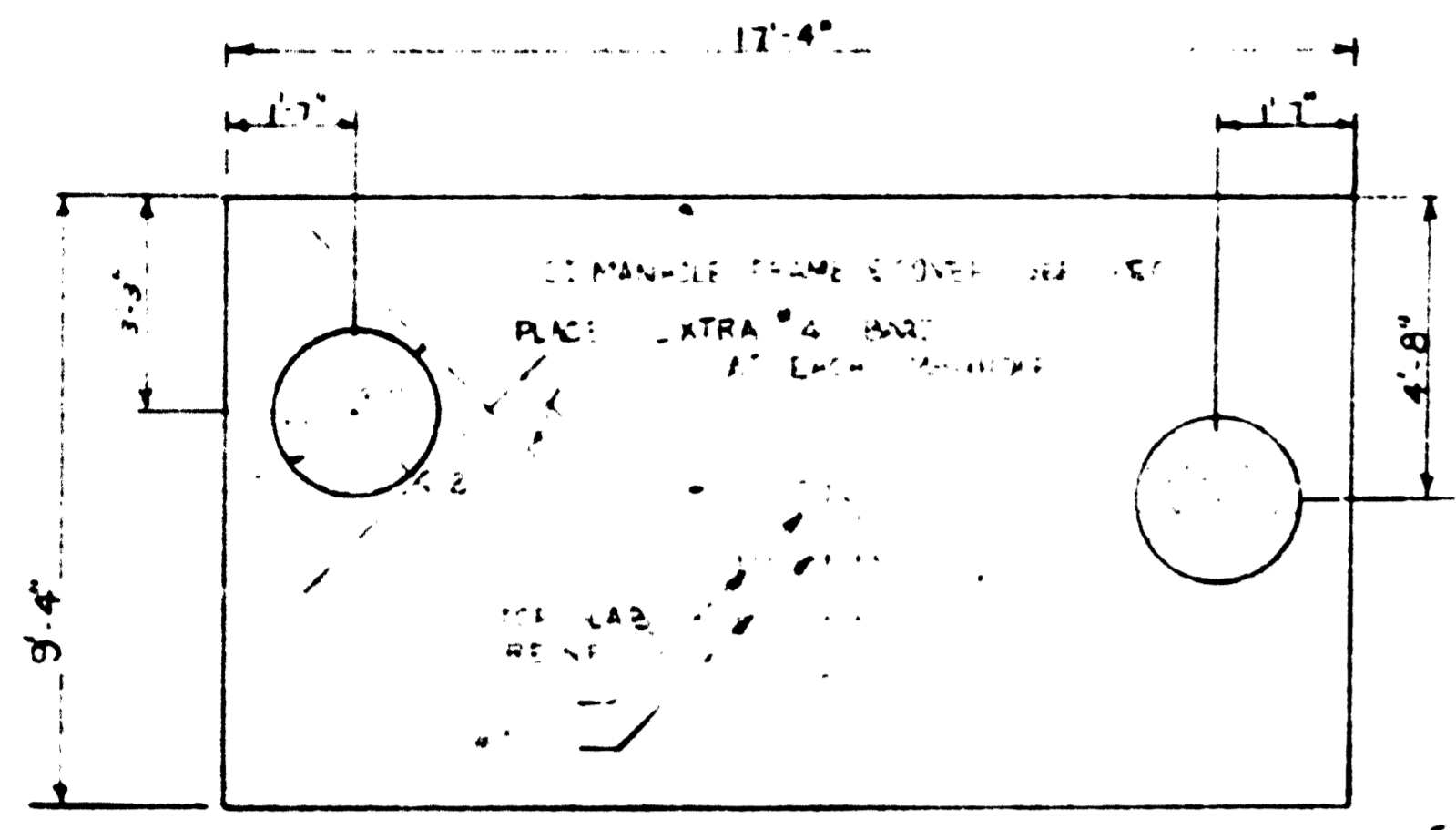
M

MARK	DESCRIPTION OF REVISION	DATE	INITIALS
A	FROM SHEET #4 OF WORKING DRAWINGS	10/15/60	G.D.

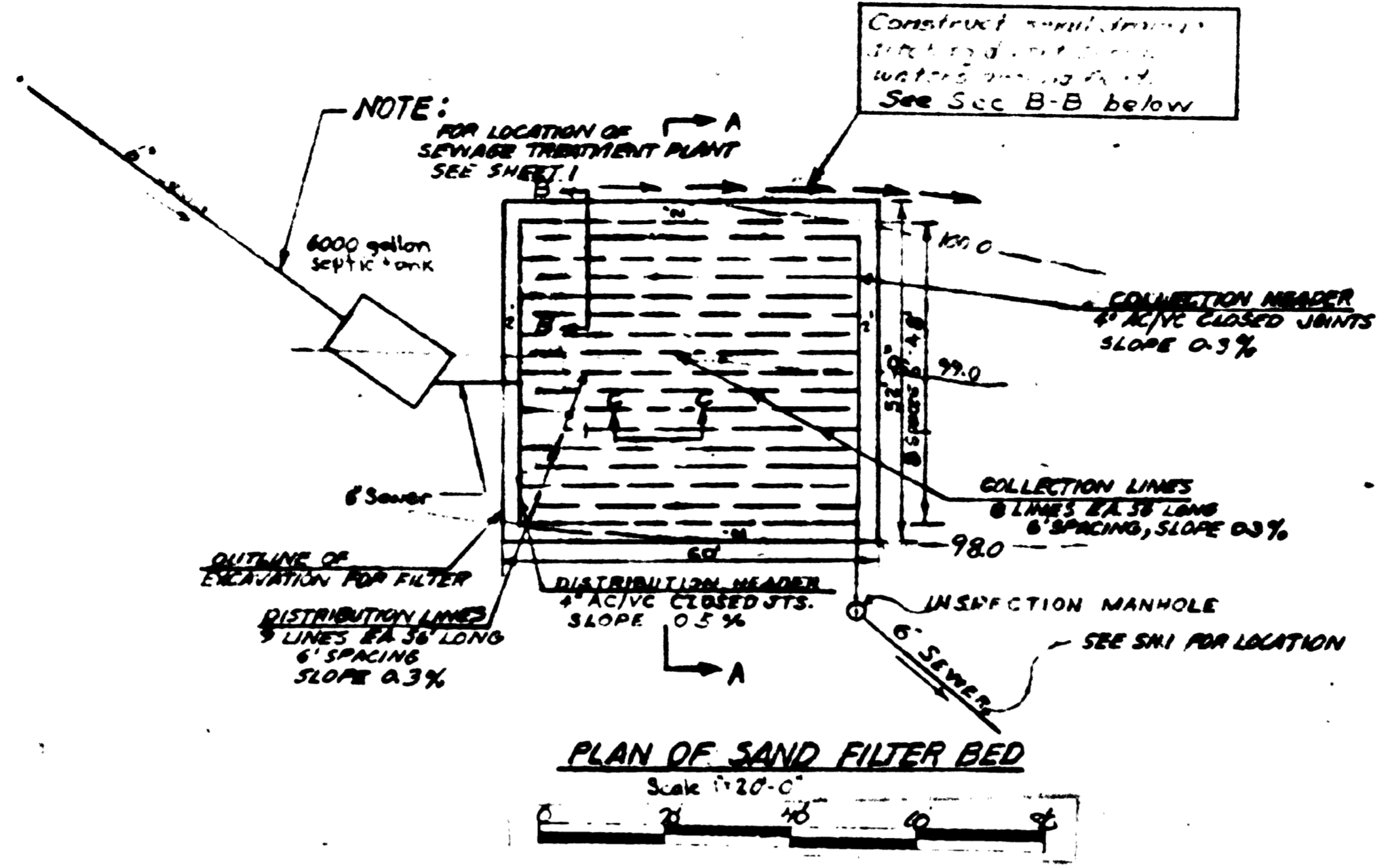
RECOMMENDED APPROVED

BASIC DATA: ...

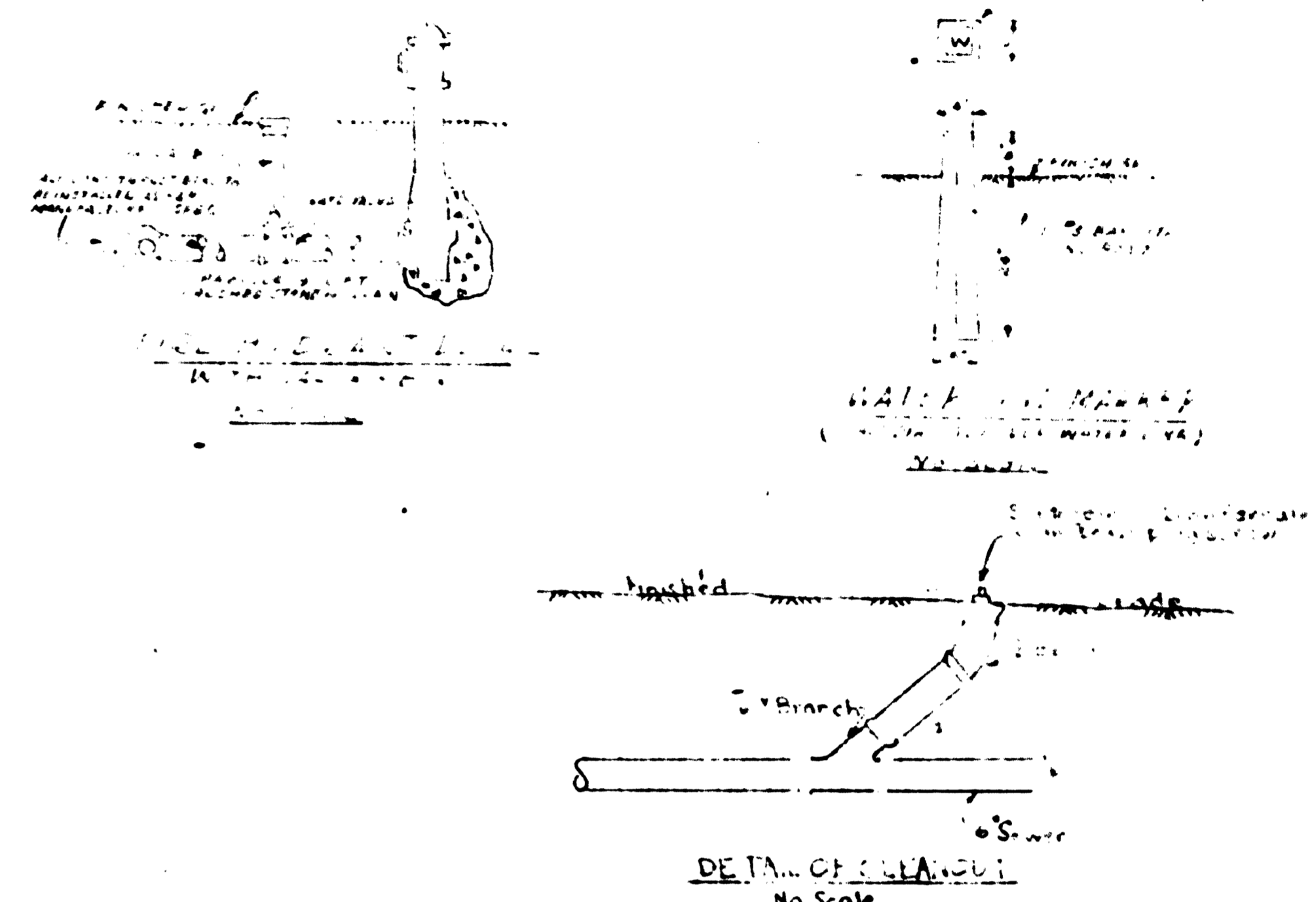
SCALE: 1" = 20'



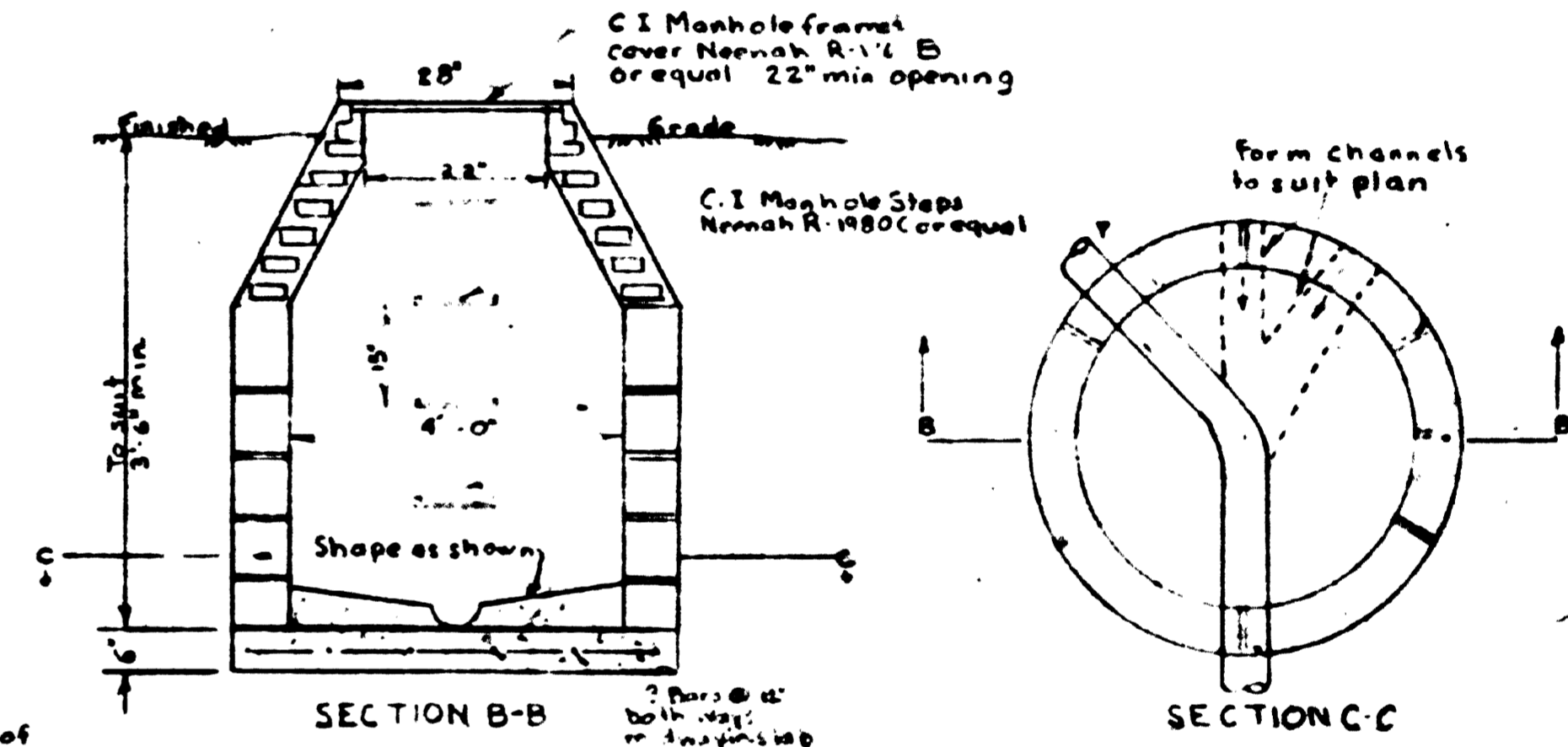
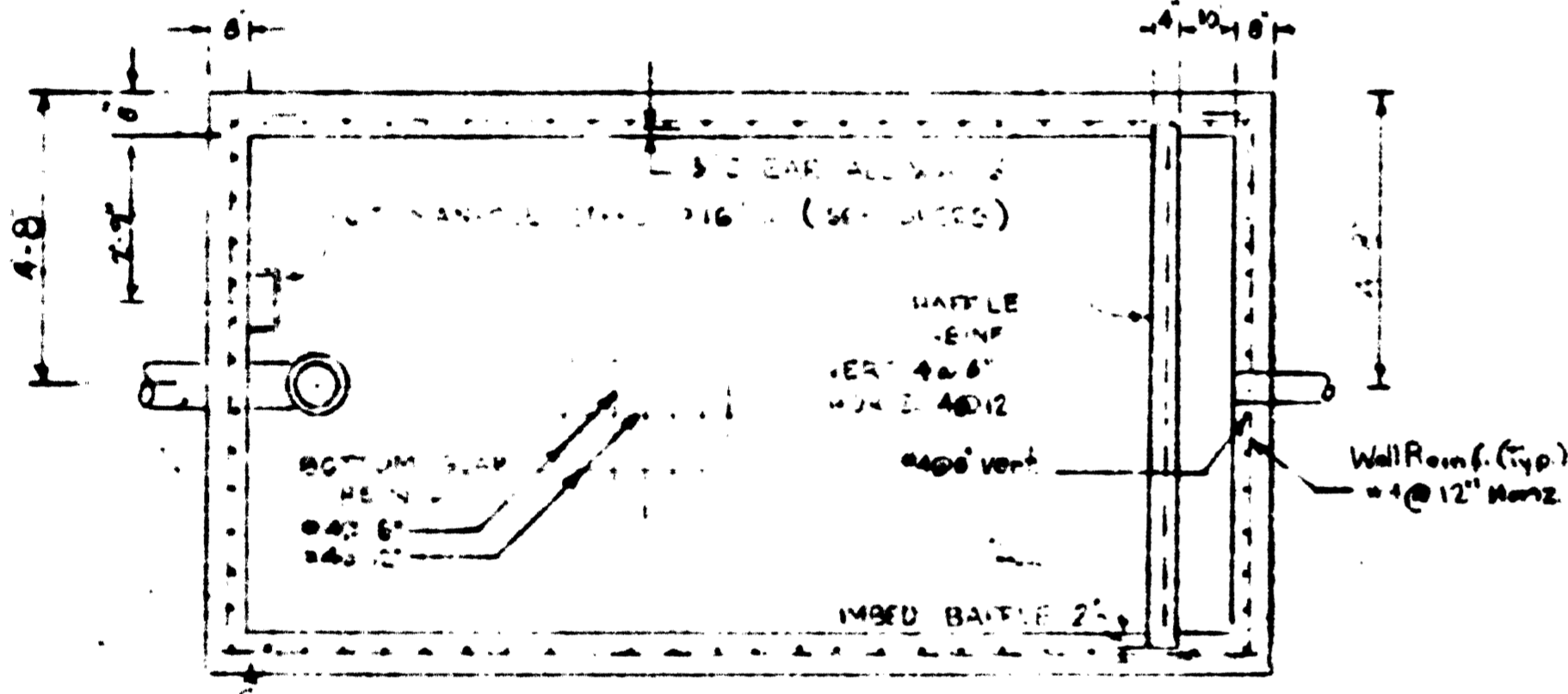
SECTION A-A
PLAN UNDER TOP SLAB
NOT TO SCALE



PLAN OF SAND FILTER BED
Scale 1/20"=1'-0"

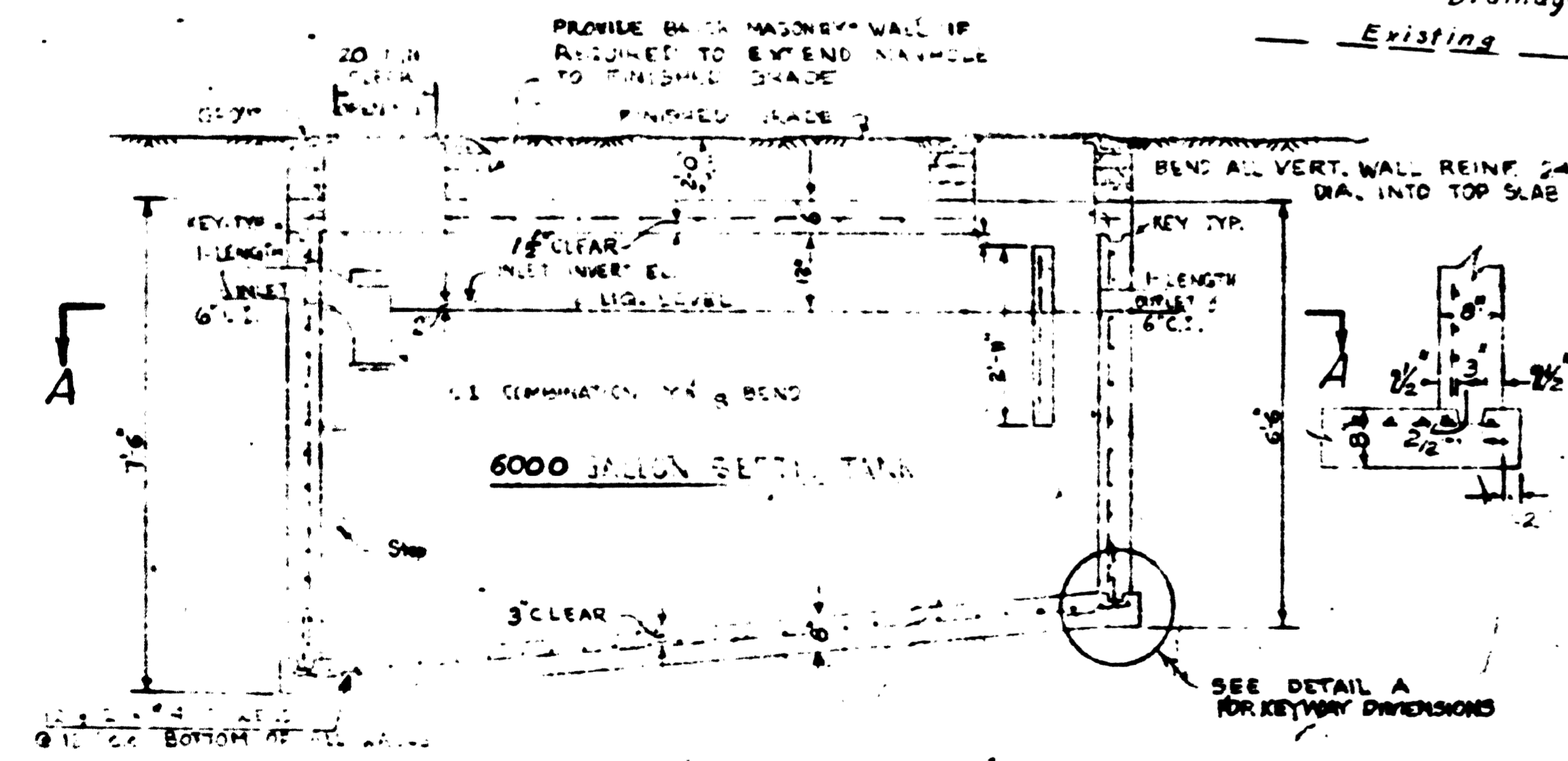


DETAILS OF MANHOLE
No Scale

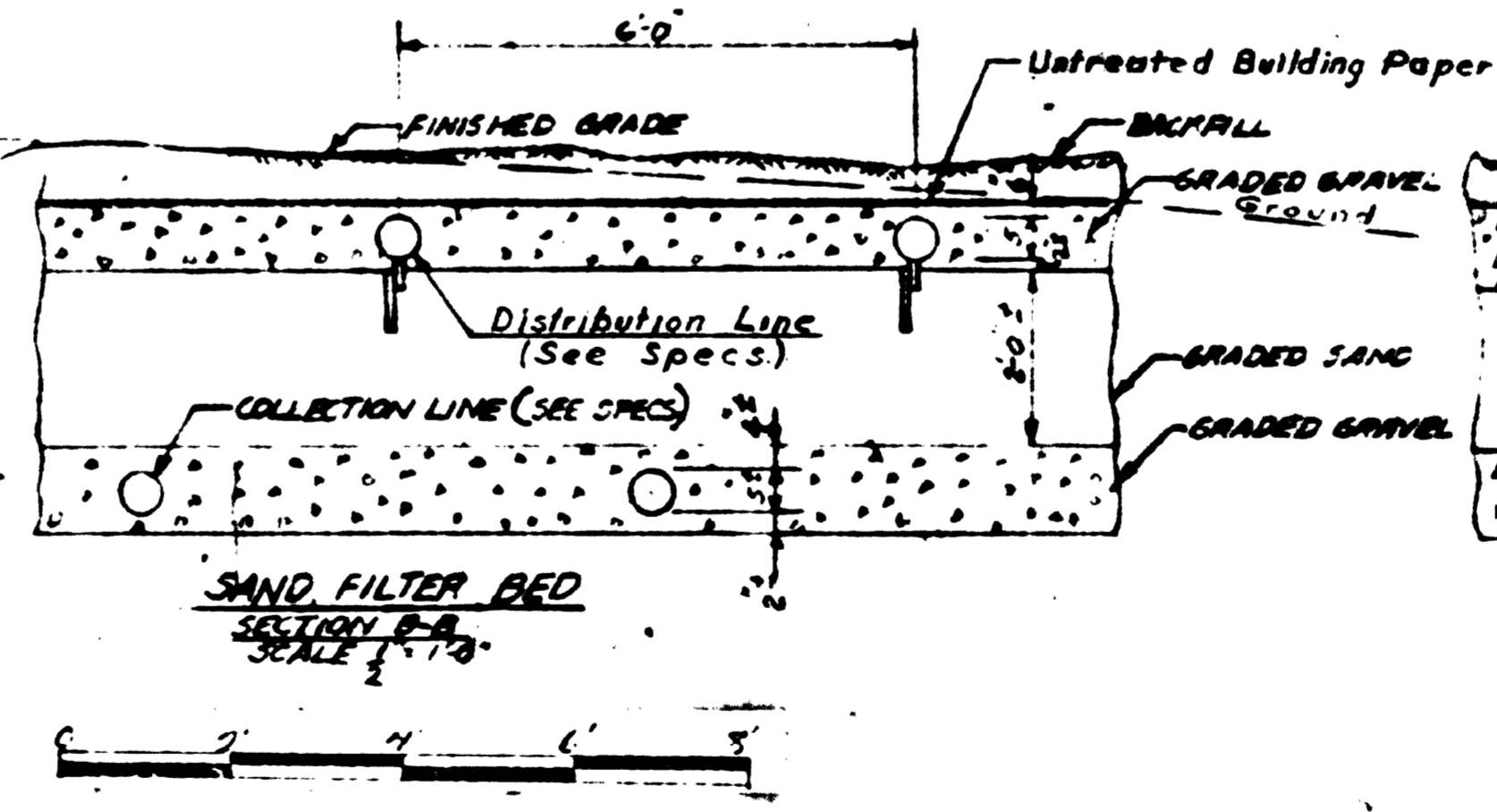


DETAILS OF MANHOLE

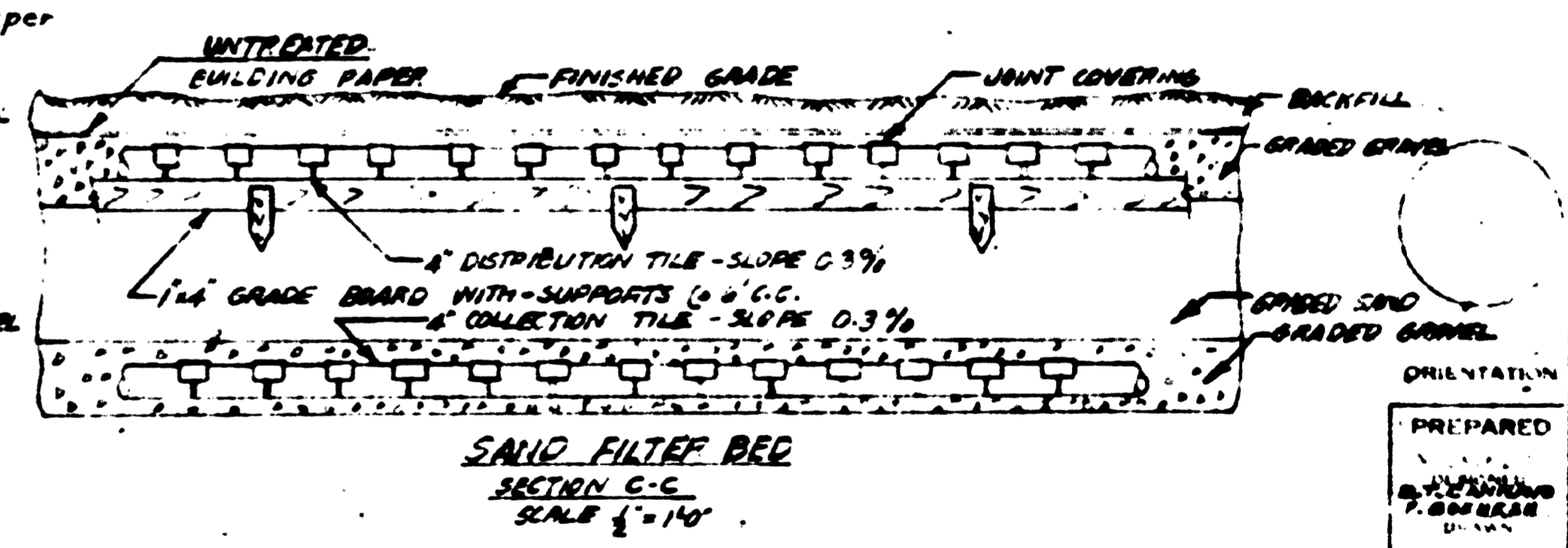
BOND ALL TRANSVERSE WALLS TO TOP SLAB AT JOINTS (SEE SPEC.)



ELEVATION
NOT TO SCALE



SAND FILTER BED
SECTION B-B
SCALE 1/10"



SAND FILTER BED
SECTION C-C
SCALE 1/10"

AS BUILT DRAWING

SCALE AS SHOWN

A CHANGED TO AS BUILT DRAWINGS		DATE	BY
DESCRIPTION OF REVISION			
UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LEGISLATIVE CONSTRUCTION DIVISION			
ROADS AND UTILITIES			
HAR IN FARM ROAD AREA			
ALLEN COUNTY, MAINE			

APPROVED

PREPARED BY
M
NORTHEAST
DRAWING BY
JCA

BASIC DATA

