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GLACIER NATIONAL PARK

REHABILITATE THE POLEBRIDGE AREA WATER SYSTEM

PARK (GLAC)
PMIS NO. 329234B

PROJECT SPECIFICATIONS

NATIONAL PARK SERVICE
December 2025

MONTANA
ABIGAIL
KING
No. 108096PE
LICENSED
PROFESSIONAL ENGINEER

Signed by:
3/17/2026

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SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Work Covered by Contract Documents
2. General Requirements
3. Attachments

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. All field work is located in the Polebridge Ranger Station Area, located in Glacier National Park's northwest corner, approximately 1.0 miles from Polebridge, Montana.

B. Work generally consists of construction of a new public water system that includes a new infiltration gallery, new water storage tank, and new water main or service lines to service area buildings. Four housing units and two administrative buildings will be connected to the new potable water service. A new programmable logic controller, pump control panel, pump protection system, and tank monitoring system will be installed. The chlorination treatment system will remain unchanged. Work also includes the installation of fiber optic lines to five buildings. Refer to the attached Civil Plans.

C. Refer to 01 27 00 Definition of Contract Line Items for a breakdown of Contract Line Items and how bid items are to be split out.

D. All work will be completed under a single prime contract.

1.3 GENERAL REQUIREMENTS

A. Wildlife Protection
   1. Refer to Section 01 35 05 Environmental Protection and Special Controls.

B. Natural Resource Protection
   1. Refer to Section 01 35 05 Environmental Protection and Special Controls for additional requirements.
      a. Imported gravel, rip rap, rock, straw, and other natural materials must be certified weed-free and from a Park-approved source.
      b. Vehicles and equipment shall be cleaned prior to entering the Park.

C. Archeological and Cultural Resource Protection
   1. Refer to Section 01 35 13.22 Archeological Protection.

D. Visitor Management
   1. Incorporate visitor management and traffic control precautions and procedures into the *Safety and Accident Prevention Plan*.

a. The project area interacts with areas used by both visitors and NPS.
b. Visitors have access to the Ranger Station loop area, B#1842 Vault Toilet, the Inside North Fork Road, and the Bowman Lake Road. The majority of traffic that enters the Park at the Polebridge Ranger Station turns north to visit Bowman Lake or Kintla Lake; traffic turning south towards Logging Creek is light. Expect to see moderate visitor vehicle and bicycle traffic on all roads. Visitation typically tails off in early October and is light in the late fall and winter months. The gate beyond the Ranger Station loop typically closes at the first notable snowfall and remains closed until late April, or whenever the roads are free of snow and dried out.
c. Approximately eight NPS employees live and work in the Polebridge housing and maintenance areas. Approximately seven other NPS employees (stationed at Kintla, Bowman, or Logging) use the housing and maintenance areas regularly. All but two employees are seasonal employees and will depart between mid-September to mid-October.
d. Take great caution while operating equipment to prevent hazards to visitors and NPS.

2. The Contractor is responsible for jobsite safety and security. The Contractor shall secure the jobsite to prevent any potential hazards to visitors and NPS staff at all times.
3. Minimize interference with NPS operations, visitors, and traffic near the project area. Coordinate with NPS.

E. Contractor Access to Park and Facilities

1. The Park does not provide lodging or campsites to Contractors. The Contractor shall not set up undesignated camps at (or near) the project site. The Contractor is responsible for arranging their own accommodations.
2. Coordinate with the COR for to obtain a *Commercial Vehicle Non-Recreational Entrance Pass*. An *Entrance Pass* is required to be displayed on the dashboard of all Contractor vehicles. Come to a full stop at the Entrance Station, show the *Entrance Pass* to the Park Ranger at the window, and they will wave you through. *Entrance Passes* are of no cost to the Contractor.
   a. The *Entrance Pass* will be valid for entering the Park at the West Entrance (in West Glacier), Camas Entrance (Camas Road), and the Polebridge Entrance (Polebridge).
3. Coordinate with the COR for access to gates and buildings. The Contractor shall be responsible for safekeeping any loaned keys. The Contractor shall pay to replace lost or damaged keys.
4. Generally, work inside of Park buildings shall be supervised by NPS. Coordinate with NPS.

F. Contractor Use of Utilities

1. Refer to Section 01 50 00 Temporary Facilities and Controls for additional requirements.
2. Utility Access
   a. No Contractor access to electrical service. Bring generators.
   b. No Contractor access to telephone or internet service. Polebridge is far from cell service. The Park will loan a few portable radios for emergency use.
   c. The Contractor may use the potable water service from the Polebridge water system at a rate of $20.936 per 1000 gallons. The Contractor may also obtain water from a fire hydrant in the West Glacier Headquarters area. Refer to Section 01 50 00 Temporary Facilities and Controls for additional requirements.
   d. Surface water may be drafted from Bowman Creek. Refer to Section 01 35 05 - Environmental Protection and Special Controls and Section 01 50 00 Temporary Facilities and Controls for additional requirements.

e. The Contractor may use B#1842 Vault Toilet located in the Maintenance Area through the end of October 2026, on the condition that this facility is kept reasonably clean for visitor and NPS use. Sweep out mud and clean up messes immediately. During the winter, NPS has limited staffing and no practical method to pump out the vault toilet. The Contractor shall use portable toilets for work in the winter months. Vault toilets must be lockable to prevent wildlife access, firmly secured to the ground to prevent tipping, and maintained regularly. Refer to Section 01 35 05 - Environmental Protection and Special Controls for additional requirements.

3. Utility Marking
   a. The Contractor shall notify NPS of any ground disturbing work at least 10 business days in advance. Call Montana 811 **at least five business days in advance** of anticipated ground disturbance. The Contractor shall not proceed with any ground-disturbing work until explicit permission is granted by the COR after all NPS and outside utilities have been marked.
   b. If ground disturbance is imminent in only a portion of the project area, the Contractor shall provide NPS with a map of the exact locations where utility markings are needed.
   c. The Contractor shall ensure that all utilities are properly marked for the duration of ground disturbing work.
   d. The Contractor shall verify the location of underground utilities prior to excavation work. Some utilities may only be locatable by potholing.
   e. All existing utilities shall be protected in place by the Contractor; accidental damage or disruptions shall be remedied immediately at no cost to NPS.
4. Water System Testing and Winterization
   a. Water service connections and main line installation will occur while the Polebridge area buildings are in "winter status."
      1) B#97 Ranger Residence and B#1451 Strissel Cabin are the only buildings that have year-round water service, under normal circumstances. B#1448 Fire Cache, Ranger Storage, Chlorinator has no domestic water service, but the chlorination equipment operates year-round.
      2) B#98 Cabin, B#1454 Laundry and Shower, B#1455 Polebridge Ranger Station, B#1594 Dorm, and B#1865 School to Park Cabin have seasonal water service only. A new yard hydrant will used seasonally.
         a) NPS will winterize the interior fixtures of these buildings.
         b) The Contractor shall drain the water main or service lines to be abandoned or removed, remove the existing water service, make the new water service connection, test the new water lines and fixtures per Section 33 01 12 Testing of Water Distribution, and then fully remove all water from the service lines, main lines, and fixtures that are typically winterized.

G. Contractor Use of Site
   1. Refer to the Civil Plans, Section 01 35 05 Environmental Protection and Special Controls, and Section 01 50 00 Temporary Facilities and Controls

H. Vehicles, Equipment, Parking, and Staging Areas
   1. Refer to the Civil Plans and Staging Areas Exhibit for project limits and staging areas.
   2. Vehicles and equipment shall be cleaned and inspected by NPS prior to entering the Park. Refer to Section 01 35 05 Environmental Protection and Special Controls for additional details.

3. All project vehicles shall be driven at speeds within posted speed limits on existing roads and shall not exceed 20 mph within project boundaries.
4. Hauling vehicles greater than 20,000 gross vehicle weight travelling on approved roads within the Park between sunset and sunrise will be limited to speeds of no more than 10 miles per hour (mph) below the posted speed limit.
5. Comply with all local, State, and Federal loading, hauling, and road restrictions.
   a. Hauling on Camas Road is not permitted. All hauling traffic should take the North Fork Road to Polebridge.
6. Access to the project areas requires use of the following bridges:
   a. North Fork Flathead River Bridge, Glacier Drive
      1) Inventory Rating – 34.0 tons
      2) Operating Rating – 57.0 tons
   b. Bowman Creek Bridge, Inside North Fork Road
      1) Inventory Rating – 21.0 tons
      2) Operating Rating – 36.0 tons
   c. Submit overload and oversize permits for non-legal loads transported within the park boundary to the CO utilizing the FLH Bridge Oversized or overload vehicle permit request form. The Government will make the form available under FAR Clause 52.236-4 – Physical Data. Allow 14 days for review of the permit application.

I. Material Handling and Waste
1. Refer to the Civil Plans, Section 01 35 05 Environmental Protection and Special Controls, 01 74 19 Construction Waste Management and Disposal for additional requirements.
2. The Contractor shall be present to inspect and accept all deliveries. On-site drop off locations may be arranged. NPS will not accept deliveries on the Contractor's behalf – do not ship to an NPS building.
3. All waste must be immediately contained in bear-proof containers or dumpsters. Food waste and construction waste shall not be mixed.

J. Quality Control
1. Refer to 01 40 00 Quality Requirements for additional requirements.
2. All work shall be high quality, professional work. The work performed by each trade shall meet or exceed all quality standards published by their respective trades.
3. Where trades overlap, carefully coordinate work.

K. Safety and Accident Prevention
1. Refer to Section 01 35 05 Environmental Protection and Special Controls and Section 01 35 23 Safety Requirements.

L. Fire Prevention and Protection
1. Refer to Section 01 50 00 Temporary Facilities and Controls for additional requirements.
2. Should the Park enter Stage 2 Fire Restrictions during the period of performance, the contractor may be required to obtain a Stage 2 Fire Restriction Exemption Permit from the GLAC Fire Management Office. Additional firefighting tools may be required to be readily available during work.

M. Weather and Snow
1. Road Access
   a. Polebridge is accessible year-round via the North Fork Road through Columbia Falls, MT. Expect the North Fork Road to be icy, bumpy, and slow-moving during the winter months. Travelers must be prepared.

b. Polebridge is accessible from West Glacier, MT via Camas Road until the first significant snowfall, typically in November or December, forces a closure of Camas Road.

2. Snow
   a. The Inside North Fork Road or Bowman Lake Road are not plowed by NPS. These roads typically close to visitor vehicle traffic at the first significant snowfall and will not open until April or May, or whenever the roads are free of snow and dried out.
   b. NPS typically plows snow around the Ranger Station loop, Maintenance Area, and Housing Area. Please coordinate with NPS on the location of snow piles to avoid interference with work.
   c. Please note that snow removal performed by NPS may not be immediate – the Contractor may have to remove snow to continue working in an area.
3. Rain and Creek Flows
   a. October and November can be extremely wet months. Expect a sharp increase in the flow of Bowman Creek in October. Bowman Creek flows year-round.

N. Work Phases, Anticipated Timelines, and Work Schedules

1. The following work shall be allowed in each timeframe:
   a. Beginning on or later than August 3, 2026:
      1) Mobilization
      2) Vegetation clearing (note – please coordinate with NPS to survey the area for nesting birds prior to any vegetation clearing)
      3) Installation of temporary erosion control measures
      4) Work in the Chlorination Room of B#1448 Fire Cache, Storage, and Chlorinator Building that can be performed without interrupting the existing water system's operation

   b. Beginning on or later than August 17, 2026:
      1) Installation of the new infiltration gallery; disturbed area restoration work.
      2) Installation of water supply, main, and service lines in housing and maintenance areas and up the hill to the Inside North Fork Road; disturbed area restoration work.
      3) Electrical and communications related work in the housing and maintenance areas.

   c. Beginning on or later than October 3, 2026:
      1) Disruption of potable water service to all buildings served by the existing system, including demolition of existing water system infrastructure.
      2) Water tank installation work; disturbed area restoration.
         a) The Contractor may close the Inside North Fork Road from B#1455 Ranger Station heading south towards Logging Creek for this work. The Contractor shall allow emergency vehicle traffic to pass through immediately, and other administrative traffic to pass through with a delay.
      3) Installation of water supply, main, and distribution between the new water infiltration gallery, in front of B#1455 Ranger Station, and to B#1448 Fire Cache, Storage, and Chlorinator Building; road restoration work.
         a) NPS will not collect fees at the window of B#1455 Ranger Station during this time.
         b) Phase trenching work and set up temporary traffic control such that vehicle access to the Inside North Fork Road is available at all times.

The Contractor shall close one side of the loop around B#1455 Ranger Station and allow two-way traffic to pass through the other side of the loop to allow vehicle traffic to and from the Inside North Fork Road. A maximum 15-minute traffic delay will be allowed. The Contractor shall allow emergency vehicle traffic to pass through immediately.

c) The Contractor should complete this trenching work in 10 working days or less. Coordinate with NPS at least two weeks prior to the anticipated closure.

4) Installation of water main lines, electrical lines, and communications lines along the Inside North Fork Road

a) This work requires a full closure of the Inside North Fork Road to all visitor and NPS vehicle traffic between the Ranger Station Area and the water tank area. NPS will stage a vehicle to the south of the water tank area and will access the vehicle by foot, if necessary. Please coordinate with NPS.

b) The Contractor should complete this trenching work in 10 working days or less. Coordinate with NPS at least two weeks prior to the anticipated closure.

c) Handhole installation work and road restoration work may be completed outside of this 10 working day trenching window, provided that the road is passable to NPS administrative traffic. A maximum 15-minute traffic delay will be allowed for road restoration work. The Contractor shall allow emergency vehicle traffic to pass through immediately.

d. No later than April 18, 2026:

1) Water service available for seasonal housing units (note – this date may be later in April or early May based on the move-in dates of 2026 seasonal employees).

di. Approximately May 1, 2026

1) North Fork area roads typically open to visitor vehicle traffic in early May, depending on weather and road conditions. Work in front of B#1455 Ranger Station and all road restoration work on the Inside North Fork Road shall be completed by early May.

dii. No later than May 14, 2027:

1) Potable water service to the Ranger Station shall be available by May 16, 2027.

diii. No later than June 21, 2027:

1) Substantial completion for all work.

2. Potable water is required to support the following NPS permanent residences, seasonal residences, and administrative buildings.

Only two buildings, B#97 Ranger Residence and B#1451 Strissel Cabin, have potable water service year-round under normal circumstances. After the October 3, 2026 date at which the Contractor is allowed to interrupt potable water service to all buildings, NPS Law Enforcement personnel will likely occupy these residences during their regularly

scheduled work days, but not on their off days. NPS personnel will bring their own potable water jugs while potable water service is not available.

The Contractor should prioritize restoring potable water service to B#97 Ranger Residence and B#1451 Strissel Cabin for the convenience of NPS. Please seek to restore potable water service to these buildings in less than 60 days.

For seasonal residences, the *2026 Potable Water Close Date* is the latest planned date for 2026 seasonal employees to move out; the 20*27 Potable Water Open Date* is the earliest expected date for 2027 seasonal employees to move in. These dates may vary slightly; coordinate with NPS.

Building	Type	2026 Potable Water Close Date	2027 Potable Water Open Date
B#97 Ranger Residence	Permanent Residence	Year-Round Use; potable water supply may be interrupted after October 3, 2026. The Contractor should prioritize restoring potable water service in less than 60 days.	
B#98 Cabin	Seasonal Residence	No later than October 3, 2026	April 18, 2027 (anticipated)
B#1451 Strissel Cabin	Permanent Residence	Year-Round Use; potable water supply may be interrupted after October 3, 2026. The Contractor should prioritize restoring potable water service in less than 60 days.	
B#1454 Laundry and Shower	Administrative	No later than October 3, 2026	April 18, 2027 (anticipated)
B#1455 Ranger Station	Administrative	September 8, 2026	May 14, 2027
B#1594 Dorm	Seasonal Residence	No later than October 3, 2026	April 18, 2027 (anticipated)
B#1865 School to Park Cabin	Seasonal Residence	No later than October 3, 2026	April 18, 2027 (anticipated)

3. Work shall generally be performed from 7 am to 6 pm, Monday to Friday. If the Contractor desires to work outside of these hours or on weekends and holidays, the Contractor shall submit a written narrative that outlines the work to be performed to the CO and COR for their approval at least two business days in advance of the anticipated work.

1.4 ATTACHMENTS

1. Civil Plans
2. Project Specifications
3. Polebridge Ranger Station Land Survey
4. Geotechnical Report
5. Site Photos
6. As-Built Drawings (1980, 1989, 1996, 2001, 2007)

SECTION 01 27 00 – DEFINITION OF CONTRACT LINE ITEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section explains, in general, how bidders shall break their prices out into separate work items to allow NPS to evaluate bid prices.

B. Measurement for payment will be based on percentage complete of items included in an approved schedule of values for these items.

C. Progressive payments will be made based on percent complete of the contract lump sum price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF CONTRACT LINE ITEMS

A. CLIN 10: Water System Improvements. Provide a price for each of the following Sub-CLIN items associated with CLIN 1.

1. Sub-CLIN 10.1 - Distribution System
   a. This sub-item consists of construction of the following items:
      1) All trench excavation, shoring, dewatering, pipe bedding, flowable fill, water pipes, tracer wire, detectable warning tape, foam insulation, trench backfilling, and related work.
      2) All fittings, valves, curb stops, fire hydrants, blowoff hydrants, yard hydrants, low point drains, and related appurtenances throughout the project area.
      3) All conduit, wiring, and handholes for the water control system between the infiltration gallery, Chlorination Room, and water tank.
      4) Testing, disinfection, means for flushing and bleeding air from the water lines.
      5) Existing pipe, curb stop, fire hydrant, valve, and related demolition work.
      6) All gravel road restoration work.
      7) All landscaped or vegetated area restoration work.
      8) Temporary facilities including traffic control.
      9) All mobilization, materials, tools, equipment, labor, and performance of all work necessary or incidental for the completion of this item.
2. Sub-CLIN 10.2: Infiltration Gallery
   a. This item consists of construction of the following items:
      1) All demolition of the existing infiltration gallery, valve vault, electrical breaker, tree removals, vegetation removals, and related removals work near the infiltration gallery.
      2) All excavation, shoring, dewatering, bedding, and backfilling related work at the infiltration gallery.

3) All infiltration gallery casement pipe, infiltration pipe, geotextile fabric, and similar work.
4) All area restoration work.
5) All mobilization, materials, tools, equipment, labor, and performance of all work necessary or incidental for the completion of this item.

3. Sub-CLIN 10.3: Water Tank
   a. This item consists of construction of the following items:
      1) All existing water tank demolition work.
      2) All excavation, shoring, dewatering, bedding, and backfilling related work.
      3) All water tank installation related work.
      4) All water tank overflow and drain line related work.
      5) All mobilization, materials, tools, equipment, labor, and performance of all work necessary or incidental for the completion of this item.
4. Sub-CLIN 10.4: Control System
   a. This item consists of construction of the following items:
      1) Demolition of existing system controls inside of B#1448 Fire Cache, Storage, and Chlorination Building.
      2) Replacement of the propane heater in the Chlorination Room.
      3) All pump control panel, pump protection system, programmable logic controller, and hypochlorite feed pump related work.
      4) All mobilization, materials, tools, equipment, labor, and performance of all work necessary or incidental for the completion of this item.

B. CLIN 20: Fiber Optics
   1. This item consists of construction of the following items:
      a. Material and installation costs of conduit, fiber optic cable, and detectable warning tape.
         1) Where the fiber optic conduit is placed in the same trench as water lines, exclude trench excavation, bedding, backfilling, and handhole related work from CLIN 2 – the cost of this work should be included in CLIN 1.
         2) Where the fiber optic conduit is not placed in the same trench as water lines, include the cost of trench excavation, bedding, backfilling, and restoration work in CLIN 2.
      b. All fiber optic building connection related work.
      c. All mobilization, materials, tools, equipment, labor, and performance of all work necessary or incidental for the completion of this item.

END OF SECTION 01 27 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Definitions
2. Construction Coordination
3. Submittals
4. Requests for Information (RFIs)
5. Project Meetings
6. Environmental Coordination
7. Permits

B. Related Requirements:

1. Section 01 32 16 "Construction Schedule" for preparing and submitting Contractor's construction schedule.

2. Section 01 35 05 "Environmental Protection and Special Controls" for coordinating environmental requirements of the Contract.
3. Section 01 73 40 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
5. Section 01 79 00 "Demonstration and Training" for coordinating training requirements for Government staff on new equipment.

1.2 DEFINITIONS

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

1.3 CONSTRUCTION COORDINATION

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

1. Schedule construction operations in sequence required to obtain best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of components, including mechanical and electrical.
5. Properly plan construction operations to include permit requirements. Allow enough time to execute permit provisions to maintain work schedule, site visits, inspections, and reporting deadlines.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Refer to 01 40 00 "Quality Requirements".
2. Provide Method of Procedure for all outages and coordination with NPS; provide step-by-step procedure, timelines, and critical involvement required by Contractor and NPS.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to:

1. Preparation of Contractor's Construction Schedule
2. Preparation of the Schedule of Values
3. Installation and removal of temporary facilities and controls
4. Delivery and processing of submittals
5. Progress meetings
6. Permit requirements
7. Pre-installation conferences
8. Project closeout activities
9. Commissioning activities

1.4 SUBMITTALS

A. Division 1 documents:

1. Letter designating Project Superintendent
2. Construction Schedule
3. Schedule of Values
4. Accident Prevention Plan
5. A List of Subcontractors for this project
6. Written statements from Subcontractors certifying compliance with applicable labor standard clauses
7. Certificates of Insurance and Standard Form SF1413 for Contactor and all Subcontractors
8. Waste Management Plan
9. Quality Control Plan
10. Temporary Storm Water Pollution Prevention Plan (SWPPP)
11. List of Required Construction Permits. Include the following information for each permit:

a. Name of Permit
b. Agency(ies) with Jurisdiction issuing the permit
c. Information required from Government to complete permit application

B. Provide items listed to Contracting Officer at least one week prior to Pre-Construction Conference, or as directed by Contracting Officer.

1. Failure to submit items may result in:

a. Construction conference may be cancelled, Notice to Proceed may not be issued, and Contracting Officer will consider other contractual remedies.
b. Work shall not commence until written Notice to Proceed has been issued and Certificates of Insurance and SF1413 documents are received for Contractor and all Subcontractors.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of Contract Documents, Contractor shall prepare and submit an RFI to the Contracting Officer.

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

1. RFI number, numbered sequentially
2. Date
3. RFI subject
4. Specification Section number and title and related paragraphs, as appropriate.
5. Drawing number and detail references, as appropriate.
6. Field dimensions and conditions, as appropriate.
7. Contractor's suggested resolution: If Contractor's suggested resolution impacts Contract Time or Contract Sum, Contractor shall state impact in RFI.
8. Contractor's signature
9. Requested date for response
10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

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

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

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

1.6 PROJECT MEETINGS

A. Preconstruction Conference: Before start of construction, Contracting Officer will arrange a meeting with Contractor. The meeting agenda will include the following, at minimum:

1. Roles & Responsibilities / Lines of Authority
2. Park rules and regulations
3. Jobsite Safety
4. Coordination of Subcontractors
5. Labor law application
6. Modifications
7. Payments to Contractor
8. Payroll reports
9. Notice to proceed
10. Correspondence procedures
11. NPS/DSC Project website
12. Acceptance/rejection of work
13. Progress meetings
14. Submittal procedures
15. Environmental requirements
16. Permit requirements
17. As-constructed drawings/operation and maintenance (O&M) manuals.
18. Saturday, Sunday, holiday, and night work.
19. Reference materials
20. Value engineering
21. Schedule of Values

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

1. Attendees: In addition to Government Representatives, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Meeting agenda will include:
   a. Submittal status
   b. Review of off-site fabrication and delivery schedules.
   c. Requests for information (RFI) and other issues.
   d. Modifications
   e. Work in progress and projected.
   f. Inspections of work in progress and projected
   g. Construction Schedule update
   h. Status of Project Record Drawings and O&M manuals
   i. Other business relating to work
   j. Permit requirements

1.7 ENVIRONMENTAL COORDINATION

A. Contractor's Environmental Manager: Designate on-site party responsible for overseeing Contractor's conformance to environmental goals for project and implementing procedures for environmental protection. The Environmental Manager may be the same person as the Site Superintendent or Quality Control Manager.

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

a. Implementation of the project specific elements in the NEPA. See Section 01 35 35 "Environmental Protection and Controls" for a copy of the NEPA.

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

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

1. Quality Requirements
2. Regulatory Requirements
3. Temporary Storm Water Pollution Prevention Environmental Management
4. Construction Waste Management

C. Contractor's Environmental Training: Contractor shall provide environmental training for workers performing work on the project site. Training shall include:
1. Overview of environmental issues related to Project.
2. Review of site-specific procedures and management plans:

a. Wildlife Safety in accordance with trainings provided by the Park

b. Construction Waste Management
c. Temporary Storm Water Pollution Prevention

1.8 PERMITS

A. General:

1. Permits and Responsibilities: Contractor shall, without additional expense to the Government, be responsible for obtaining necessary licenses and permits, and for complying with Federal, State and municipal laws, codes, and regulations applicable to the performance of the work. Contractor shall also be responsible for damages to persons or

property that occur as a result of Contractor's fault or negligence; and for materials delivered and work performed until completion and acceptance of the work.

2. For the purpose of this contract, Contractor will not be considered an agent of the Government. Contractor shall comply with appropriate Federal, State and local laws.

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

1. MT DEQ, Permit to Construct. No additional terms and conditions outside of these construction documents.

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

1. Stormwater Pollution Prevention Permit (SWPPP) – EPA
   a. Developing a Stormwater Pollution Prevention Plan (SWPPP) | US EPA
2. MT DEQ Permits
   a. (Water Permitting and Operator Assistance | Montana DEQ)
      1) Stormwater Pollution Prevention Plan – MT DEQ (Must submit SWPPP to both agencies.)
      2) Construction Dewatering Permit – MT DEQ
3. Oversize/Overweight Transportation Permit – Montana Dept of Transportation
   a. Online Permits & Licenses | Montana Department of Transportation (MDT)
4. Well Construction/Abandonment Notification – MT DEQ

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

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

E. Administrative Procedures:

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

END OF SECTION 01 31 00

SECTION 01 32 16 – CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Section consists of Construction Schedule requirements including:
   1. Construction Schedule
   2. Construction Schedule Updates

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

1.2 SUBMITTALS

A. Construction Schedule: After contract award and before Pre-Construction conference, submit a copy of the construction schedule using a Gantt Chart or similar methodology. List all major construction items. Note long lead time items, schedule restrictions, closures, and utility interruptions.

B. Three-Week Look Ahead: Prior to every regular construction progress meeting, provide a Three-Week Look Ahead Schedule to provide the anticipated schedule of activities. Note closures, utility interruptions, and when the Contractor needs access to NPS facilities.

C. Construction Schedule Updates: If there are major revisions to the Construction Schedule, provide an updated schedule that includes revised dates for all remaining work items.

END OF SECTION 01 32 16

SECTION 01 32 33 – PHOTO DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for:

1. Existing condition images
2. Periodic construction images

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

1.2 SUBMITTALS

A. Construction Images: Submit images electronically within 14 days of taking the image. Include:

1. Date, time, and number (sequentially number all images).
2. Description of vantage point, indicating location, direction.
3. Submit digital images exactly as originally recorded in digital camera, without alteration.

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

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

PART 2 - EXECUTION

2.1 CONSTRUCTION IMAGES

A. General: Take digital images using the maximum range of depth of field, in-focus, to clearly show the Work. No blurry or out-of-focus areas accepted.
   1. Maintain one set of images accessible in field office at Project site available for reference.

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

1. Flag construction limits before recording construction images.
2. Take images to show existing conditions adjacent to property before starting Work as follows:
   a. Images every 50 feet along pipeline alignments to capture both sides of the alignment.
   b. Images of every existing visible appurtenance (i.e. hydrant, meter pit, vault)
   c. Images of existing surface features, hardscapes, surface improvements or construction obstructions.
   d. Images of existing buildings adjacent to or affected by construction.

e. Images of facilities proposed for demolition or modifications, from all sides.
f. Images of areas proposed for new facility construction (wells, buildings, appurtenances, tanks, etc.)

C. Periodic Construction Images: Take a minimum of 25 color, digital images weekly, 5 per day per work area. Select vantage points to show the status of construction and progress since the last images were taken.

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

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

a. Immediate follow-up when on-site events result in construction damage or losses.
b. Fabrication locations away from Project site.

END OF SECTION 01 32 33

SUBMITTAL			REQUIREMENTS(indicate with an "X")								A/E REVIEW TIME (indicate number of hours)						
			INFORMATIONAL				ACTION										
Spec. Sec.	Par. No.	Description	CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS	PERMITS	SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS	FIELD REPORTS	ARCH (hrs)	CE (hrs)	SE (hrs)	ME (hrs)	EE (hrs)	PM - Coor. (hrs)	LA (hrs)
Division 1																	
01 31 00	1.4	Letter designating Project Superintendent		X													
		Construction Schedule		X													
		Schedule of Values		X													
		Accident Prevention Plan		X													
		List of Subcontractors for this Project		X													
		Written Statements from Sub Certifying Compliance		X													
		Certificates of Insurance for Contractor and Subs		X													
		Waste Management Plan		X													
		Quality Control Plan		X													
		SWPPP and Permit		X													
01 32 33	1.3	Pre-construction & Pre-demolition Videos (digitals)								X							
01 35 05	1.3	Spill Prevention and Response Plan		X													
01 40 00	1.4	Quality Control Plan		X													
		Qualification Data		X													
		Contractor's Quality Control Daily Reports		X													
		Test Reports		X													
		Off-Site Inspection Reports		X													
		Permits, Licenses and Certificates		X		X											
01 43 33	1.03	Testing Forms								X							
01 57 23	1.3	SWPPP and Permit		X													
		Inspection Schedule		X													
		Erosion Control Products			X												
01 67 00	1.3	Environmental Data (for specified products)	X														
		MSDS's Sheet (only for products listed in this Section)	X														
		Chain of Custody (only for products listed in this Section)	X														
01 74 19	1.2	Waste Management Plan and required submittals		X													
01 78 23	1.3	O and M Manual		X													
Division 2																	
02 41 16	1.5	Proposed Protection Measures		X													
		Schedule of Demolition Activities		X													
		Pre-demolition Video								X							
		Detail and Descriptions of Temporary Equipment		X													
Division 3																	
03 30 00	1.6	Concrete Mix Design	X														
		Concrete Mix Results	X														
		Concrete Mix Admixtures	X														
		Concrete Delivery		X													
Division 26																	
26 00 00	2.1	Conduit					X		X	X							
	2.2	Conduit Support					X		X	X							
	2.3	Outlet and Device Boxes					X		X	X							
	2.4	Pull and Junction					X		X	X							
	2.5	Junction Boxes					X		X	X							
	2.10	Wire and Cable					X		X	X							
	2.11	Wiring Devices					X		X	X							
	2.14	Surge Protection					X		X	X							
26 05 26	2.2	Grounding Conductors					X		X								
	2.3	Connector Products					X		X								
	2.4	Ground Rods					X		X								
26 05 29	2.2	Supporting Devices					X		X								
	2.1	Raceway Cable Identification Materials					X	X	X								

SUBMITTAL			REQUIREMENTS(indicate with an "X")								A/E REVIEW TIME (indicate number of hours)						
			INFORMATIONAL				ACTION										
Spec. Sec.	Par. No.	Description	CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS	PERMITS	SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS	FIELD REPORTS	ARCH (hrs)	CE (hrs)	SE (hrs)	ME (hrs)	EE (hrs)	PM - Coor. (hrs)	LA (hrs)
26 05 53	2.2	Conductors and Communication - and Control - Cable Identrification Materials					X	X	X								
	2.3	Equipment Identification Nameplates					X	X	X								
	2.4	Equipment Identification Labels					X	X	X								
	2.5	Miscellaneous Identification Products					X	X	X								
	2.5	Underground-Line Warning Tape					X	X	X								
26 29 13	2.2	Manual and Magnetic Motor Controllers					X		X	X							
Division 27																	
27 13 23	2.1	Fiber Optic Cable			X												
Division 31																	
31 05 13	1.4	Material Sources	X						X								
		Fill Material - Weed Free Certification	X						X								
31 05 16	2.2	Weed Free Certification for all Products	X														
	2.3	Aggregates for Drains	X						X								
	2.4	Imported Aggregate Base Course	X						X								
	2.5	Structural Fill	X						X								
	2.5	Cobble Rock	X						X								
	2.7	Granular Fill	X						X								
	2.8	Aggregates for Pervious Backfill Material	X						X								
	2.10	Type 1 Pipe Bedding	X						X								
	2.11	Type 2 Pipe Bedding	X						X								
31 10 00	1.5	Video and Photographic Documentation prior to Site Clearing								X							
		Record Drawings of Subsurface Structures and Utilities.								X							
31 23 17	1.5	Construction Plan for Bowman Creek Infiltration		X													
	2.2	Underground warning tape							X								
	3.6	Field Testing of Backfill		X						X							
31 23 18	1.4	Rock Removal Method (if required)		X													
31 23 19	1.5	Bowman Creek Infiltration Gallery Plan		X													
		Dewatering Pumps							X								
		Monitoring Reports	X							X							
31 23 23	2.2	Geotextile Fabric							X								
	3.7	Field Testing of Backfill		X						X							
31 23 24	2.1	Flowable Fill Mix Design	X						X								
Division 32																	
32 91 19	2.1	Topsoil Weed Free Certification	X														
Division 33																	
33 05 17	2.1 & 2.2	Concrete Vault and Manholes, incl. Frame, Cover, Access Hatches, Eye Bolts, Steps, Grout and Sealants.					X		X								
33 14 13	1.3	SWPPP Plan		X													
		Certificate of Qualification for HDPE Pipe Fusion Foreman	X														
		Project Record Documents of Installation								X							
	2.1	PVC Pipe and Fittings							X								
	2.2	PVC Pre Packed Screen							X								
	2.4	Geotextile Fabric							X								
	2.5	Pipe Material							X								
	2.6	Pump							X								
	1.4 & 1.5	Manufacturer Recommended Fusion Procedures			X												
		Certificate of Qualification for HDPE Pipe Fusion Foreman	X														
		Project Record Documents of Installation								X							
	2.1 & 2.2	HDPE Water Pipe and Fittings							X								
	2.3	Gate Valves							X								

SUBMITTAL			REQUIREMENTS(indicate with an "X")								A/E REVIEW TIME (indicate number of hours)						
			INFORMATIONAL				ACTION										
Spec. Sec.	Par. No.	Description	CERT./LAB TEST	REPORT/CALC. OR PLAN	Mfg. DATA & INSTRUCTIONS	PERMITS	SHOP DRAWING	SAMPLE	Mfg. DATA & INSTRUCTIONS	FIELD REPORTS	ARCH (hrs)	CE (hrs)	SE (hrs)	ME (hrs)	EE (hrs)	PM - Coor. (hrs)	LA (hrs)
33 14 16	2.3	Valve Boxes							X								
	2.4	Curb Stop							X								
	2.5	Curb Boxes							X								
	2.6	Flange Coupling Adapters							X								
	2.7	Couplings and Sleeves							X								
	2.8	Flange and Mechanical Joint Hardware							X								
	2.9	Water Service Pipe							X								
		Service Saddles							X								
		Corporation Stop							X								
		Pump Out Drains							X								
	2.10	Fire Hydrants							X								
	2.11	Flushing Hydrant							X								
	2.12	Insulation							X								
	2.15	Tracer Wire							X								
	2.16	Yard Hydrant							X								
	2.17	Drain Drywell and Tank Drains							X								
33 14 17	1.3	Written Plan and Procedures		X													
		Disinfection Reports (Pipelines and Tanks)		X						X							
		Disinfection Chemicals							X								
		De-chlorination Chemicals							X								
33 16 61	2.1	Storage Tank					X		X								
	2.2	Tank Bedding Material							X								
	2.3	Yard Piping							X								
	2.4	Tank Drain/Overflow Outlet							X								
	2.5	Tank Level Control							X								
33 41 00	2.1	Culvert Pipe							X								
Division 40																	
40 63 43	2.1	PLC					X		X								
	2.3	UPS							X								
	2.5	Enclosure					X		X								
40 67 00	1.4	Panel Fabrication					X		X								
											To	0	0	0	0	0	0	0

Note:(See color coded instructions on page 2 - Instructions)

SECTION 01 33 23 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

B. Informational Submittals: Written information that does not require Government's responsive action. Submittals may be rejected for not complying with requirements.

1.3 GENERAL SUBMITTAL PROCEDURES

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

1. Contracting Officer (CO) reserves 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 for legibility, accuracy, completeness, and compliance with Contract Documents.

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

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

1. Action Submittals

a. Initial Review: Allow **7** days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
b. Re-submittal Review: Allow 7 days for review of each re-submittal.

2. Informational submittals

a. Review: Allow 7 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. Manufacturer's literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.

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

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

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

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

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

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

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

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

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

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

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

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

1.4 CONTRACTOR'S USE OF CAD/BIM FILES

A. General: At Contractor's written request, copies of AutoCAD Civil 3D, 2024 files will be provided to Contractor for Contractor's use in connection with Project, subject to:

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

PART 2 - PRODUCTS

2.1 SUBMITTAL LIST

A. See attached submittal list. Not all required submittals may be on the attached list.

2.2 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, and highlight products being supplied, as applicable, include:

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

g. Compliance with specified referenced standards.
h. Testing by recognized testing agency.

4. Submit product data in PDF (portable document format) file format before or concurrent with samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of CAD Drawings is otherwise permitted.

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

a. Dimensions
b. Identification of products
c. Fabrication and installation drawings
d. Roughing-in and setting diagrams
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring
f. Shopwork manufacturing instructions
g. Templates and patterns
h. Schedules
i. Notation of coordination requirements
j. Notation of dimensions established by field measurement
k. Relationship to adjoining construction clearly indicated
l. Seal and signature of professional engineer if specified
m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring

2. Submit shop drawings as PDF electronic file

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

2.3 INFORMATIONAL SUBMITTALS

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

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

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

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

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

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

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

H. Qualification Data: Prepare written information demonstrating capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

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

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

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

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

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

N. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in Contract Documents.

O. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

P. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

Q. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in Contract Documents.

R. 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.

S. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in Contract Documents.

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

U. Design Data: Prepare written and graphic information, including: performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

V. Manufacturer's Instructions: Prepare written or published information documenting manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.

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

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

X. 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.

Y. Demolition and Work Phasing Plan: Prepare a written plan for all major demolition and construction activities.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

3.2 CONTRACTING OFFICER'S ACTION

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

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

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

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

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

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

END OF SECTION 01 33 23

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Work Covered by Contract Documents
2. General Requirements
3. Attachments

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. All field work is located in the Polebridge Ranger Station Area, located in Glacier National Park's northwest corner, approximately 1.0 miles from Polebridge, Montana.

B. Work generally consists of construction of a new public water system that includes a new infiltration gallery, new water storage tank, and new water main or service lines to service area buildings. Four housing units and two administrative buildings will be connected to the new potable water service. A new programmable logic controller, pump control panel, pump protection system, and tank monitoring system will be installed. The chlorination treatment system will remain unchanged. Work also includes the installation of fiber optic lines to five buildings. Refer to the attached Civil Plans.

C. Refer to 01 27 00 Definition of Contract Line Items for a breakdown of Contract Line Items and how bid items are to be split out.

D. All work will be completed under a single prime contract.

1.3 GENERAL REQUIREMENTS

A. Wildlife Protection
   1. Refer to Section 01 35 05 Environmental Protection and Special Controls.

B. Natural Resource Protection
   1. Refer to Section 01 35 05 Environmental Protection and Special Controls for additional requirements.
      a. Imported gravel, rip rap, rock, straw, and other natural materials must be certified weed-free and from a Park-approved source.
      b. Vehicles and equipment shall be cleaned prior to entering the Park.

C. Archeological and Cultural Resource Protection
   1. Refer to Section 01 35 13.22 Archeological Protection.

D. Visitor Management
   1. Incorporate visitor management and traffic control precautions and procedures into the *Safety and Accident Prevention Plan*.

a. The project area interacts with areas used by both visitors and NPS.
b. Visitors have access to the Ranger Station loop area, B#1842 Vault Toilet, the Inside North Fork Road, and the Bowman Lake Road. The majority of traffic that enters the Park at the Polebridge Ranger Station turns north to visit Bowman Lake or Kintla Lake; traffic turning south towards Logging Creek is light. Expect to see moderate visitor vehicle and bicycle traffic on all roads. Visitation typically tails off in early October and is light in the late fall and winter months. The gate beyond the Ranger Station loop typically closes at the first notable snowfall and remains closed until late April, or whenever the roads are free of snow and dried out.
c. Approximately eight NPS employees live and work in the Polebridge housing and maintenance areas. Approximately seven other NPS employees (stationed at Kintla, Bowman, or Logging) use the housing and maintenance areas regularly. All but two employees are seasonal employees and will depart between mid-September to mid-October.
d. Take great caution while operating equipment to prevent hazards to visitors and NPS.

2. The Contractor is responsible for jobsite safety and security. The Contractor shall secure the jobsite to prevent any potential hazards to visitors and NPS staff at all times.
3. Minimize interference with NPS operations, visitors, and traffic near the project area. Coordinate with NPS.

E. Contractor Access to Park and Facilities

1. The Park does not provide lodging or campsites to Contractors. The Contractor shall not set up undesignated camps at (or near) the project site. The Contractor is responsible for arranging their own accommodations.
2. Coordinate with the COR for to obtain a *Commercial Vehicle Non-Recreational Entrance Pass*. An *Entrance Pass* is required to be displayed on the dashboard of all Contractor vehicles. Come to a full stop at the Entrance Station, show the *Entrance Pass* to the Park Ranger at the window, and they will wave you through. *Entrance Passes* are of no cost to the Contractor.
   a. The *Entrance Pass* will be valid for entering the Park at the West Entrance (in West Glacier), Camas Entrance (Camas Road), and the Polebridge Entrance (Polebridge).
3. Coordinate with the COR for access to gates and buildings. The Contractor shall be responsible for safekeeping any loaned keys. The Contractor shall pay to replace lost or damaged keys.
4. Generally, work inside of Park buildings shall be supervised by NPS. Coordinate with NPS.

F. Contractor Use of Utilities

1. Refer to Section 01 50 00 Temporary Facilities and Controls for additional requirements.
2. Utility Access
   a. No Contractor access to electrical service. Bring generators.
   b. No Contractor access to telephone or internet service. Polebridge is far from cell service. The Park will loan a few portable radios for emergency use.
   c. The Contractor may use the potable water service from the Polebridge water system at a rate of $20.936 per 1000 gallons. The Contractor may also obtain water from a fire hydrant in the West Glacier Headquarters area. Refer to Section 01 50 00 Temporary Facilities and Controls for additional requirements.
   d. Surface water may be drafted from Bowman Creek. Refer to Section 01 35 05 - Environmental Protection and Special Controls and Section 01 50 00 Temporary Facilities and Controls for additional requirements.

e. The Contractor may use B#1842 Vault Toilet located in the Maintenance Area through the end of October 2026, on the condition that this facility is kept reasonably clean for visitor and NPS use. Sweep out mud and clean up messes immediately. During the winter, NPS has limited staffing and no practical method to pump out the vault toilet. The Contractor shall use portable toilets for work in the winter months. Vault toilets must be lockable to prevent wildlife access, firmly secured to the ground to prevent tipping, and maintained regularly. Refer to Section 01 35 05 - Environmental Protection and Special Controls for additional requirements.

3. Utility Marking
   a. The Contractor shall notify NPS of any ground disturbing work at least 10 business days in advance. Call Montana 811 **at least five business days in advance** of anticipated ground disturbance. The Contractor shall not proceed with any ground-disturbing work until explicit permission is granted by the COR after all NPS and outside utilities have been marked.
   b. If ground disturbance is imminent in only a portion of the project area, the Contractor shall provide NPS with a map of the exact locations where utility markings are needed.
   c. The Contractor shall ensure that all utilities are properly marked for the duration of ground disturbing work.
   d. The Contractor shall verify the location of underground utilities prior to excavation work. Some utilities may only be locatable by potholing.
   e. All existing utilities shall be protected in place by the Contractor; accidental damage or disruptions shall be remedied immediately at no cost to NPS.
4. Water System Testing and Winterization
   a. Water service connections and main line installation will occur while the Polebridge area buildings are in "winter status."
      1) B#97 Ranger Residence and B#1451 Strissel Cabin are the only buildings that have year-round water service, under normal circumstances. B#1448 Fire Cache, Ranger Storage, Chlorinator has no domestic water service, but the chlorination equipment operates year-round.
      2) B#98 Cabin, B#1454 Laundry and Shower, B#1455 Polebridge Ranger Station, B#1594 Dorm, and B#1865 School to Park Cabin have seasonal water service only. A new yard hydrant will used seasonally.
         a) NPS will winterize the interior fixtures of these buildings.
         b) The Contractor shall drain the water main or service lines to be abandoned or removed, remove the existing water service, make the new water service connection, test the new water lines and fixtures per Section 33 01 12 Testing of Water Distribution, and then fully remove all water from the service lines, main lines, and fixtures that are typically winterized.

G. Contractor Use of Site
   1. Refer to the Civil Plans, Section 01 35 05 Environmental Protection and Special Controls, and Section 01 50 00 Temporary Facilities and Controls

H. Vehicles, Equipment, Parking, and Staging Areas
   1. Refer to the Civil Plans and Staging Areas Exhibit for project limits and staging areas.
   2. Vehicles and equipment shall be cleaned and inspected by NPS prior to entering the Park. Refer to Section 01 35 05 Environmental Protection and Special Controls for additional details.

3. All project vehicles shall be driven at speeds within posted speed limits on existing roads and shall not exceed 20 mph within project boundaries.
4. Hauling vehicles greater than 20,000 gross vehicle weight travelling on approved roads within the Park between sunset and sunrise will be limited to speeds of no more than 10 miles per hour (mph) below the posted speed limit.
5. Comply with all local, State, and Federal loading, hauling, and road restrictions.
   a. Hauling on Camas Road is not permitted. All hauling traffic should take the North Fork Road to Polebridge.
6. Access to the project areas requires use of the following bridges:
   a. North Fork Flathead River Bridge, Glacier Drive
      1) Inventory Rating – 34.0 tons
      2) Operating Rating – 57.0 tons
   b. Bowman Creek Bridge, Inside North Fork Road
      1) Inventory Rating – 21.0 tons
      2) Operating Rating – 36.0 tons
   c. Submit overload and oversize permits for non-legal loads transported within the park boundary to the CO utilizing the FLH Bridge Oversized or overload vehicle permit request form. The Government will make the form available under FAR Clause 52.236-4 – Physical Data. Allow 14 days for review of the permit application.

I. Material Handling and Waste
1. Refer to the Civil Plans, Section 01 35 05 Environmental Protection and Special Controls, 01 74 19 Construction Waste Management and Disposal for additional requirements.
2. The Contractor shall be present to inspect and accept all deliveries. On-site drop off locations may be arranged. NPS will not accept deliveries on the Contractor's behalf – do not ship to an NPS building.
3. All waste must be immediately contained in bear-proof containers or dumpsters. Food waste and construction waste shall not be mixed.

J. Quality Control
1. Refer to 01 40 00 Quality Requirements for additional requirements.
2. All work shall be high quality, professional work. The work performed by each trade shall meet or exceed all quality standards published by their respective trades.
3. Where trades overlap, carefully coordinate work.

K. Safety and Accident Prevention
1. Refer to Section 01 35 05 Environmental Protection and Special Controls and Section 01 35 23 Safety Requirements.

L. Fire Prevention and Protection
1. Refer to Section 01 50 00 Temporary Facilities and Controls for additional requirements.
2. Should the Park enter Stage 2 Fire Restrictions during the period of performance, the contractor may be required to obtain a Stage 2 Fire Restriction Exemption Permit from the GLAC Fire Management Office. Additional firefighting tools may be required to be readily available during work.

M. Weather and Snow
1. Road Access
   a. Polebridge is accessible year-round via the North Fork Road through Columbia Falls, MT. Expect the North Fork Road to be icy, bumpy, and slow-moving during the winter months. Travelers must be prepared.

b. Polebridge is accessible from West Glacier, MT via Camas Road until the first significant snowfall, typically in November or December, forces a closure of Camas Road.

2. Snow
   a. The Inside North Fork Road or Bowman Lake Road is not plowed by NPS. These roads typically close to visitor vehicle traffic at the first significant snowfall and will not open until April or May, or whenever the roads are free of snow and dried out.
   b. NPS typically plows snow around the Ranger Station loop, Maintenance Area, and Housing Area. Please coordinate with NPS on the location of snow piles to avoid interference with work.
   c. Please note that snow removal performed by NPS may not be immediate – the Contractor may have to remove snow to continue working in an area.
3. Rain and Creek Flows
   a. October and November can be extremely wet months. Expect a sharp increase in the flow of Bowman Creek in October. Bowman Creek flows year-round.

N. Work Phases, Anticipated Timelines, and Work Schedules

1. The following work shall be allowed in each timeframe:
   a. Beginning on or later than August 3, 2026:
      1) Mobilization
      2) Vegetation clearing (note – please coordinate with NPS to survey the area for nesting birds prior to any vegetation clearing)
      3) Installation of temporary erosion control measures
      4) Work in the Chlorination Room of B#1448 Fire Cache, Storage, and Chlorinator Building that can be performed without interrupting the existing water system's operation

   b. Beginning on or later than August 17, 2026:
      1) Installation of the new infiltration gallery; disturbed area restoration work.
      2) Installation of water supply, main, and service lines in housing and maintenance areas and up the hill to the Inside North Fork Road; disturbed area restoration work.
      3) Electrical and communications related work in the housing and maintenance areas.

   c. Beginning on or later than October 3, 2026:
      1) Disruption of potable water service to all buildings served by the existing system, including demolition of existing water system infrastructure.
      2) Water tank installation work; disturbed area restoration.
         a) The Contractor may close the Inside North Fork Road from B#1455 Ranger Station heading south towards Logging Creek for this work. The Contractor shall allow emergency vehicle traffic to pass through immediately, and other administrative traffic to pass through with a delay.
      3) Installation of water supply, main, and distribution between the new water infiltration gallery, in front of B#1455 Ranger Station, and to B#1448 Fire Cache, Storage, and Chlorinator Building; road restoration work.
         a) NPS will not collect fees at the window of B#1455 Ranger Station during this time.
         b) Phase trenching work and set up temporary traffic control such that vehicle access to the Inside North Fork Road is available at all times.

The Contractor shall close one side of the loop around B#1455 Ranger Station and allow two-way traffic to pass through the other side of the loop to allow vehicle traffic to and from the Inside North Fork Road. A maximum 15-minute traffic delay will be allowed. The Contractor shall allow emergency vehicle traffic to pass through immediately.

c) The Contractor should complete this trenching work in 10 working days or less. Coordinate with NPS at least two weeks prior to the anticipated closure.

4) Installation of water main lines, electrical lines, and communications lines along the Inside North Fork Road

a) This work requires a full closure of the Inside North Fork Road to all visitor and NPS vehicle traffic between the Ranger Station Area and the water tank area. NPS will stage a vehicle to the south of the water tank area and will access the vehicle by foot, if necessary. Please coordinate with NPS.

b) The Contractor should complete this trenching work in 10 working days or less. Coordinate with NPS at least two weeks prior to the anticipated closure.

c) Handhole installation work and road restoration work may be completed outside of this 10 working day trenching window, provided that the road is passable to NPS administrative traffic. A maximum 15-minute traffic delay will be allowed for road restoration work. The Contractor shall allow emergency vehicle traffic to pass through immediately.

d. No later than April 18, 2026:

1) Water service available for seasonal housing units (note – this date may be later in April or early May based on the move-in dates of 2026 seasonal employees).

e. Approximately May 1, 2026

1) North Fork area roads typically open to visitor vehicle traffic in early May, depending on weather and road conditions. Work in front of B#1455 Ranger Station and all road restoration work on the Inside North Fork Road shall be completed by early May.

f. No later than May 14, 2027:

1) Potable water service to the Ranger Station shall be available by May 16, 2027.

g. No later than May 28, 2026:

1) Substantial completion for all work.

2. Potable water is required to support the following NPS permanent residences, seasonal residences, and administrative buildings.

Only two buildings, B#97 Ranger Residence and B#1451 Strissel Cabin, have potable water service year-round under normal circumstances. After the October 3, 2026 date at which the Contractor is allowed to interrupt potable water service to all buildings, NPS Law Enforcement personnel will likely occupy these residences during their regularly

scheduled work days, but not on their off days. NPS personnel will bring their own potable water jugs while potable water service is not available.

The Contractor should prioritize restoring potable water service to B#97 Ranger Residence and B#1451 Strissel Cabin for the convenience of NPS. Please seek to restore potable water service to these buildings in less than 60 days.

For seasonal residences, the *2026 Potable Water Close Date* is the latest planned date for 2026 seasonal employees to move out; the 20*27 Potable Water Open Date* is the earliest expected date for 2027 seasonal employees to move in. These dates may vary slightly; coordinate with NPS.

Building	Type	2026 Potable Water Close Date	2027 Potable Water Open Date
B#97 Ranger Residence	Permanent Residence	Year-Round Use; potable water supply may be interrupted after October 3, 2026. The Contractor should prioritize restoring potable water service in less than 60 days.	
B#98 Cabin	Seasonal Residence	No later than October 3, 2026	April 18, 2027 (anticipated)
B#1451 Strissel Cabin	Permanent Residence	Year-Round Use; potable water supply may be interrupted after October 3, 2026. The Contractor should prioritize restoring potable water service in less than 60 days.	
B#1454 Laundry and Shower	Administrative	No later than October 3, 2026	April 18, 2027 (anticipated)
B#1455 Ranger Station	Administrative	September 8, 2026	May 14, 2027
B#1594 Dorm	Seasonal Residence	No later than October 3, 2026	April 18, 2027 (anticipated)
B#1865 School to Park Cabin	Seasonal Residence	No later than October 3, 2026	April 18, 2027 (anticipated)

3. Work shall generally be performed from 7 am to 6 pm, Monday to Friday. If the Contractor desires to work outside of these hours or on weekends and holidays, the Contractor shall submit a written narrative that outlines the work to be performed to the CO and COR for their approval at least two business days in advance of the anticipated work.

1.4 ATTACHMENTS

1. Civil Plans
2. Project Specifications
3. Polebridge Ranger Station Land Survey
4. Geotechnical Report
5. Site Photos
6. As-Built Drawings (1980, 1989, 1996, 2001, 2007)

SECTION 01 35 13.22 – ARCHEOLOGICAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

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

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

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

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

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. At least three weeks before on-site work begins, Contractor shall meet with Contracting Officer and Cultural Resources Office to discuss Daily Work Schedule, equipment, and special methods used in archeologically sensitive areas. Contractor shall ensure approved Daily Work Schedule is followed throughout construction.

B. All trenching and ground disturbing activities must be monitored for archeological resources. The park's Cultural Resources Office must be contacted at least 3 weeks in advance to schedule monitoring.

PART 2 - PRODUCTS

2.1 DAILY WORK SCHEDULE

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

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

PART 3 - EXECUTION

3.1 BARRICADES

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

3.2 OBSERVATION

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

3.3 DISCOVERY OF RESOURCES

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

B. If resources are discovered while Archeological Monitor is absent, ground disturbing activities must stop immediately and the park's Cultural Resources Specialist, Sierra Mandelko, notified. If archeological resources are identified, excavation will not resume until resources are recorded.

C. Any discovered cultural resources must be turned over to the park immediately upon discovery.

3.4 WORK STOPPAGE

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

END OF SECTION 01 35 13.22

SECTION 01 35 23 - SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

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

B. Site Safety Supervisor:

1. Designate authorized onsite representative for preparation and maintenance of the APP. The Site Safety Supervisor may serve the same role as the Site Superintendent or Quality Control Manager or Environmental Manager.
2. Shall be responsible for:

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

C. Qualifications of Employees:

1. Physically and able to perform their assigned duties in a safe manner.
2. Do not allow employees whose ability or alertness is impaired because of prescription or illegal drug use, fatigue, illness, intoxication, or other conditions that may expose themselves or others to injury to perform work.

3. Provide operating instructions for equipment. Operators of vehicles, hoisting equipment, and hazardous plant equipment shall be able to understand signs, signals, operating instructions, and be fully capable of operating such equipment. Newly hired operators shall be individually tested by an experienced operator or supervisor to determine if they are capable of safely operating equipment.
4. Retain copies of operator licenses and certifications onsite.

1.4 REFERENCES

A. Occupational Safety and Health Administration
   1. 29 CFR 1926: Safety and Health Regulations for Construction.

B. United States Army Corps of Engineers
   1. EM385-1-1 (2014): Safety and Health Requirements.

1.5 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.

B. Within 7 days of a reportable accident or exposure, 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 EM 385-1-1, Appendix A and project requirements (a generic plan is not acceptable) including but not limited to the following:

   1. Name and qualifications 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. 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 an Activity Hazard Analysis (AHA)/Job Safety Analysis (JSA), etc.
   4. AHA will be in conformance with EM 385-1-1.
   5. Project site specific plans for all definable features of work.
   6. Project site specific plans for NPS, visitor, and traffic management. Consider vehicle traffic, foot traffic, and bicycle traffic.
   7. Plans for potentially dangerous wildlife encounters.
   8. Plans for fire protection and prevention.
   9. Plans for accidental utility damage or disruptions, particularly the propane system.

10. Plans for preventing and clean-up of hazardous spills.
11. Project site specific training, both prior to commencing work and continuing.
12. 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.

B. Weekly and monthly safety meetings shall be documented with topic and attendees.

2.3 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

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

2.2 SITE SAFETY HEALTH OFFICER

A. Assign a Site Safety Health Officer (SSHO). The SSHO may serve other roles.

B. The SSHO or designee shall be present for each active work area.

C. SSHOs shall have at least 5 years of demonstrated construction safety experience.

D. SSHO responsibilities per 29 CFR 1926 and EM 385-1-1.

PART 3 - EXECUTION

3.1 DAILY SAFETY INSPECTIONS

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

3.2 EMERGENCY INSTRUCTIONS

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

B. 911 service and cell service is not available. Utilize two NPS provided radios to contact Glacier Dispatch.

3.3 FIRE AND LIFE SAFETY

A. Comply with requirements of 2024 International Fire Code Chapter 33.

B. Any required field welding or torch cutting shall be conducted in a safe manner and with necessary precautions to prevent fires. Coordinate hot work permits through NPS/GRCA.

C. 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.

3.4 GENERAL DUTY CLAUSE

A. Furnish a work site that is free from recognized hazards that are likely to cause harm to employees.

B. Refer to 29 CFR 1926.

3.5 PROTECTIVE EQUIPMENT

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

B. Inspect, maintain, and document other protective equipment and devices before use to ensure safe operation. Retain inspection documentation onsite.

3.6 PROTECTIVE EQUIPMENT AREAS

A. All areas where construction, demolition, alteration, building, or similarly related activities take place, all workers shall have appropriate personal protective clothing and equipment as identified by the project reference standards including but not limited to OSHA and USACE requirements.

B. Eye and face protection equipment shall meet the requirements of ANSI / American Society of Safety Engineers (ASSE) Z87.1, and bear a legible and permanent "Z87" logo to indicate compliance with the standard. Eye and face protection equipment shall be distinctly marked to facilitate identification of the manufacturer and provides side protection.

C. Persons involved in activities that subject the hands to injury (for example, cuts, abrasions, punctures, burns, chemical irritants, toxins, vibration, and forces that can restrict blood flow) shall select and use hand protection appropriate for the hazard in accordance with ANSI/International Safety Equipment Association (ISEA) 105. Protective equipment shall be of heat, fire, chemical, and/or electrical-resistive material when conditions require protection against such hazards.

3.7 HAZARDOUS MATERIAL USE

A. Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material. Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions.

B. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site.

C. Approval by the Contracting Officer of protective measures and storage area is required prior to the start of the work.

3.8 HAZARDOUS MATERIAL EXCLUSIONS

A. Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint are prohibited.

B. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

3.9 SAFETY MEETINGS

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

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

3.10 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

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

B. It is Contractor's responsibility to require persons working on or visiting site to wear hard hats and PPE in good repair at all times.

3.11 TRAINING

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

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

3.12 HOUSEKEEPING

A. The Contractor shall be responsible for cleaning up the site daily. The Contractor shall require its personnel to keep the immediate work site clean of all dirt and debris resulting from work under this contract. Accumulated dirt and debris shall be hauled off and disposed of in accordance with local law and at least once a week by the Contractor. Additionally, all debris in work areas shall be cleaned up daily or more frequently if necessary. Construction debris may be temporarily located in an approved location; however garbage accumulation must be removed each day. Cloths, mops, and brushes containing combustible materials shall be disposed of or stored outside of the buildings in tight covered metal containers. Paints and thinners shall not be poured into inlets of the interior or exterior sewage system. Paint, stains, and other residues on adjacent surfaces or fixtures caused by the Contractor shall be carefully removed and cleaned to original finish. Upon completion of the work, the Contractor shall remove all construction equipment, materials and debris resulting from the work. The entire work site and the area used by Contractor personnel shall be left clean.

3.13 SITE EXCAVATION AND RIGGING SAFETY

A. Only competent persons shall be allowed to operate excavating equipment.

3.14 DRUG PREVENTION PROGRAM

A. Contractor is responsible for preventing the possession and use of drugs and drug paraphernalia by any and all employees thereof.

B. Possession or consumption of alcohol is prohibited within the Park.

END OF SECTION 01 35 23

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements. Quality of work shall be responsibility of the Contractor.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with Contract Document requirements.
2. All work shall be high quality, professional work. The work performed by each trade shall meet or exceed all quality standards published by their respective trades.

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

1.2 DEFINITIONS

A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the work to evaluate actual products incorporated into the work and completed construction comply with requirements.

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

D. Product Testing: Tests and inspections performed by a Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or a testing agency qualified to conduct product testing, to establish product performance and compliance with industry standards.

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

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

G. Testing Agency or Laboratory: 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 certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of corresponding generic name.

1.3 CONFLICTING REQUIREMENTS

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

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

1.4 SUBMITTALS

A. Quality Control Plan:

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

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

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

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

D. Test Reports

1. Test reports shall be completed by person performing test.
2. Submit Daily Test Information Sheets with Quality Control Daily Reports.

3. Submit failing test results and proposed remedial actions within four hours of noted deficiency.
4. Submit three copies of complete test results no later than one calendar day after test was performed.

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

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

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

1.5 QUALITY ASSURANCE

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

B. Quality of Work: All work shall be high quality, professional work. The work performed by each trade shall meet or exceed all quality standards published by their respective trades.

C. Coordination: Where trades overlap, carefully coordinate work.

D. Contractors Quality Control Staff:

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

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

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

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

H. Professional Engineer Qualifications: Professional engineer legally qualified to practice in jurisdiction where Project is located and is experienced in providing engineering services of kind indicated (including Structural Tests and Special Inspections (STSI)). Engineering services are

defined as those performed for installations of system, assembly, or products similar to those indicated for Project in material, design, and extent.

I. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for activities indicated.

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

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

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

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

1.6 QUALITY CONTROL

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

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

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

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

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

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

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide:

1. Access to Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for material mixes that require control by testing agency.
7. Security and protection for samples and testing and inspecting equipment at Project site.

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

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

PART 2 - PRODUCTS

2.1 QUALITY CONTROL PLAN

A. Quality Control Plan shall include:

1. List of personnel responsible for quality control and assigned duties. Include each person's qualifications. Include alternate(s) and qualifications.
2. Copy of letter of direction to Contractor's Quality Control Supervisor(s) outlining assigned duties and authorities designated by principal or owner.
3. Names, qualifications / accreditations, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms from laboratories.
4. Methods of performing, documenting, and enforcing quality control of work including Contractor report forms and acknowledgment of NPS forms.
5. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.

6. Specific discussion regarding mockups, off-site visits, receiving inspections, manufacturers representation, startup requirements, and other aspects of performance specific to Project.
7. Provisions for substantial completion(s) and final inspection(s) per Contract.

PART 3 - EXECUTION

3.1 OFF-SITE CONTROL

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

3.2 ON-SITE CONTROL

A. Notification:

1. Notify Contracting Officer at least 48 hours in advance of preparatory phase meeting.
2. Notify Contracting Officer at least 24 hours in advance of initial and follow-up phases.

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

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

C. Initial Phase:

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

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

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

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

3.3 DOCUMENTATION

A. Maintain Quality Control Daily Reports and Daily Test Report Information Sheets of quality control activities and test (download from DSC Workflows website > Forms/Templates/Samples/Guidelines page > Construction Forms section). The Contractor may use their own forms, provided that the Contractor's forms contain substantially the same information.

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

3.4 ENFORCEMENT

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

3.5 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

Comply with Contract Document requirements for Section 01 73 29 "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 43 33 - ELECTRICAL TESTING

PART 1 – GENERAL

1.01 PROCEDURES

A. This Section specifies the work necessary to test, commission and demonstrate that the electrical work satisfies the criteria of these specification and functions as required by the Contract Documents.

1.02 GENERAL

A. The work of this Section includes furnishing the labor, equipment, and power required to support the testing specified in this and other sections of the Specification. Electrical testing specified in Division 26 and functional testing of all power and controls not tested under Division 40 shall be completed before commencement of start-up testing. This scope of work may require the Contractor to activate circuits, shutdown circuits, run equipment, take electrical measurements, replace blown fuses, install temporary jumpers, etc.

B. The Contractor shall provide support to disconnect and reconnect cables, and perform any other functions required to test electrical equipment at no extra cost to the Owner. The Contractor is responsible for all work, equipment damage, power interruptions and schedule delays caused by the testing agency.

C. Electrical tests shall be performed by third party, National Electrical Testing Association (NETA) certified, testing agency hired by the Contractor. Testing Agency shall meet the qualifications of this Section. All electrical testing shall be witnessed by the Contracting Officer to be considered valid.

D. All electrical testing performed per this Section shall be done during Pre-Demonstration period. Refer to Specifications on facility startup for further testing requirements.

1.03 SUBMITTALS

A. Submit testing forms for approval. Testing forms shall be based on (NETA) latest Acceptance Testing Specifications having a sign-off (tester and witness), pass/fail status, data filed for each line item covered by NETA's Acceptance Testing Specifications latest edition.

B. Results of all testing shall be submitted to the Contracting Officer prior to final project acceptance. Results to be included as part of final O&M Manuals. Results shall describe test conditions, weather (including temperature and humidity), test date, duration of test, test equipment, tested equipment, testing technician, "as found" and "as-left" results, expected results, actual results, pass/fail status based on listed testing standards and a registered Professional Engineers stamp and signature; registered in Electrical Engineering in the state of Montana.

C. Testing agency engineer to submit confirmation that "equipment is ready to be energized". Confirmation shall be on company letterhead with name, signature and stamp of responsible Professional Engineer of Testing Agency.

1.04 TESTING AGENCY QUALIFICATION

A. NETA testing shall be performed by a separate and independent subcontractor who has been regularly engaged in the testing of equipment for a period of at least five (5) years. All testing shall be conducted under the direct supervision of an electrical engineer, registered in the state of Montana. This registered electrical engineer will prepare and sign test reports with values, recommendations, comments, pass/fail status, as well as ready for energization confirmation letter.

B. Testing equipment required to conduct the specified tests shall be furnished by the NETA testing organization. Testing equipment shall be in good working condition and comply with the requirements of this Specification and applicable industry standards.

C. Testing equipment shall have valid calibration sticker during testing.

D. Testing shall be done in accordance with the manufacturer's instructions, these Specifications, and NETA Acceptance Testing Specifications, NEMA, ANSI, NFPA, and ASTM Standards. All testing shall be done in the presence of the Contracting Officer, and forms shall include space for Contracting Officer sign-off at time of test.

E. The testing organization shall be responsible for testing, and verification of results of Contractor performed testing, of equipment listed below:

1. Switchboard, Main Distribution Panel: Including bus, grounding, breakers, automatic transfer switch, panelboards, transformers, and starters.
2. Cables – shall be tested by Contractor after pulling and prior to termination. Refer to Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables. Testing organization is responsible to review results, provide pass/fail evaluation and include results submittal.
3. Electric Motors.
4. Pump Controls.
5. Grounding System.
6. Miscellaneous Testing – shall be performed by Contractor.

1.05 FIELD (NETA) TESTING

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

B. The following test requirements are intended to supplement test and acceptance criteria that may be stated elsewhere:

1. Main Switchboard and Main Distribution Panel:
   a) Perform Field Testing per NETA Standards.
   b) Perform manufacturer recommended Field Testing on solid state starters.
2. Panelboards and Transformers:
   a) Perform Field Testing per NETA Standards.

3. Motor Testing:
   a) Perform Field Testing per NETA Standards
4. Pump Controls:
   a) Perform Field Testing per NETA Standards.
5. Grounding System:
   a) Perform Field Testing per NETA Standards.
6. Miscellaneous Testing– to be performed by Contractor:
   a) Refer to Section 26 05 00 – General Electrical.
   b) Refer to Sections 26 32 13 - Engine-Driven Generator Sets – Propane for additional testing.

PART 2 – EXECUTION

2.01 TESTING

A. All testing shall be witnessed and signed-off by the Contracting Officer. Each test sheet must be signed-off prior to submittal.

B. After equipment is tested and approved, testing organization shall apply sticker on equipment noting date of test and initial of tester.

C. Pre-Demonstration period shall include all NETA Field Testing, and manufacturer recommended testing and testing requirements listed in equipment specification sections.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 43 33

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 QUALITY ASSURANCE

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

1. Regulatory Requirements
2. Noise and Acoustics Management
3. Environmental Management
4. Construction Waste Management

1.3 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

C. Barrier Tape: Yellow tape Imprinted with "CAUTION: CONSTRUCTION AREA," 3” wide tape, 2” letters, weather resistant 3- mil poly

2.2 TEMPORARY FACILITIES

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

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

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

2.3 EQUIPMENT

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

1. Locate facilities to limit site disturbance and as directed by the Contracting Officer.

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

3.2 TEMPORARY UTILITIES

A. General: Install temporary service or connect to existing service.

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

B. Non-potable water for construction may be drafted from Bowman Creek.

1. Contractor shall submit a non-potable water plan including the equipment specifications and the anticipated location for drafting water, as well as an estimated volume required, and the proposed method for tracking non-potable water usage.
2. Refer to 01 35 05 for Environmental Controls for additional requirements related to non-potable water drafting.

C. Potable water for general use is available on site, when the water system is operational. Additionally, potable water may be obtained from the West Glacier Headquarters area.

1. Make connections to existing facilities as needed with suitable backflow prevention facilities. Facilities must be cleaned and maintained in a condition acceptable to NPS. At Substantial Completion, restore these facilities to condition existing before initial use.
2. The use rate is $20.936 per 1000 gallons. Water use shall be tracked using a flow meter with a backflow preventer provided by the Contractor.

D. Toilets: The Contractor may use B#1842 Vault Toilet located in the Maintenance Area on the condition that the facility is kept in a state that is acceptable to NPS for visitor use through the end of October. Please clean up any mud, debris, or other messes immediately. Close the toilet lid and latch the door when not in use. During the winter, NPS has limited staffing and no practical

method to pump out the vault toilet. The Contractor shall use portable toilets for work in the winter months.

1. The portable toilet must be lockable and staked firmly into the ground to resist the force of 70 mile per hour winds, or that of a curious grizzly bear.
2. Place in approved locations secluded from public observation and convenient to work stations. Relocate as work progress requires.
3. Maintain and clean toilet facilities at least weekly.
4. Toilet facilities shall be available for the full duration of work. Completely remove sanitary facilities on completion of work.

E. Electric Power Service: Electrical service is not available for Contractor use. Bring a generator for power needs.

F. Lighting: Work in the early morning or early evening hours in the late fall or winter may require mobile lighting units. The Contractor may provide temporary lighting, if needed.

G. Telephone Service: Polebridge is far from cell service. B#1455 Ranger Station has a landline phone for NPS use that the Contractor could use in an emergency.

1. Satellite internet, generally, works well in the Polebridge area. Connectivity may be hampered by cloudy, rainy, snowy, or smoky conditions.
2. NPS will loan portable radios to the Contractor for emergency use. These portable radios can contact the North Fork Area Ranger or other NPS personnel in the North Fork area, or Glacier Dispatch in case of an emergency. The Contractor is responsible for safekeeping loaned radios and equipment. The Contractor will be held responsible for lost or damaged radios and equipment.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 50 feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove structures, equipment, and furnishings, and terminate services after punch list is 100 percent completed or when directed by Contracting Officer. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Contracting Officer. Retain paragraph and subparagraph above or first paragraph and subparagraphs below. Retain above if temporary roads and paved areas are not in same location as permanent roads or paved areas. See Evaluations.

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

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
3. Illuminate barricades and obstructions at night; keep safety lights burning from sunset to sunrise.
4. Adequately barricade and post open cuts in or adjacent to thoroughfares.
5. Protect pedestrian traffic by guardrails or fences.

6. When pedestrian traffic is detoured onto a roadway, provide temporary walkways with protection as required at ends and overhead. For walkways, use lumber running parallel to direction of traffic movement and provide ramps at changes of elevation.
7. Cover pipes, hoses, and power lines crossing sidewalks and walkways with troughs using beveled edge boards.

C. Parking: Use designated areas of existing shown on drawings parking areas for construction personnel.

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

1. Dispose of rainwater in lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.
3. Snowplow as required to maintain access to the work site and site safety.

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

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

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of agency(ies) with jurisdiction.
1. Dumpsters for construction waste and recyclables must be protected from dumping garbage. Dumpsters shall be locked and wildlife-proof certified.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

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

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

D. Tree and Plant Protection: Refer to Section 01 35 05 Environmental Protection and Special Controls.

E. Pest Control: Follow NPS requirements to minimize attraction and harboring of rodents, roaches, and other pests and perform extermination and control procedures at regular intervals so Project

will be free of pests and residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

F. Barricades, Warning Signs, and Lights: Comply with requirements of Manual on Uniform Traffic Control Devices (MUTCD), part IV, 2003 edition for erecting structurally adequate barricades, including warning signs and lighting.

G. Temporary Fire Protection: The Contractor shall maintain temporary fire-protection equipment or facilities per NFPA 241 to protect against fire danger.

1. Fire Safety: Observe and enforce standards of fire protection. A capable and qualified person shall be in change of fire protection and prevention. Their responsibilities include maintaining fire protection equipment and establishing and maintaining safe torch cutting and welding procedures.

2. Open Fires: No open fires shall be allowed.

3. Hazard Control: Take all necessary precautions to prevent fire during construction. Do not store flammable or combustible liquids in enclosed areas. Provide adequate ventilation during use of volatile or noxious substances.

4. Vehicles and Equipment: Provide one fire extinguisher on each vehicle or piece of equipment. A minimum of one fire extinguisher shall be readily available at (ideally, within 100 feet of) all work areas. Extinguishers shall have a minimum UL rating of 2-A:10-B:C. Locate fueling and servicing areas at least 50 feet from buildings or dried vegetation, and at least 100 feet from waterways.

5. Spark Arrestors: Equip all gasoline or diesel-powered equipment used in potential forest or grass fire locations with spark arresters approved by the U.S. Forest Service. Written determinations of areas and periods of potential fire hazard will be issued by CO. Locate internal combustion equipment so that exhausts discharge away from combustible materials. Shut down equipment before refueling.

6. Smoking: Smoking inside of structures or near potentially combustible materials is prohibited. Cigarette butts shall be discarded in non-combustible containers and disposed of properly.

7. Welding and Grinding: Cutting by torch or grinding shall only be performed when adequate fire protection is provided and readily available.

8. Stage 2 Fire Restrictions: Should the Park enter Stage 2 Fire Restrictions during work, the Contractor may be required to obtain a Stage 2 Fire Restriction Exemption Permit from the Glacier National Park Fire Management Office to continue work. Additional firefighting tools (buckets, pulaskis, axes, shovels, etc.) may be required to be readily available during work. Coordinate with NPS.
   a. Stage 2 Fire Restrictions prohibit the following activities, without an exemption permit:
      1) Building, maintaining, attending, or using a campfire
      2) Smoking, outside of an enclosed vehicle or area clear of flammable materials
      3) The following acts are prohibited between 1:00 pm and 1:00 am, and a one-hour foot patrol is required following the cessation of the following activities:

a) Operation of an internal combustion engine, except for use of generators with an approved spark arrestor in an enclosed vehicle or building or area cleared of any flammable materials within three feet of the generator.
b) Welding or use of a torch with an open flame
c) Use of explosives
d) Operation of motorized vehicles off designated roads or trails.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on 24-hour basis where required to achieve indicated results and avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

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

1. Materials and facilities that constitute temporary facilities are property of Contractor. NPS reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period.

END OF SECTION 01 50 00

SECTION 01 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 United States Environmental Protection Agency (USEPA). The USEPA uses 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 existing General Permit requirements under Phase I to include/regulated 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 Agency(ies) with Jurisdiction for review and approval.

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

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

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

1.2 DEFINITIONS

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

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

C. 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 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 NPDES program.

1.3 SUBMITTALS

A. After contract award and before pre-construction conference, prepare and submit:
   1. A SWPPP showing SWPPP satisfies Federal and State NPDES permit requirements.

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

C. Inspection Schedule: Submit schedule for inspection and monitoring of storm water pollution prevention measures.

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

1.4 QUALITY ASSURANCE

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

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

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

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

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

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

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

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

E. Pollution Prevention and Erosion Control Manager: Contractor shall designate Pollution Prevention and Erosion Control Manager responsible for implementation, inspection, maintenance, and amendments to approved plan.

1. Pollution Prevention and Erosion Control Manager (ECM) shall be familiar with temporary storm water pollution prevention procedures and Best Management Practices, be certified as a Montana Department of Environmental Quality SWPPP Administrator and ensure emergency procedures and plan are updated as needed and available for inspection.

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

3. Provide an ECM to manage installation, maintenance, inspection, and reporting for erosion and sediment control measures, maintain and update the SWPPP of record, and prepare any documentation required by the construction storm water permit or the SWPPP. Furnish the ECM's name, project office address, 24-hour telephone number(s), and qualifications at the preconstruction conference.

PART 2 - PRODUCTS

2.1 TEMPORARY STORM WATER POLLUTION PREVENTION PLAN

A. Provide SWPPP which satisfies Federal and State NPDES permit requirements and includes:

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 Best Management Practices 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 natural resources within project boundaries and outside limits of work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by Contracting Officer.

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

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

3.2 REGULATORY REQUIREMENTS

A. Permits: Contractor shall obtain required NPDES permits resulting in no impacts to scheduled work. Contractor shall account for possibility of significant lead time in scheduling and executing work.

1. Implement requirements of NPDES permit for erosion control due to storm water runoff during construction.
2. Implement good housekeeping practices, inspections and record keeping.
3. Prior to construction, Contractor and Subcontractors shall sign certifications (included in the plan) that they understand requirements of NPDES permit.
4. Subcontractors shall comply with requirements of NPDES under supervision of Contractor.
5. Accepted plan shall comply with terms and conditions of EPA permit.

B. Notice of Intent (NOI): Contractor shall file a Notice of Intent and formal SWPPP as required to the Agency(ies) with Jurisdiction.

1. File NOI with both MT DEQ and US EPA.

C. Notice of Termination (NOT): After Substantial Completion of Work, file a Notice of Termination (NOT) with the Agency(ies) with Jurisdiction.

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

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

4. Prior to removal of sediment control structures.

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

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

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

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

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

3.5 HOUSEKEEPING AND SITE MANAGEMENT

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

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

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

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

3.6 EROSION CONTROL MEASURES

A. Erosion control measures shall consist of Best Management Practices for storm water discharges, including, barrier protectors, straw bales, temporary soil retention blankets, excelsior drainage filters, sediment traps and berms. Silt fence is not preferred by the Park.

B. Install all sediment perimeter control measures prior to clearing, grubbing, and grading activities. Install additional erosion and sediment control measures as needed during construction.

C. Before conducting land clearing and disturbance, mark all clearing limits in the field. Mark trees, wetlands, sensitive areas, and buffer zones for preservation as shown on the plans. Preserve existing vegetation wherever possible.

D. Stabilize and maintain construction access points between unpaved and paved sites to minimize tracking of mud and dirt onto public roads.

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

F. Phase construction activities to minimize the amount and duration of soil exposed to erosion. Establish final grade as soon as practicable and apply temporary or permanent soil stabilization measures. Limit the combined grubbing, grading, excavating, borrow, and fill within the construction limits to 5 acres (2.0 hectares) of exposed soil at one time.

G. Commence temporary or permanent soil stabilization measures immediately if no further disturbance of an area of the site or stockpile is expected within the next 14 days. Complete installation of temporary soil stabilization measures to disturbed sites or stockpiles within 14 days and installation of permanent soil stabilization measures within 7 days of last disturbance. Provide for temporary stabilization of all exposed soil prior to winter construction shut down.

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

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

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

K. Divert surface runoff around and away from exposed soils, cut and fill slopes.

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

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

N. Do not discharge concrete wastewater near or into waterways or wetlands. Submit proposed washout areas to the CO for approval.

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

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

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

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

3.7 MAINTENANCE OF TEMPORARY FACILITIES

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

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

C. Inspect the following areas of the project:
   1. All areas where soil has been disturbed and that has not been permanently stabilized;
   2. All erosion and sediment control measures and pollution prevention measures;
   3. Government-provided material, waste, borrow, staging and maintenance areas;
   4. All areas where storm water typically flows onto and within the site;
   5. All points of storm water discharge from the site; and
   6. All locations where temporary stabilization measures have been implemented.

D. Inspect all erosion and sediment control measures at least once every 7 days or once every 14 days and within 24 hours of a storm event of 0.25 inches (6 millimeters) or greater as determined by an on-site rain gauge, and/or when there is runoff from snowmelt sufficient to cause a discharge.

Specify the inspection schedule that will be used in the project SWPPP and use the same schedule throughout the duration of construction.

1. Submit completed inspection reports within 24-hours of performing an inspection.

E. Inspections may be temporarily reduced in accordance with the General Permit and the following conditions:

1. If all construction activities at the site are temporarily inactive or shutdown and all areas of disturbance have achieved temporary stabilization as defined by the General Permit the site can be inspected at a reduced frequency of once every 30 days.
2. If portions of the site are temporarily inactive or shutdown and these portions have achieved temporary stabilization in accordance with the General Permit, those portions of the site may be inspected at the reduced frequency of once every 30 days.
3. If portions of the site are completed and controls are implemented to achieve final stabilization in accordance with the General Permit, those portions of the site may be inspected at the reduced frequency of once every 30 days.
4. If an inspection is not possible due to remote site access and severe winter conditions, a delayed inspection must occur once the site is accessible.
5. Document the reason for the reduction in inspection frequency and locations (if applicable) in the SWPPP. Resume the normal inspection schedule in accordance with the General Permit once construction activities resume and/or the site is accessible.

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

3.8 REPORTING

A. If a discharge occurs or if project receives written notice or order from regulatory agency, Contractor shall immediately notify Contracting Officer and shall file written report to Agency(ies) with Jurisdiction within 7 days of discharge event, notice, or order. Corrective measures shall be implemented immediately following discharge, notice, or order. The report to the Agency(ies) with Jurisdiction shall contain:

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

3.9 SEDIMENT DISPOSAL

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

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

3.10 REMOVAL OF TEMPORARY POLLUTION CONTROL MEASURES

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

END OF SECTION 01 57 23

SECTION 01 67 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, current as of date of Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

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

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

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

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

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

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

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

1.3 SUBMITTALS

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

1. Affirmative Procurement Reporting Form. Submit on form in Appendix A of this Section, or similar form as approved by Contracting Officer (CO).
2. 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 to 16 in accordance with ANSI Z400.1 and as follows:

   a. Section 1: Chemical Product and Company Identification
   b. Section 2: Composition/Information on Ingredients
   c. Section 3: Hazards Identification
   d. Section 4: First Aid Measures
   e. Section 5: Fire Fighting Measures
   f. Section 6: Accidental Release Measures
   g. Section 7: Handling and Storage
   h. Section 8: Exposure Controls/Person Protection
   i. Section 9: Physical and Chemical Properties
   j. Section 10: Stability and Reactivity Data
   k. Section 11: Toxicological Information. Include data used to determine the hazards cited in Section 3. Identify acute data, carcinogenicity, reproductive effects, and target organ effects.
   l. Section 12: Ecological Information. Include data regarding environmental impacts during raw materials acquisition, manufacture, and use. Include data regarding environmental impacts in event of accidental release.
   m. Section 13: Disposal Considerations. Include data regarding proper disposal of the chemical. Include information regarding recycling and reuse. Indicate whether or not product is considered to be "hazardous waste" according to United States EPA Hazardous Waste Regulations 40 CFR 261 (Code of Federal Regulations).
   n. Section 14: Transportation Information. Identify hazard class for shipping.
   o. Section 15: Regulatory Information. Identify federal, state, and local regulations applicable to the material.
   p. Section 16: Other Information. Include additional information relative to recycled content, biobased content, and other information regarding environmental and health impacts.

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

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

1.6 PACKAGING

A. Where Contractor has option to provide one of listed products or equal, preference shall be given to products with minimal packaging and easily recyclable packaging as defined in ASTM D5834.

B. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.

1.7 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to greatest extent possible.

1. To greatest extent possible, provide products and materials with a lesser or reduced effect on the environment considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and/or disposal of the product.
2. Eliminate use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either Montreal Protocol and Title VI or Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account life cycle impacts.
3. Use products meeting or exceeding EPA's recycled content recommendations for EPA-designated products. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of total value of the materials in project.

1.8 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for product specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare written document containing appropriate terms and identification, ready for execution. Submit draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with Specifications, prepare written document using appropriate form properly executed.
3. Refer to Divisions 2 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products to comply with Contract Documents, undamaged and, unless otherwise indicated, new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types produced and used successfully in similar situations on other projects.
3. Government reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
4. Where products are accompanied by term "as selected," Contracting Officer will make selection.
5. Where products are accompanied by term "match sample," sample to be matched is Governments.
6. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Product: Where Specifications name single product and manufacturer, provide named product that complies with requirements or approved equal.
2. Manufacturer/Source: Where Specifications name single manufacturer or source, provide product by named manufacturer or source that complies with requirements or approved equal.
3. Products: Where Specifications include 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 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 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 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 sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide specified product, system, or approved equal.
8. Basis-of-Design Product: Where Specifications name product and include a list of manufacturers, provide specified product or a comparable product by one of the other named manufacturers, or approved equal. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics based on the product named.

2.2 COMPARABLE PRODUCTS

A. Conditions: Contracting Officer will consider Contractor's request for comparable product when the following conditions are satisfied. If following conditions are not satisfied, Contracting Officer will return requests without action, except to record noncompliance with these requirements:

1. Evidence proposed product does not require revisions to Contract Documents, that it is consistent with Contract Documents and will produce indicated results and is compatible with other portions of Work.

2. Detailed comparison of significant qualities of proposed product with those named in Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

3.1 PROTECTION AFTER INSTALLATION

A. Provide adequate coverings as necessary to protect installed materials from damage resulting from natural elements, traffic, and subsequent construction. Remove when no longer needed.

END OF SECTION 01 67 00

SECTION 01 73 40 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general procedural requirements governing execution of Work including:

1. Coordination with utility service providers
2. Construction layout
3. Field engineering and surveying
4. General installation of products
5. Progress cleaning
6. Starting and adjusting
7. Protection of installed construction
8. Correction of the Work

1.2 SUBMITTALS

A. None

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Utilities: Existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existence and location of underground utilities and other construction affecting Work.

1. Before construction, verify the location and point of connection of water, sewer, telecommunications, propane, and electrical services. Please coordinate an on-site review of the existing utility systems with NPS.
2. The Contractor shall notify the Park of any ground disturbing work at least two weeks in advance. Call Montana 811 **at least** five business days in advance of anticipated ground disturbance. The contractor shall not proceed with any ground-disturbing work until explicit permission is granted by the COR after all NPS and outside utilities have been marked. To assist NPS in planning utility locates, the Contractor shall provide to NPS a map of the exact locations where utility markings are needed during a specific timeframe.

The Contractor shall ensure that all utilities are properly marked for the duration of ground disturbing work. All existing utilities shall be protected in place by the Contractor.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 COORDINATION WITH UTILITY SERVICE PROVIDERS

A. Coordination with Utility Service Providers: Contact following Utility Service providers, sufficiently in advance to avoid delaying the work, to coordinate Contractor's portion of Work, testing requirements, inspections, etc.

1. Electric, Water, Wastewater, and Propane Service: Contact Glacier National Park Utilities, (406) 888-7964.

2. Telecommunications Service: Glacier National Park IT, AT&T, HughesNet.

3.3 PREPARATION

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

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

C. Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of the Contract Documents caused by differing field conditions outside control of Contractor, submit request for information to Contracting Officer in accordance with Section 01 31 00 "Project Management and Coordination."

3.4 CONSTRUCTION LAYOUT

A. Verification: Verify layout information shown on Drawings, in relation to the existing benchmarks before proceeding to lay out Work. Notify Contracting Officer promptly if discrepancies are discovered.

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

1. Establish benchmarks and control points to set lines of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check location, level and plumb, of every major element as Work progresses.
5. Notify Contracting Officer when deviations from required lines and levels exceed allowable tolerances.

C. Site Improvements: Locate and lay out new water, electrical, and communications infrastructure.

D. Record Log: Maintain log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make log available for review by National Park Service (NPS).

3.5 FIELD ENGINEERING

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

3.6 INSTALLATION

A. General: Locate Work and components of Work accurately in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions for best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Contracting Officer.
2. Allow for building movement, thermal expansion, and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors to be embedded in concrete or masonry. Deliver to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials not considered hazardous.

3.7 PROGRESS CLEANING

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

1. Comply with requirements in National Fire Protection Association (NFPA) 241 for removal of combustible waste materials and debris at the end of every work session.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees Fahrenheit
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

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

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of Work, broom-clean or vacuum entire work area, as appropriate.
3. Contractor shall provide progress cleaning that minimizes sources of food, water, and harborage available to pests.

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

1. Utilize non-toxic cleaning materials and methods.

E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect from damage and deterioration at time of Substantial Completion.

F. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

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

H. Final Cleaning: At completion of Work, remove remaining waste materials, rubbish, tools, equipment, machinery and surplus materials. Clean exposed surfaces and leave Project clean and ready for occupancy.

3.8 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: If factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

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

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

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

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

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

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

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

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

END OF SECTION 01 73 40

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. REFERENCES

1. Refer to 01 35 05 Environmental Protection and Special Controls for additional requirements relating to material or waste handling and storage.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations, including packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Solid Waste: Garbage, debris, sludge, or other discharged material (except hazardous waste) including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations.

D. Hazardous Materials: Material regulated as a hazardous material in accordance with 49 CFR 173 (Code of Federal Regulations), 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 potential to meet the definition of Hazardous Waste in accordance with 40 CFR 261.

E. Recycle: Recovery of demolition or waste for subsequent processing in preparation for reuse.

F. Single-use plastic products: Plastic items intended to be disposed of immediately after use, including plastic and polystyrene food and beverage containers, bottles, straws, cups, cutlery, and disposable plastic bags.

1.3 PERFORMANCE REQUIREMENTS

A. General: Project shall minimize creation of construction, deconstruction, and demolition waste to protect and restore natural habitat and resources. Minimize factors contributing to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, single-use plastic products, and contamination. A Waste Management Plan shall be developed to ensure that existing site and building materials are reused, salvaged, or recycled. Minimize waste disposal in landfills.

B. Minimize use of single-use plastics, including food and drinks packaging.

C. Material Transport: Due to the project location the Contractor shall minimize the transport of unnecessary product packaging and other non-project materials to the site.

D. If waste materials encountered during deconstruction/demolition or construction phase are found to contain lead, asbestos, polychlorinated biphenyls (PCBs), or other harmful substances, they are to be handled and removed in accordance with local, state, and federal laws and requirements concerning hazardous waste.

1.4 SUBMITTALS

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

PART 2 - EXECUTION

2.1 RECYCLING WASTE

A. Aim to recycle all metals removed during this project. Other materials, including plastics, electronics, or wood products should be recycled.

2.2 COLLECTION AND 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 at a waste management site in Flathead County.

1. Except as otherwise specified, do not allow waste materials to accumulate on-site. Immediately contain and collect all waste to prevent waste from leaving the site and polluting the pristine natural environment. Do not create trash piles – use buckets or small trash bins to collect waste. All waste shall be collected in bear-proof containers and dumpsters (alternatively, waste collected in typical trash cans can be stored in a locked trailer while not actively being used).

B. Burning: Do not burn waste materials.

2.3 EXCESS SOIL AND VEGETATION DISPOSAL

A. Haul off and dispose of excess soil material or vegetation materials at a facility outside of the Park.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including:

1. Project Record Drawings
2. Closeout Submittals
3. Substantial Completion and Final Inspection
4. Permit Closure and Transfer
5. Final Acceptance of the Work
6. Warranties

1.2 PROJECT RECORD DRAWINGS

A. Coordinate installation of underground utilities with NPS. NPS will survey the alignment and depth of new underground water piping, fittings, valves, the infiltration gallery, the water tank, and the alignment and depth of new electrical or communications infrastructure as construction progresses. NPS will also survey the location of utility crossings and abandoned utilities as best possible.

B. The Contractor shall maintain one complete full-size set of contract drawings and one full-size set of vendor-supplied drawings. Clearly mark changes, deletions, and additions to show actual construction conditions.

C. Keep record drawings current. Make record drawings available to Contracting Officer (CO) for inspection at the time of monthly progress payment requests.

D. Submit complete record drawings on completion of total project. Include shop drawings, sketches, and additional drawings to be included in final set, with clear instructions showing the location of these drawings.

1.3 CLOSEOUT SUBMITTALS

A. Refer to Section 01 22 23 for a list of required submittals. Terms and conditions of the contract require satisfaction of requirements of individual specification sections regardless of what is shown on the list. Submit the following before requesting final inspection:

1. Specific warranties, guarantees, workmanship bonds, final certifications, and similar documents.
2. Project Record Documents, operation and maintenance manuals, final completion construction digital images and similar final record information.

3. Posted Operating Instructions: As specified in individual sections. Furnish operating instructions attached to or posted adjacent to equipment. Include wiring diagrams, control diagrams, control sequence, start-up, adjustment, operation, lubrication, shut-down, safety

precautions, procedures in the event of equipment failure, and other items of instruction recommended by manufacturer.

4. Deliver tools, spare parts, extra materials, and similar items to location designated by Contracting Officer. Label with manufacturer's name and model number where applicable.

    a. Special Tools: One set of special tools required to operate, adjust, dismantle, or repair equipment. Special tools are those not normally found in possession of mechanics or maintenance personnel.

5. Keys and Keying Schedule: Submit keys including duplicates. Wire keys for each lock securely together. Tag and plainly mark with lock number, equipment identification, or panel or switch number, and indicate location, building, and room name or number.
6. Approved pre-functional checklists and functional performance testing reports from commissioning documentation.

    a. Equipment start-up requires coordination with commissioning process. Refer to Section 01 79 00 Demonstration and Training. Equipment shall not be "temporarily" started for commissioning.

7. Terminate and remove temporary facilities, mockups, construction tools, and similar elements from Project site, complete final cleaning requirements, including touchup painting.
8. Touch up and repair and restore marred exposed finishes to eliminate visual defects.
9. Instruct NPS personnel in operation, adjustment, and maintenance of products, equipment, and systems.

1.4 FINAL INSPECTION, SUBSTANTIAL COMPLETION AND ACCEPTANCE PROCEDURES

A. Request final inspection in writing when project or designated portion of project is substantially complete. Contracting Officer will proceed with inspection within 10 days of receipt of written request or will advise Contractor of items that prevent project from being substantially complete.

B. If work is determined substantially complete, following final inspection, Contracting Officer will prepare Punch List and issue a Letter of Substantial Completion.

C. If work is not determined substantially complete following final inspection, Contracting Officer will notify Contractor in writing. Contractor shall request new final inspection after completing work. Re-inspection costs may be charged against Contractor in accordance with Inspection of Construction contract clause.

D. Contractor shall complete Punch List within 30 calendar days, weather permitting.

E. One the Contractor has made all required corrections to work items, Contracting Officer will issue Letter of final acceptance of work.

F. If Contractor fails to complete work within the time frame, Contracting Officer may correct work with an appropriate reduction in contract price or charge for re-inspection costs in accordance with Inspection of Construction contract clause.

1.5 PERMIT CLOSURE AND TRANSFER

A. When work covered by the permits is complete, create list of tasks required to close or transfer permits to Park. Submit to Contracting Officer for approval.

B. After substantial completion and Punch List completion, permits shall be closed and documented by Agency(ies) with Jurisdiction for the permit.
   1. MT DEQ SWPP: Notice of Termination (NOT)
   2. USEPA SWPP: Notice of Termination (NOT)

C. If responsibility for permits is to be transferred to Park, Park shall be informed of permit provisions completed and responsibilities transferring to Park staff.

1.6 WARRANTIES

A. Contractor warranty on materials and workmanship:

   1. Period of one year after beneficial occupancy/use.

   2. Provide one warranty inspection during the warranty period to address any warranty issues.

B. Submittal Time: Submit written warranties on request of Contracting Officer for designated portions of Work where commencement of warranties other than date of Substantial Completion is indicated.

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

   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify product or installation. Provide typed description of product or installation, including name of product and name, address, and telephone number of Installer.
   3. Identify each binder on front and spine with typed or printed title "WARRANTIES," Project name, and name of Contractor.
   4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF (portable document format) file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. See Division 1 Specification Section 01 73 40 "Execution"

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.

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

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, of rubbish, waste material, litter, and other foreign substances.
b. Rake grounds that are neither planted nor paved to smooth, even-textured surface.
c. Remove tools, construction equipment, machinery, and surplus material from Project site.
d. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of stains, films, and foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to original condition.
e. Remove labels that are not permanent.

f. Touch up, repair, and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

g. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
h. Replace parts subject to unusual operating conditions.
i. Clean plumbing fixtures to sanitary condition, free of stains, including stains resulting from water exposure.
j. Leave Project clean and ready for occupancy.

B. Waste Disposal: Comply with requirements of Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

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

1. Manuals, general
2. Emergency manuals
3. Operation manuals for systems, subsystems, and equipment
4. Maintenance manuals for care and maintenance of products, materials, finishes, systems and equipment.

B. See Divisions 2 through 49 Sections for additional operation and maintenance manual requirements for Work in those Sections.

1.2 Related sections

A. The Work of this Section and all sections in Division 26 shall comply with the following, as applicable and of the following:

1. Section 01 43 33 – Electrical Testing

1.3 SUBMITTALS

A. Manual: Submit one electronic copy at least 15 days before final inspection. Contracting Officer (CO) will return copy or edit version with comments within 15 days of receipt.

B. Format: Submit operations and maintenance manuals in following format:

1. PDF (portable document format) electronic file. Assemble each manual into composite electronically indexed file. Submit on digital media acceptable to Contracting Officer.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

2. Hard copy manual: In accordance with Part 2 of this Section.

3. Correct or modify each manual to comply with Contracting Officer's comments. Submit 2 physical copies of each corrected manual within 15 days of receipt of Contracting Officer's comments.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system. Manual shall contain title page, table of contents, and manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include:

1. Project Title
2. Location
3. Park
4. Contract Number
5. Prime Contractors Name and Address
6. Date of Substantial Completion
7. Binder Volume Number

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

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

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

a. Cover Sheet: Identify binders on front and spine, with project title, location, park, contract number, prime contractor's name and address, date of substantial completion, and binder volume number. Insert cover sheet into clear plastic view pocket on front of binder. Insert sheet into clear plastic view pocket on spine with title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Data: Fill binders to no more than 75 percent of capacity. Punch holes shall not obscure any data. When contents of a single tabbed section cover more than one item, provide colored paper sheets to separate the data for each item.

a. Manufacturers' Data: Provide originals for color or copyrighted data. Black and white data may be originals or clean, good quality reproductions. No copies produced by facsimile transmission and sheets with stamps, such as submittal approval stamps. Include only sheets that apply to items installed; cross out inapplicable data.
b. Vendor Furnished As-Built Drawings: Maximum 24 inch by 36 inch sheets with minimum character or lettering size of 1/8 inch. Reduced-size reproductions may be provided instead of full-size drawings if reproductions are clear and legible. If

reduced-size drawings are used, identify as "REDUCED SIZE" and provide graphic scales, if applicable.

c. Custom Data: Data supplemented by drawings and schematics necessary to describe systems adequately.
d. Equipment Data Sheet: Data, using form at end of this section.
e. Schedules: Schedules reflecting final, as-installed conditions.
f. Poorly reproduced or illegible data will be rejected.

3. Dividers: Divider sheets with Mylar reinforced edges and pre-printed numbered tabs aligned with numbers and title lines on index sheet. Include typed list of products and major components of equipment included in section on each divider, cross-referenced to Specification Section number and title of Project Manual.
4. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

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

2.2 EMERGENCY MANUALS

A. Content: Organize manual into separate section for type of emergency, emergency instructions, and emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, flood, gas leak, water leak, power failure, water outage, equipment failure, and chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of National Park Service (NPS) operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION AND MAINTENANCE MANUALS

A. Operation Requirements

1. Content: In addition to requirements in Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

2. Descriptions: Include:

    a. Product name and model number
    b. Manufacturer's name
    c. Equipment identification with serial number of each component
    d. Equipment function
    e. Operating characteristics
    f. Limiting conditions
    g. Performance curves
    h. Engineering data and tests
    i. Complete nomenclature and number of replacement parts

3. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
4. Systems and Equipment Controls: Describe sequence of operation, and diagram controls as installed.
5. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

B. Maintenance Requirements for Systems and Equipment

1. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, and equipment data sheets as described below.
2. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
3. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:
4. Maintenance Procedures: Test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training videotape if available**,** detailing essential maintenance and environmental procedures.
5. Maintenance and Service Schedules: Service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
6. Spare Parts List and Source Information: Lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
7. Warranties and Bonds: Copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, (all sections as applicable to the work performed on this project) as described below.

B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include:

1. Product name and model number
2. Manufacturer's name
3. Color, pattern, and texture
4. Material and chemical composition
5. Reordering information for specially manufactured products

D. Environmental Requirements

1. Identify environmentally preferable products incorporated into Project. Include: product model; manufacturer’s name, address, phone, and website; and local technical representative.

a. Verify plastic products to be incorporated into Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.

1) Type 1: Polyethylene Terephthalate (PET, PETE)
2) Type 2: High Density Polyethylene (HDPE)
3) Type 3: Vinyl (Polyvinyl Chloride or PVC)
4) Type 4: Low Density Polyethylene (LDPE)
5) Type 5: Polypropylene (PP)
6) Type 6: Polystyrene (PS)
7) Type 7: Other. Use of this code indicates that package in question is made with a resin other than the six listed above or is made of more than one resin listed above and used in a multi-layer combination.

b. Describe maintenance procedures associated with environmentally preferable materials and systems. Provide cleaning recommendations in accordance with ASTM E1971 and approved Integrated Pest Management (IPM) plan.

1) Include potential environmental impacts of recommended maintenance procedures and materials.
2) Include potential indoor air quality impacts of recommended maintenance procedures and materials.
3) Where proposed maintenance procedures incorporate composting of plastics, assess potential effect of each type of plastic to be included in composting process in accordance with ASTM D5509 or ASTM D6002

c. Material Safety Data Sheets (MSDS): Include MSDSs as specified.

2. Develop environmental management programs for facility as follows:

a. Waste management program: Develop in accordance with ASTM E1609. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.
b. Indoor Air Quality (IAQ) management program: Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D6245. Provide for evaluation of VOCs (volatile organic compounds) in indoor air in accordance with ASTM D6345.
c. Water management program: Develop water monitoring program for surface and ground water on project site in accordance with ASTM D5851 and consistent with water management program utilized during construction operations.

E. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers’ Maintenance Documentation: Manufacturers’ maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following and items detailing essential maintenance procedures:

1. Test and inspection instructions

2. Troubleshooting guide
3. Precautions against improper maintenance
4. Disassembly; component removal, repair, and replacement; and reassembly instructions
5. Aligning, adjusting, and checking instructions
6. Demonstration and training video recording

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

1. Include procedures and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 GENERAL

A. At start of project, begin accumulating operation and maintenance data and initiate index. Install and index data in binders within 30 days after delivery of items. As custom written data and test results are produced, add to operation and maintenance data file.

B. List of Operation and Maintenance requirements has been attached at end of the Division 1 Specifications for your convenience. Intent is to provide an overall summary of requirements and not a comprehensive list. Terms and conditions of the contract require satisfaction of requirements of individual specification sections regardless of what is shown on the list.

C. Keep operation and maintenance data current. Make operation and maintenance binders available to Contracting Officer for inspection at time of monthly progress payment requests. If operation and maintenance binders are not current, Contracting Officer may retain an appropriate amount of the progress payment.

3.2 MANUAL PREPARATION

A. Manual Types

1. Emergency Manual: Assemble complete set of emergency information indicating procedures for use by emergency personnel and by NPS operating personnel for types of emergencies indicated.
2. Product Maintenance Manual: Assemble complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into Work.
3. Operation and Maintenance Manuals: Assemble complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

B. Manual Contents: Including, as applicable:

1. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark sheet to identify product or component incorporated into Work. If data include more than one item in a tabular format, identify each item using appropriate references from Contract Documents. Identify data applicable to Work and delete references to information not applicable.
2. Custom Written Data: For data not in manufacturer's standard literature, provide text, drawings, and schematics specifically applicable to installed systems. Include step-by-step descriptions of operating procedures; identification of individual components and their functions; descriptions of how system components relate to one another and operate together to accomplish a common process or function; and sequence of operation for system control circuits. For seasonally operated systems, provide start-up and shutdown instructions.
3. Equipment Data Sheets: For each item of equipment included in operation and maintenance data, provide Equipment Data Sheet using form at the end of this section. For equipment consisting of a driven machine and a driver (for example, a pump and a motor), equipment data shall cover both the driven machine and the driver. For similar type equipment (for example, multiple exhaust fans of the same model and type), provide a single equipment data sheet with an attached schedule listing individual equipment items.
4. Vendor Furnished As-Built Drawings: Provide for each electrical and each mechanical control system.

    a. For each control system, provide control circuit schematic drawings. Identify each wire and terminal block number. Show terminal numbers on control devices. Show control wires and devices remote from control panel.
    b. For each control panel, provide general arrangement drawing showing location of each control component and terminal block on the panel front and interior. Include materials list of panel-mounted control components as well as field-installed control components remote from the panel, identifying components, manufacturer, model number, and initial set points or sensing ranges of devices where applicable.
    c. For packaged equipment systems, provide general arrangement drawings showing interrelationships of the various items of equipment and components.
    d. In addition to control wiring schematic, provide power wiring schematic drawing showing power flow to each motor. Identify each power conductor. Show over-current protection and motor starting devices.

C. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

EQUIPMENT DATA SHEET	
Equipment Item: _____ Designation: _____ Function: _____ Location: _____ Project: _____ Model Number: _____ Serial Number: _____	
Manufacturer Address and Phone:	Supplier Address and Phone:
Preventive Maintenance Tasks:	
Nameplate Data:	
Spare Parts Furnished and Other Information:	

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing National Park Service (NPS) personnel, including:

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

B. See Divisions 2 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 GENERAL REQUIRMENTS

A. List of System Demonstration and Training requirements has been attached at end of Division 1 Specifications for your convenience. Intent is to provide overall summary of requirements and not a comprehensive list. Terms and conditions of contract still require satisfaction of requirements of individual specification sections regardless of what is shown on list. The foll

1. Well Pump Control Panel, Pump Protection System, PLC Control Panel, Infiltration Gallery, Water Tank Systems, and related equipment.

B. Related Sections

1. Section 01 43 33 Electrical Testing

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: Factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Contracting Officer (CO).

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections (include the following information, as applicable to the work performed in this project).

1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
3. Emergencies: Instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
4. Operations: Startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
5. Adjustments: Alignments and checking, noise, vibration, economy, and efficiency adjustments.
6. Troubleshooting: Diagnostic instructions and test and inspection procedures.
7. Maintenance: Inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
8. Repairs: Diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 INSTRUCTION

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

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

1. Schedule training with NPS through Contracting Officer with at least seven days' advance notice.
2. Conduct training sessions after equipment or system has been accepted and turned over to Government. Coordinate with commissioning requirements.
3. Provide training of sufficient duration to adequately cover subjects.

END OF SECTION 01 79 00

DIVISION 2

EXISTING CONDITIONS

SECTION 02 41 00 - DEMOLITION

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. Demolition and removal of existing water facilities including, but not limited to, Chlorination Building electrical and controls, water storage tank, valves, curb stops, infiltration/collection components, pipe, fire hydrants, vaults and concrete.
2. Abandoning in-place, and or removing below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place, and/or removing site utilities.
4. Salvaging items for reuse by the Government.

B. Related Sections:

1. Section 01 11 00 - Summary of Work: Use of the premises, Work Phasing requirements, State notification well abandonment requirements and Hazardous Materials Report.
2. Section 01 32 33 - Photographic Documentation: Preconstruction videos taken before new construction or demolition activities.
3. Section 01 74 19 - Construction Waste Management and Disposal: Administrative and procedural requirements for salvaging nonhazardous demolition and construction waste, recycling nonhazardous demolition and construction waste, and disposing of nonhazardous demolition and construction waste.
4. Section 32 91 19.13 – Topsoil Placement and Grading.
5. Division 33 - Utilities: Shutting off, disconnecting, removing, and sealing/capping water utilities.

1.3 DEFINITIONS

A. See PART 1.3 - Definitions, Section 01 74 19 – Construction Waste Management.

B. Remove: Detach item or facility from existing construction and legally dispose of outside the Park.

C. Demolish: Break up, remove or backfill in place as indicated.

D. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include all fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property, the environment, and mitigation of dust and noise. Indicate proposed locations and construction of barriers.

1. Adjacent Facilities: Detail special measures proposed to protect adjacent facilities to remain including means of egress from those facilities.

B. Schedule of Demolition Activities: Indicate the following:

1. Detailed sequence of demolition Work, with starting and ending dates for each activity.
2. Disconnecting, shutting off, capping and/or re-routing of utility services connected to the demolition Work.
3. Proposed methods of hazardous and universal waste removal and disposal.
4. Temporary interruption of utility services.

C. Pre-demolition Video: Show existing conditions of adjoining construction and site improvements, including finished surfaces that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 "Photographic Documentation."

D. Detail and descriptions of temporary equipment, Comply with requirements of Section 01 74 19 - Construction Waste Management and Disposal.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction (AHJ).

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

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

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review dewatering requirements, if any.
5. Review and finalize protection requirements.
6. Review procedures for noise and dust control.
7. Review procedures for protection of adjacent facilities.
8. Review procedures for hazardous and universal waste removal.
9. Verify pre-demolition videos have been received by the CO.
10. Review items to be salvaged by the Government prior to demolition.

1.7 PROJECT CONDITIONS

A. Buildings or structures to be demolished shall be vacated and their use discontinued before start of the Work.

B. Facilities immediately adjacent to demolition area will be occupied. Conduct demolition so operations of occupied facilities will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied facilities.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent facilities.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent facilities without written permission from authorities having jurisdiction.

C. The Government assumes no responsibility for structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by the Government as far as practical.

2. All equipment listed for demolition or removal will become property of the contractor.

D. On-site storage or sale of removed equipment or materials is not permitted.

1.8 COORDINATION

A. Arrange demolition schedule so as not to interfere with Government operations.

B. Arrange with utility owners the locating, relocating, disconnection, and/or abandonment of utilities.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: Backfill existing structures with Type S1 - Select Fill in accordance with Section 31 05 13 - Soils for Earthwork.

PART 3 - EXECUTION

3.1 LIMITS OF WORK

A. Confine removal of existing facilities to the limits designated on the contract drawings.

3.2 EXAMINATION

A. In order to maintain continuous water supply during construction, demolition of all structures shall only occur after the new systems are complete, tested and accepted by the CO.

B. Review Project Record Documents of existing and new construction provided by the Government. The Government does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged according to section 01 74 19 – Construction Waste Management. Provide photographs, or video of conditions that might be misconstrued as damage caused by salvage operations according to Section 01 32 33 "Photographic Documentation."

D. Verify with the CO that hazardous materials have been identified and there is an approved remediation plan before proceeding with demolition operations.

3.3 PREPARATION

A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Prior to demolition Work, locate buried utilities in accordance with Section 01 73 40 – Execution.
2. For utilities serving facilities scheduled for demolition, coordinate with the utility companies and AHJ's the location where the utility should be disconnected and the proper procedures for disconnecting and final abandonment.
3. If removal, relocation, or abandonment of utility services will affect adjacent buildings or water facilities, provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to remaining facilities.
4. Abandoned conduits shall be cut off a minimum of 24 inches below grade. Cap, valve, or install mechanical plug and seal remaining portion of pipe or conduit after bypassing according to requirements of AHJ's.
5. Plug pipes to be abandoned in-place with a 24-inch thick concrete plug. Do not use concrete plugs to seal pipes that will remain pressurized.
6. Verify that utilities have been properly disconnected and capped prior to starting demolition of any facility. Do not start demolition Work until utility disconnecting and sealing has been completed and verified in writing.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Salvaged Items: Comply with the following:

1. Allow Government 72 hours' following notification of demolition to remove items from the building or structure. See paragraph 1.7C above for Government salvaged items.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits to adjacent buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by the CO and/or AHJ.
2. Provide temporary services during interruptions to existing utilities that are acceptable to the CO and/or AHJ's.

    a. Provide at least 72 hours' notice to CO and occupants of affected buildings if shutdown of service is required during a changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences and railings where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 50 00 "Temporary Facilities and Controls." Erect temporary protection in order to:

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
3. Provide temporary barricades and other protection required to prevent injury to people, animals and damage to adjacent buildings and facilities to remain.
4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to demolition operations.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 GENERAL

A. Debris originating from demolition must be lawfully disposed of outside the park. Contractor shall be responsible for any disposal permits and fees required for this project.

B. Demolition Work shall be completed in accordance with applicable O.S.H.A. Standards and authorities having jurisdiction.

C. General: Demolish indicated buildings and structures completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Prior to structure demolition, remove liquids and hazardous materials that pose environmental risks.
2. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
3. Maintain fire watch during and for at least 4 hours after flame cutting operations.
4. Maintain adequate ventilation when using cutting torches.

5. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Unless indicated otherwise, all demo materials originating from demolition shall be lawfully hauled and disposed of outside the Park.
7. Separate recyclables and dispose of according to Section 01 74 19 "Construction Waste Management."

D. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

E. Site Access and Temporary Controls: Conduct demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from the CO and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic when required.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

F. Existing Utilities: Disconnect existing utilities and below-grade utility structures indicated in the plans.
1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

G. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION OF WATER FACILITIES

A. Utility Vaults and Manholes: Demolish or remove utility vaults as indicated in the plans and according to the following definitions and requirements:

1. Definitions:
   a. "Demolish Water Vault or Manhole" shall constitute removal of mechanical equipment and recyclables, plugging of open ended pipes, removal of the upper portion of the structure to at least 24 inches below grade, and backfilling the structure with native material to finished grade.
   b. "Remove Water Vault or Manhole" shall constitute removal and disposal of the entire structure including piping and equipment and backfilling with native material to finished grade.
2. Requirements:
   a. Contractor shall remove and dispose of outside the Park concrete manhole and vaults lids.
   b. All metals shall be removed for recycle.
   c. Place 24-inch concrete plugs in each abandoned open-ended pipe.
   d. For vaults called to be demolished and buried in place, cut or break a minimum12-inch diameter hole through the structure floor to promote free drainage.

e. Crushed concrete, less than 12 inches in size, can be mixed with onsite soils and used as backfill within remaining structures. Placement of demolished concrete within 24 inches of finished grade is not permitted.

B. Asbestos Cement Piping
1. The Contractor is responsible for complying with all applicable federal, state, and local regulations for asbestos cement pipe for cutting of pipe (and disposal if required), and worker training and safety.
2. The Contractor shall properly dispose of all pipe material removed as part of this contract in accordance with local, State and Federal regulations.

3.7 BACKFILL

A. Backfill holes with soils generated onsite and compact in accordance with Section 31 23 23 – Fill.

3.8 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition operations with satisfactory soil materials.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades. Comply with Section 32 91 19.13 – Topsoil Placement and Grading.

C. Install and grade topsoil in accordance with Section 32 91 19.13 – Topsoil Placement and Grading.

3.9 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in a landfill acceptable to authorities having jurisdiction. See Section 01 74 19 "Construction Waste Management and Disposal" for recycling and disposal of demolition waste.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning of materials within the Park is not allowed.

3.11 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to the condition existing before building demolition operations began.

1. Contractor shall clean roadways of debris caused by debris transport.

END OF SECTION 02 41 00

DIVISION 3

CONCRETE

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes Cast-in-place concrete including, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Concrete Thrust Blocks

B. Related Sections:
1. Section 01 33 23 – Submittal Procedures
2. Section 33 14 00 – Water Utility Distribution Equipment

1.3 REFERENCES

A. American Concrete Institute:
1. ACI 117 – Standard Tolerances for Concrete Construction and Materials
2. ACI 211.1 – Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. ACI 214 – Recommended Practice for Evaluation of Strength Test Results of Concrete
4. ACI 301 - Specifications for Structural Concrete for Buildings
5. ACI 302.1R – Guide for Concrete Floor and Slab Construction
6. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
7. ACI 305 - Hot Weather Concreting.
8. ACI 306.1 - Standard Specification for Cold Weather Concreting.
9. ACI 308.1 - Standard Specification for Curing Concrete.
10. ACI 309 – Guide for Consolidation of Concrete
11. ACI 315 – Details and Detailing of Concrete Reinforcement
12. ACI 318 - Building Code Requirements for Structural Concrete.
13. ACI 347 – Guide to Formwork for Concrete
14. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures
15. ACI SP-66 – American Concrete Institute Detailing Manual

B. ASTM International:
1. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. ASTM A1064/A1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

3. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
4. ASTM C33 - Standard Specification for Concrete Aggregates.
5. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
6. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
7. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
8. ASTM C127 – Standard Test Method for Specific Gravity and Absorption of Course Aggregate.
9. ASTM C128 – Standard Test Method for Specific Gravity and Absorption of Fine Aggregate.
10. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
11. ASTM C150 - Standard Specification for Portland Cement.
12. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
13. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
14. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
15. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
16. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
17. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
18. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
19. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
20. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
21. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
22. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
23. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
24. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
25. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM C1260 – Test Method for Potential Alkali Reactivity of Aggregates.
28. ASTM C1567 – Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate.
29. ASTM D395 – Test Methods for Rubber Property – Compression set.
30. ASTM D412 – Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomer – Tension.
31. ASTM D624 – Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomer.
32. ASTM D746 – Test Method for Brittleness Temperature of Plastics by Impact.
33. ASTM D792 – Test Method for Specific Gravity (Gravity Density) and Density of Plastics by Displacement.
34. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

35. ASTM D1190 – Concrete Joint Sealer, Hot-Poured Elastic Type.
36. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
37. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
38. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
39. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
40. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
41. CRSI – Concrete Reinforcing Steel Institute – Manual of Standard Practice.
42. CRSI – Placing Reinforcing Bars, 8th edition.

1.4 DEFINITIONS

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

1.5 PERFORMANCE TOLERANCES

A. Cast in Place concrete shall conform to ACI 307R and ACI 347, as modified herein. In case of conflict, ACI 347 governs.

1.6 SUBMITTALS

A. Section 01 33 23 – Submittal Procedures.

B. Concrete 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. Submit Concrete mix design for each strength of concrete specified. Submit separate mix designs when admixtures are required for Hot and cold weather concrete work and air entrained concrete work.
2. Submit Concrete mixture proportions and characteristics of proposed mix design along with test data identifying compression strength at 7 day and 28 day testing.
3. Mix design to include proposed admixtures to provide workability; prevention of rapid drying; and improved finishing capabilities' for the contractor to achieve acceptable placement, finishing and consolidation; with concrete mix requirements of Low Water Cement Ratio and low slump.
4. Mix design and admixtures must have the minimum strength and properties required.
5. Proportions of materials for concrete shall be established to provide workability and consistency to permit concrete to be worked readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.
6. Concrete Mix Design & Laboratory Test reports to include:

a. Slump Range on which the design is based.
b. Total gallons of water per cubic yard.
c. Brand, type, composition and quantity of fly ash (if used)
d. Specific gravity and gradation of each aggregate.
e. Ratio of fine to total aggregates.
f. Surface-dry weight of each aggregate per cubic yard.
g. Brand, type, ASTM designation, and active chemical ingredients and quantity of each admixture.
h. Air content and tolerance.
i. Water/Cementitious material ratio and tolerance.
j. Compressive strength based on 7 day and 28 day compression tests in accordance with ASTM C39.
k. Submit supplier certified fly ash test reports for each shipment delivered to concrete supplier.
l. Signed by contractor and concrete supplier.

C. Concrete Mix Test Results:

1. Submit ASTM C1260 or ASTM C1567 test results for aggregates used; & ASTM C618 test results if fly ash is to be used.
2. Test results to be submitted for approval a minimum of 30 days prior to intended concrete placement.
   a. In the event the mix design and/or test results are not acceptable and additional ASTM testing is required, additional time will be needed for the contractor to get an approved mix design and the appropriate test results obtained.
3. ASTM C1260 (Test for Potential Alkali Reactivity of Aggregates) Laboratory Test Results.
4. ASTM C1567 – (Test for Determining the Potential Alkali Silica Reactivity of Combinations of Cementitious Materials and Aggregate) laboratory test results if reactivity mitigation is required by ASTM C1260 test results.
5. ASTM C618 – Fly Ash Test Results, as indicated in the section below.

D. Concrete Mix Admixtures:

1. If Fly Ash is used in the Concrete Mix design, it must conform to ASTM C618 and meet all the requirements. ASTM C618 test results must be submitted for review. *Fly Ash used must be in compliance with ASTM C618-97, and the "Supplementary Optional Chemical Requirement" must be provided.
   a. Fly Ash sources used must be approved per ASTM C618-97– "Approved Fly Ash Sources for Mitigation". Fly Ash not included on that list; or not meeting Table 1A of ASTM C618-97, will not be allowed.

E. Concrete Mix Product Data:

1. Provide product data on all admixtures and components of the mix design.
   a. Hot and cold weather concrete work.
   b. Air entrained concrete work.
2. Identify mix ingredients and proportions, including admixtures.
3. Indicate amounts of mixing water to be withheld for later addition at Project site.

F. Concrete Delivery:

1. The Concrete Delivery Plan shall include alternatives for delivery and placement procedures, in the event of unforeseen mechanical malfunctions or other delays.
2. Backup supply sources and placement equipment should be available for use within 30 minutes in the event of primary supply or equipment breakdown.
3. The Delivery Plan shall also include a plan to keep concrete in acceptable condition during delivery time. Timing of successive delivery trucks, and course of action if one truck is delayed on delivery or delayed on placement, shall be provided along with the effects on additional deliveries.
4. The Contractor must coordinate with the concrete mix provider to develop a plan of action if the concrete mix arrives on site and is out of specification for air content; slump; or water cement ratio, or if the concrete mix is not of consistency to permit workability and placement without segregation or excessive bleeding.
    a. If the concrete mix is out of specification and the specification requirements cannot be achieved on site; the concrete will be rejected and not allowed to be placed.

1.7 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

B. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

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

B. Testing Agency Qualifications: A agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

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

E. The Contractor will employ a testing laboratory to perform tests and to submit test reports.

F. Sampling and testing for quality control during placement of concrete shall be as indicated in Section 3 of this specification, and as directed by the Contracting Officer. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C97.

G. Acquire cement and aggregate from same source for all Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Cement and Fly Ash: Store in moisture proof enclosures, do not use if caked or lumpy.

B. Aggregate: Store to prevent segregation and inclusion of foreign materials, do not use the bottom 6 inch of piles in contact with the ground.

C. Rubber and Plastic Materials: Store in a cool place off the ground and protected from moisture, dirt, oil, other contaminants, and do not expose to direct sunlight.

D. Protect all materials from damage during handling and installation in accordance with the manufacturer's instructions.

E. Prepare a delivery ticker for each load of ready-mixed concrete. Truck operator shall hand the ticket to the Contractor at time of delivery and the ticket to show:

1. Quantity delivered
2. Actual quantity of each material in batch
3. Outdoor temperature in the shade
4. Time at which cement was added
5. Numerical sequence of the delivery
6. Quantity of water that can be added in the field based on the approved mix design
   a. The Contractor must verify the quantity of water that can be added in the field after calculating the water cement ratio from the batch plant; and the water cement ratio with the addition of said quantity of water – before any water is added in the field.
   b. The Contractor must be able to determine the water cement ratio of the mix from the quantities shown on the ticket, and the water cement ratio will be determined and verified for each truck prior to placement.
7. Free moisture in fine and coarse aggregate in percent by weight.
8. Temperature of batch.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150, Type II. Where aggregates are alkali reactive, a low-alkali cement having a maximum alkali content of 0.60% Na_2O equivalent shall be used.

a. Fly Ash: ASTM C 618, Class F or C, except loss on ignition not more than 5%, & Available Alkalies (as Na_2O) less than max % allowed.

1) Fly Ash used in the mix design or for mitigation must be in compliance with ASTM C618-97 with "Supplementary Optional Chemical Requirements" provided, and the Available Alkalies as equivalent as Na_2O% must be below the maximum % indicated in ASTM C618-98, or the Fly Ash will be rejected.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Fine Aggregate: Clean, natural sand, ASTM C33; no manufactured or artificial sand. Free of materials with deleterious reactivity to alkali in cement.

D. Coarse Aggregate: Crushed rock, natural gravel, or other inert granular material graded, ASTM C33 except clay and shale particles no more than 1%. Free of all materials deleteriously reactive with alkalies in the cement in an amount to cause excessive expansion of concrete. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.

E. All Coarse and Fine Aggregates shall be tested for Alkali-Silica Reactivity (ASR) according to ASTM C1260 tests. Aggregate sources which exhibit ASTM C1260 mean mortar expansion greater than 0.10% at 14-days shall be considered potentially reactive and shall require mitigation. Mitigative additives may be approved fly ash, lithium nitrates, or other additives in any combination. The proposed mix design with Mitigative additions shall be tested according to ASTM C1567.

F. Water: ASTM C 94/C 94M

1. Water to be Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or steel.

2.2 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

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

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

C. Admixtures including Accelerators – High range water reducer; Retarders; and Plasticizers shall all be included in the concrete mix design for review and approval.

D. All admixtures must be accepted in writing by the Contracting Officer.

2.3 CURING MATERIALS

A. Cure concrete surfaces to requirements of Specification Section 03 37 00 – Concrete Curing.

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

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

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

E. Water: Potable or non potable.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

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

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

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

J. Cementitious Materials: Use fly ash, pozzolan, and silica fume as acceptable for the concrete mix design requirements. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

   1. Fly Ash: 25 percent.
   2. Combined Fly Ash and Pozzolan: 25 percent.
   3. Silica Fume: 10 percent.
   4. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

K. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

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

   1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.4 CONCRETE MIXING

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

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd, increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.5 SOURCE QUALITY CONTROL

A. Test the proposed concrete mix for each size and gradation of aggregates and each consistency intended for use in the project.

B. Aggregates: Sample and test according to ASTM C33. Determine bulk specific gravity in accordance with ASTM C127 & ASTM C128.

PART 3 - EXECUTION

3.1 TRANSPORTING MIXED CONCRETE

A. Transporting of mixed concrete shall conform to ACI 304R – Guide for Measuring, Mixing, Transporting and Placing concrete; & ASTM C94 – Standard Specification for Ready-Mixed Concrete.

B. Do not exceed manufacturer's guaranteed capacity of truck agitators. Maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

C. Do not incorporate additional mixing water into the concrete during hauling or after arrival at the delivery point, unless ordered by the Contractor & approved by the Contracting Officer. If additional water is approved to be incorporated into the concrete, revolve the drum not less than 30 revolutions at mixing speed after the water is added and before placing the concrete.

D. Furnish a water measuring device in good working condition, mounted on each transit mix truck, for measuring the water added to the mix on the site, if approved by the Contractor and Contracting Officer.

E. Provide delivery ticket and comply with delivery requirements.

3.2 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Contracting Officer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, and subject to the approval of the Contracting Officer.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints if approved by the Contracting Officer. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
4. Minimum concrete temperature at time of mixing:
   a. When the Outdoor Temperature is below 30 degrees Fahrenheit: Concrete Temperature at mixing to be: 70 degrees Fahrenheit.

b. When the Outdoor Temperature is between 30 degrees and 45 degrees Fahrenheit: Concrete Temperature at mixing to be: 60 degrees Fahrenheit.

5. Do not place heated concrete that is warmer than 80 degrees Fahrenheit.
6. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 degrees Fahrenheit for 5 days or 70 degrees Fahrenheit for 3 days with forms in place.
7. Do not allow concrete to cool suddenly
8. Do not water cure during cold weather. Use membrane curing compound, if approved by the Contracting Officer.

F. Hot-Weather Placement: Comply with ACI 305 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
3. Do not allow concrete temperature to exceed 70 degrees Fahrenheit at placement.
4. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
5. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 pounds per square foot per hour as determined from ACI 305, Fig. 2.1.4.

G. Prepare previously placed concrete by cleaning with steel brush or sandblasting and applying bonding agent in accordance with manufacturer’s instructions.

H. Concrete cold joints to have additional concrete placement must have the joining surface intentionally roughened by raking or other means to a depth of ¼ inch prior to additional concrete placement.

I. In locations where new concrete is doweled to existing work, drill holes in existing concrete, and insert dowels with epoxy resin system as specified on the project drawings. Epoxy dowels are allowed only at locations indicated on the project drawings.

J. Rigidly secure forms, reinforcing steel, embedment, and anchor bolts in proper position prior to placing concrete. Ensure reinforcement, inserts, embedded parts, waterstops, and mechanical or electrical embeds are not disturbed during concrete placement.

K. Remove all mud, water, ice, snow, frozen material, and debris from space to be occupied by concrete.

L. Clean surfaces encrusted with dried concrete from previous concrete operations.

M. Convey to the point of final deposit by methods that will prevent separation or loss of ingredients.

N. Place concrete in final position without being moved laterally more than 5 feet.

O. Place concrete in approximately horizontal layers of proper depth for proper compaction, not more than 2 feet. Concrete shall not be allowed to drop freely more than 4 feet or through a cage of reinforcing steel.

P. After concreting is started, it shall be carried on as a continuous operation until each pour is complete as indicated by construction joints shown on the drawings. Ensure to place subsequent layer while the preceding layer is still plastic.

Q. All concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement and embedded fixtures, waterstops, and into corners of forms. Use of vibrating equipment to move concrete horizontally is not permitted.

R. Remove all laitance, debris, and surplus water from the tops of the forms by screeding, scraping or other effective means.

3.3 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases as indicated on the project drawings.
3. Minimum Compressive Strength: 4000 psi at 28 days, unless noted otherwise.
4. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.4 CONCRETE PROTECTING AND CURING

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

B. Cure concrete surfaces to requirements of specification Section 03 37 00 – Concrete Curing.

C. Immediately after placement, protect and cure concrete.

D. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

E. Cure concrete by methods that will keep concrete surfaces adequately wet during curing, in accordance with ACI 308.

3.5 FIELD QUALITY CONTROL

A. Inspections:
1. Verification of use of required design mixture.
2. Concrete placement, including conveying and depositing.

3. Curing procedures and maintenance of curing temperature.

END OF SECTION 03 30 00

SECTION 03 37 00 – CONCRETE CURING

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. Initial and final curing of horizontal and vertical concrete surfaces.

B. Related Sections:
1. Section 03 30 00 – Cast In Place Concrete

1.3 REFERENCES

A. ACI 301 – Standard Specification for Structural Concrete for Buildings
B. ACI 302.1R- Guide for Concrete Floor and Slab Construction
C. ACI 308 – Standard Practice for Curing Concrete
D. ACI 350 – Environmental Engineering Concrete Structures
E. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete
F. ASTM C309 – Standard Specification for Liquid Membrane – Forming Compounds for curing Concrete.
G. ASTM D2103 – Standard Specification for Liquid Membrane –Forming Compounds for curing Concrete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, and used.
1. Provide manufacturers data sheets on curing methods and components, film, compatibilities, and limitations.

B. Procedure: Provide a Summary & Schedule of curing procedures to be utilized on each surface; to the Contracting Officer and Structural Engineer of Record for review and approval prior to construction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

B. Perform work in accordance with ACI 301; ACI 302; & ACI 308.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver; handle; store; and protect all curing materials according to the manufacturer's recommendations and in manufacturers packaging, including application instructions.

B. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.

C. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Membrane Curing Compound Type A: ASTM C309, Type 1, Class A chlorinated rubber type, clear or colored as indicated in subsection 3 of this specification.

B. Saturated Wet Covering such as burlap, cotton mats, & rugs: Any covering must be new and suitable, and must not leave any un-acceptable residue.

C. Impervious paper or plastic sheets.

D. Water: Potable, not detrimental to concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Immediately after placement, protect all concrete from premature drying, moisture loss, & excessively hot or cold temperatures and mechanical injury.

1. Curing should begin immediately after finishing, and must ensure continued hydration of the cement; strength gain of the cement; and a minimum of early drying shrinkage.

2. All newly placed and finished concrete walls and slabs must be cured and protected from drying; extreme changes in temperature; and from damage by subsequent construction traffic.

B. Verify that substrate surfaces are ready to be cured.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete. Concrete shall be maintained above 50 degrees F and in a moist condition for at least the first 7 days after placement.

D. Cure concrete by methods that will keep concrete surfaces adequately wet during curing, in accordance with ACI 308.

E. Maintain rate of temperature change less than 5 degrees Fahrenheit in any one (1) hour period.

3.2 PREPARATION

A. In cold weather, arrangement must be made in advance for heating, covering, insulating, or enclosing the concrete.

1. Cold weather curing must be in accordance with ACI 306.

B. In hot weather, special precautions must be taken against rapid evaporation and drying due to high temperatures, drying conditions, and wind.

1. Hot weather curing must be in accordance with ACI 305.

3.3 PROTECTION OF FINISHED WORK

A. Protect finished work from cosmetic and structural damage.

B. Do not permit traffic over unprotected floor/slab surfaces.

END OF SECTION 03 37 00

SECTION 03 60 00 - GROUTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawing 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. Grouting of Equipment and support systems base plates.
   2. Grouting of anchors and dowels into existing concrete
   3. Patching cavities in concrete.
   4. Other grouting specified or indicated on drawings.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete
   2. Division 33 Utilities

1.3 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 318 - Building Code Requirements for Structural Concrete.
   3. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures.

B. American Society of Testing and Materials:
   1. ASTM C33 - Standard Specification for Concrete Aggregates.
   2. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
   3. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
   4. ASTM C150 - Standard Specification for Portland Cement.
   5. ASTM C157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar and Concrete.
   6. ASTM C191 - Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
   7. ASTM C307 - Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.

C. U. S. Army Corps of Engineers Concrete Research Division (CRD):
   1. CRD C621 - Non-Shrink Grout.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's catalog sheet for material indicating test data and physical properties.

B. Manufacturer's Installation Instructions: Submit manufacturer’s instructions for mixing, handling, surface preparation and placing epoxy type and non-shrink type grouts.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Confirm to applicable industry standard as specified in CRD-C-621.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver grout in manufacturer's unopened containers with proper labels intact.

B. Store grout in a dry shelter, protect from moisture.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I and II.

B. Water:
1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
   a. Corrosion of steel.
   b. Volume change increasing shrinkage cracking.
   c. Efflorescence.
   d. Excess air entraining.

C. Fine Aggregate:
1. Washed natural sand.
2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities as determined by ASTM C40.

D. Mix:
1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 EPOXY GROUT/ADHESIVE

A. Manufacturers:
1. Sika
2. Master Builders
3. Hilti
4. Sikadur
5. Or Equal

2.3 NON-SHRINK CEMENTITIOUS GROUT

A. Manufacturers:
   1. Master Builders – Masterflow 928
   2. Burke – Non Ferrous Non-Shrink
   3. L & M Inc. – Crystex
   4. M.R. Meadows – Sealtight 588
   5. Sonneborn – Sonogrout G.P.
   6. Tamms – Tammsgrout 621
   7. Sika – Sika Grout 212
   8. Or Equal

B. Non-shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides.

C. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx.)
		Final	3 hours (Approx.)
Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi
		28 days	8,000 psi to 10,000 psi

2.4 CURING

A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Verify areas to receive grout.

3.2 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

F. Cold weather conditions:
   1. Warm concrete, substrate and baseplate to 40-degree Fahrenheit, or above; store grout in warm area.
   2. Follow manufacturer’s recommendations for Cold weather application.

G. Hot weather conditions:
   1. Use cold mixing water and cool baseplate if possible; store grout in cool area.
   2. Follow manufacturer’s recommendations for hot weather application.

3.3 MIXING

A. Portland Cement Grout:
   1. Use proportions of 2 parts sand and 1 part cement, measured by volume.
   2. Prepare grout with water to obtain consistency to permit placing and packing.
   3. Mix water and grout in two steps; pre-mix using approximately 2/3 of water; after partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing 2 to 3 minutes.
   4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
   5. Do not add additional water after grout has been mixed.
   6. Capable of developing minimum compressive strength of 2400psi in 48 hours and 7000 psi in 28 days.

B. Mix and prepare epoxy grout in accordance with manufacturer's instructions.

C. Mix and prepare non-shrink cementitious grout in accordance with manufacturer's instructions.

D. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

3.4 PLACING GROUT

A. Place grout material quickly and continuously.

B. Do not use pneumatic-pressure or dry-packing methods.

C. Apply grout from one side only to avoid entrapping air.

D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

E. Thoroughly compact final installation and eliminate air pockets.

F. Do not remove leveling shims for at least 48 hours after grout has been placed.

G. Non-Shrink; Non-Metallic Grout:
   1. Mix in a mechanical mixer
   2. Use no more water than necessary to produce flowable grout
   3. Provide air vents where necessary to eliminate air pockets.
   4. Place in accordance with manufacturer's instructions.
   5. Completely fill all spaces and cavities below the top of baseplates.
   6. Provide forms where baseplates and bedplates do not confine grout.
   7. Where exposed to view finish grout edges smooth.
   8. Except where a slope is indicated on the drawings, finish edges flush at the baseplate, bedplate, member or piece of equipment.
   9. Protect against rapid moisture loss by immediately covering with wet rags and polyethylene sheets or curing compound.
   10. Wet cure grout for 7 days, minimum.
   11. Maintain the temperature at a minimum of 40-degree Fahrenheit until grout reaches 3000 psi.

H. Epoxy/grout adhesive – for Adhesive Anchors
   1. Apply only to clean, dry, sound surface.
   2. Epoxy grout to be a two-component system consisting of a resin and hardener.
   3. Each component furnished in separate tubes within cartridge.
   4. Drill hole to proper diameter and depth.
   5. Clean hole removing laitance and debris.
   6. Dispense adhesive into hole
   7. Insert dowel or threaded rod, slowly turning during insertion.
   8. Obtain manufacturer's field technical assistance as required to insure proper placement.

3.5 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.6 SCHEDULE

A. Non-Shrink, Non-Metallic Grout: General Use

   1. Grouting equipment baseplates.

B. Epoxy Grout/adhesive
   1. Patching cavities in concrete including, but not limited to tie holes.
   2. Grouting of dowels and anchor bolts into existing concrete.

END OF SECTION 03 60 00

DIVISION 26

ELECTRICAL

SECTION 260000 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic electrical requirements for materials and methods applicable to electrical equipment specified under this Section and other related sections

B. Conduit

C. Boxes

D. Wire and Cable

E. Wiring Devices and Device Plates

F. Maintenance Materials

1.2 REFERENCES

A. ACI 318—Conduits and Pipes Embedded in Concrete

B. ANSI C2—National Electrical Safety Code

C. ANSI/NEMA FB 1—Fittings and Supports for Conduit and Cable Assemblies

D. ANSI/NEMA OS 1—Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports

E. IEEE—All applicable standards

F. IPCEA—All applicable standards

G. NEMA—All applicable standards

H. NEMA 250—Enclosures for Electrical Equipment (1,000 Volts Maximum)

I. NFPA 70—National Electrical Code

J. UL—All applicable standards

1.3 DEFINITIONS

A. Finished Area: Unless otherwise indicated finished areas include offices, meeting rooms, control rooms, lobbies, laboratories, restrooms, breakrooms, and associated administrative spaces

B. Unfinished Area: Unless otherwise indicated unfinished areas include process areas, pipe galleries, pump and blower rooms, chemical rooms, mechanical equipment rooms, electrical rooms, maintenance rooms, shops, and similar spaces

C. Wet Areas: Unless otherwise indicated wet areas include all areas where washdown with hose directed water is likely to occur or where liquid filled process piping is located. This will include all pump areas, pipe galleries, areas containing process tanks or open channels, chemical rooms, and similar spaces

1.4 SUBMITTALS

A. Shop Drawings:

1. Conduit:
   a. Submit building conduit layout prior to installation of conduit
   b. Identify location and size of junction boxes
2. Building Electrical: Indicate luminaire, panel, equipment, motor, and control station size and locations to verify compliance with specifications

B. Product Data:

1. Provide data on electrical materials and accessories
2. Provide sufficient information to verify compliance with specifications

C. Submit shop Drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal

D. Mark dimensions and values in units to match those specified

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of conduit, panels and accessories

1.6 REGULATORY REQUIREMENTS

A. Electrical: Conform to NFPA70, National Electrical Code and applicable local codes

B. Coordinate, obtain and pay for all permits, inspections and approvals of authority having jurisdiction

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on Drawings

B. Verify routing and termination locations of conduit

PART 2 - PRODUCTS

2.1 CONDUIT

A. Minimum Size:

1. General: 3/4 inch minimum unless otherwise specified
2. Luminaire pendants: 1/2 inch

B. Underground Installations:

1. Without Concrete Encasement:
   a. Use smoothwall or ribbed wall HDPE conduit
   b. Provide PVC coated rigid metal 90-degree elbow and extension for all conduit turning out of ground
2. Minimum Size: 1 inch

C. Outdoor Locations, Above Grade: Use rigid metal conduit

D. Interior Locations:

1. Exposed: Use rigid metal conduit
2. Concealed in Walls: Use rigid metal conduit

E. In Suspended or Structural Concrete Slab and Concrete Walls:

1. Use thickwall nonmetallic conduit
2. Provide PVC coated rigid metal 90-degree elbow and extension for all conduit turning out of concrete slab or wall
3. Maximum Size Conduit in Slab: 1-1/2 inch; 3/4 inch for conduits crossing each other

F. In or Under Concrete Slab on Grade:

1. Use thickwall non-metallic conduit
2. Provide PVC coated rigid metal 90-degree elbow and extension for all conduit turning out of concrete slab
3. Provide concrete encasement for conduit under slab

G. Motor Flexible Connections:

1. Conduit:
   a. Vinyl jacketed, liquid-tight, flexible steel
   b. Anaconda Type UA,
   c. Electroflex Type LA,
   d. or approved equal
2. Connectors:
   a. Watertight
   b. Appleton Type ST or STB,
   c. Crouse-Hinds Type LT or LTC,
   d. or approved equal

2.2 CONDUIT SUPPORT

A. General: Galvanized steel framing channel

B. Unistrut, Powerstrut, or approved equal

2.3 OUTLET AND DEVICE BOXES

A. General:

1. Sheet Metal Outlet Boxes: NEMA OS 1, Galvanized:
   a. Luminaire and equipment supporting boxes: Rated for weight of equipment supported
   b. Concealed in Finished Areas

B. Outdoor and Indoor Wet Areas:

1. Cast Boxes: NEMA FB 1, Cast Ferroalloy
   a. Provide gasketed cover by box manufacturer
   b. Provide threaded hubs
   c. Crouse-Hinds VXF, GRFX, FS/FD or approved equal

2.4 PULL AND JUNCTION

A. General

1. Sheet Metal Boxes: NEMA OS 1, Galvanized Steel

B. Outdoor and Indoor Wet Areas:

1. Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box:
   a. Material: Galvanized cast iron
   b. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws
   c. Crouse-Hinds WCB or approved equal

C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Material: Galvanized cast iron
2. Cover: Nonskid cover with neoprene gasket and stainless-steel cover screws
3. Cover Legend: ELECTRIC
4. Model: WJBF as manufactured by Crouse-Hinds

2.5 LARGE JUNCTION BOXES AND WIRING GUTTERS

A. Indoor Locations:

1. General:
   a. Sheet-steel galvanized after fabrication
   b. NEMA 1
2. Wet Areas:
   a. Corrosion-resistant cast metal
   b. NEMA 4

B. Outdoors:

1. Corrosion-resistant cast metal
2. Weather-tight NEMA 4

C. Construction:

1. Provide rigid handles for box covers larger than 9 sq-ft or heavier than 25 lbs
2. Provide split covers for covers larger than 12 sq-ft
3. Aluminum boxes in concrete not allowed

2.6 SEAL FITTINGS

A. Model ESU with Apelco sealing cement and fiber, as manufactured by Appleton

B. Model EZS with Chico X Fiber and Chico A compound as manufactured by Crouse-Hinds

2.7 FLEXIBLE SEALING COMPOUND

A. "Duxseal" as Manufactured by Johns-Manville

B. "Permagum" as Manufactured by Inmount

2.8 WIRE AND CABLE

A. Power and Lighting Circuits, 600-volt and Below

1. General Use:
   a. Conductors: Single, copper, 12 AWG minimum
   b. Stranded where larger than 10 AWG, solid or stranded for 10 AWG and 12 AWG
   c. Insulation: 600-volt thermoplastic, UL Type THWN/THHN
   d. Jacket: Nylon
   e. Suitability: Wet or dry locations at 75 °C copper temp
   f. Or as specified for service entrances
2. Service entrance and 4 AWG and above:
   a. Conductors: Single, stranded, copper
   b. Insulation: 600-volt cross-linked polyethylene, UL Type XHHW/USE
   c. Suitability: Wet or dry locations at 75 °C copper temp
   d. Manufacturers: Okonite, General Cable, or approved equal
3. Terminations: Lugs, cup washers or pressure type; do not use wire nuts on stranded cable or wrap stranded cable around screw type terminals

B. Control Circuits, 600-volt and Below

1. Conductors: Single, copper, 14 AWG minimum
2. Stranded
3. Insulation: 600-volt thermoplastic, UL Type THWN/THHN
4. Jacket: Nylon
5. Suitability: Wet or dry locations at 75 °C copper temp

C. Millivolt or Milliampere Instrument Signal Cable:

1. Conductors:
   a. Pair: 16 AWG stranded copper
   b. Triad: 18 AWG stranded copper
2. Insulation: .81 mm, minimum, 80 °C PVC or cross-linked polyethylene
3. Shield: Mylar aluminum tape with 18 AWG copper drain wire, fully covering conductors
4. Jacket: .81 mm, minimum, 80 °C PVC
5. Suitability: Wet or dry steel conduit
6. In cable tray: Multiconductor Type TC
7. Manufacturers:
   a. Pair: Belden 8719, or approved equal
   b. Triad: Belden 8770, or approved equal

D. Arc-Proofing Tape: Irvington "77 Arc-Proofing Tape," Slipknot No. 50 or Slipknot No. 3, or approved equal

2.9 WIRING DEVICES

A. General:

1. Specification grade
2. Brown or ivory to match device plates with phenolic plastic device plates

B. Receptacles (UL 498):

1. 120-volt duplex outlets: NEMA 5-20R, 3-wire, grounding, 20-amp, 125-volt, Hubbell 5362, General Electric 4108-1, or approved equal

2.10 DEVICE PLATES

A. General:

1. Mounting hardware countersunk and finished to match plate
2. Provide over-sized plates where standard plates do not cover wall opening
3. Provide engraving as indicated on Drawings

B. Indoors:

1. Surface mounted devices: Galvanized or cadmium-plated steel
2. Flush mounted devices: Type 302 stainless steel

C. Outdoors and Indoor Wet Areas:

1. While-in-use weatherproof covers
2. Crouse-Hinds TP7491 or equal
3. Provide an adaptor plate for flush mounted device plates

2.11 GROUNDING AND BONDING

A. Provide grounding and bonding in accordance with Section 260526

1. NFPA 70

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install all equipment level and plumb
2. Separate sheet metal junction boxes, equipment enclosures, sheet metal raceways, etc., mounted on water or earth-bearing walls or wall-mounted outdoors 1/4-inch from wall by corrosion resistant spacers
3. Screen or seal with flexible sealing compound all openings into outdoor equipment to prevent the entrance of rodents, wasps, and mud-daubers

B. Raceways:

1. General:
   a. Except as otherwise indicated on the Drawings, install conduit exposed in unfinished areas
   b. Metal conduit connections and terminations to be reamed, de-burred, threaded and provided with bushings
   c. Securely fasten conduit connections to sheet metal enclosures with locknuts inside and out
   d. Provide deflection fittings across structural joints where structural movement is allowed
   e. Keep conduit clear of structural openings and indicated future openings
   f. Neatly grout conduit into any opening cut into structure
   g. Cap or plug conduits during construction to prevent entrance of trash, dirt and water
   h. Seal conduits with flexible sealing compound forced to a minimum depth equal to the conduit diameter after cable is installed:
      1) Building entrance junction boxes
      2) One inch or larger connections to equipment
   i. Seal conduits with sealing fittings and hardening sealing compound:
      1) Entering submersible enclosures
   j. Provide flexible conduit where flexible connections are necessary, including each motor without flexible cord:
      1) Length kept to a minimum, 6 feet max
      2) No sharp bends
2. Conduit exposed in structures:
   a. Install parallel to structural members and surface
   b. Install conduits of same general routing parallel with symmetrical bends
   c. Arrange supports to prevent misalignment during wiring installation
   d. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers
   e. Group related conduits; support using conduit rack. Construct rack using steel channel and provide space on each for 25 percent additional conduits
   f. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size
   g. Provide suitable pull string in each empty conduit except sleeves and nipples

h. Maintain 6-inch clearance to ducts, piping and flues
i. Support rigidly with galvanized or cadmium-plated hardware and framing materials, including nuts and bolts
j. Provide expansion fittings at 100 feet centers outdoors, 200 feet centers indoors; in each conduit run longer than 100 feet outdoors, 200 feet indoors
k. Provide pipe caps on conduit stubs for future use
l. Allow 7 feet headroom for horizontal conduit runs, except along structures, piping equipment or where not possible
m. Except as otherwise indicated, do not install exposed conduit in water chambers
n. Where allowed, coat conduit exposed in water chambers with 2 coats of coal tar paint with paint injuries repaired or use PVC coated conduit

3. Underground:
   a. One inch minimum
   b. Two feet minimum bend radius at vertical risers, 3 feet elsewhere
   c. Install underground conduit so that it does not drain to cable pulling access in buildings; where necessary, provide a handhole near or adjacent to building
   d. Provide 2 feet minimum earth cover unless shown otherwise on drawings
   e. Isolate intercommunication and milliampere instrumentation circuits from all power wiring raceways, conduits, boxes, vaults, manhole and handhole
4. Junction boxes and wiring gutters:
   a. Install electrical boxes as shown on drawings and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements
   b. Install pull boxes and junction boxes to maintain headroom and to present neat mechanical appearance
   c. Install level and plumb
   d. At least code size including space for full size continuation of any conduit not originally continued
   e. Arrange conduit for maximum space for future conduits
   f. Support boxes independently of conduit ,except cast box that is connected to rigid metal conduits both supported within 12 inches of box

C. Wire and Cable:

1. General:
   a. Protect the cable and avoid kinking conductors, cutting or puncturing jackets, contaminating by oil or grease or damaging in any manner
   b. Terminate stranded cable with lugs, cup washers, or pressure type connectors; do not wrap stranded cable around screw type terminals
   c. Splice stranded cable with pressure type connectors; do not use wire nut type connectors on stranded cable
   d. Splice cables only at readily accessible locations
   e. Do not pull cable tight against bushings or press heavily against enclosures
   f. Use cable pulling lubricants as recommended by the cable manufacturer
   g. Use swab to clean conduits and ducts before pulling cables
   h. Install cable and accessories in accordance with manufacturer's instructions
   i. Coil and tape spare cable ends
   j. Use 10 AWG conductors for 20 amperes, 120-volt branch circuits longer than 75 feet
   k. Clean conductor surfaces before installing lugs and connectors

l. Make splices, taps, and terminations to carry full ampacity of conductors

2. Special cables:
   a. Isolate intercommunication and milliampere instrumentation cables from all power circuits
3. Conductor identification:
   a. Color code all service, feeder, and branch circuit conductors, 208/120-volt AC and 240/120-volt AC as follows:
      1) Phase A: Black
      2) Phase B: Red
      3) Phase C: Blue
      4) Neutral: White
      5) Ground: Bare or Green
   b. Identify single control conductors by color coding orange and by labeling each end conductor with adhesive labels, Brady "Quicklabel" or approved equal
   c. Identify multi-conductor instrumentation and control cables with adhesive labels, Brady "Quicklabel", or approved equal
   d. Contractor shall establish a control and instrumentation conductor and cable identification system acceptable to Engineer

D. Wiring Devices:

1. Flush mount wiring devices in concealed conduit system
2. Surface mount wiring devices in exposed conduit systems
3. Provide extension rings to bring outlet boxes flush with finished surface
4. Clean debris from outlet boxes
5. Install products in accordance with manufacturer's instructions
6. Install devices plumb and level
7. Install receptacles with grounding pole on top
8. Connect wiring device grounding terminal to branch circuit equipment grounding conductor
9. Connect wiring devices by wrapping conductor around screw terminal
10. Install wall receptacle 18 inches above finished floor in finished areas and 36 inches above finished floor in unfinished areas
11. Inspect each wiring device for defects
12. Operate each wall switch with circuit energized and verify proper operation
13. Verify that each receptacle device is energized
14. Test each receptacle device for proper polarity
15. Test each GFCI receptacle device for proper operation
16. Verify that each telephone jack is properly connected and circuit is operational
17. Adjust devices and wall plates to be flush and level

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Flexible raceway runs.

3.3 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.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-(10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Galvanized steel.
3. Channel Width: Selected for applicable load criteria.

4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: 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.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325 (Grade A325M).
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: 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 (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: 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. To Existing Concrete: Expansion anchor fasteners.
5. 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 (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
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 by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

END OF SECTION 260529

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 SUBMITTALS

A. Include a copy of this specification section; pertinent Contract Drawings; other relevant specification sections as noted above; and all addendum updates with each specification paragraph and Contract Drawing clearly check-marked to indicate compliance with specification and drawing requirements or marked to indicate requested deviations/substitutions from the specification requirements.

B. Product Data: For each electrical identification product indicated.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's

wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

D. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

2.4 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
   3. Inscriptions for Orange-Colored Tapes: COMMUNICATIONS CABLE.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

D. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white or light-gray background. Minimum letter height shall be 3/8 inch.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.
   5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.

J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench.

K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, , 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

B. Accessible Raceways within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
   1. Power.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      b. Colors for 240/208/120-V Circuits:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral: White
         5) Ground: Green

c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, use write-on tags with the conductor or cable designation, origin, and destination.

E. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes or self-adhesive, self-laminating polyester labels with the conductor designation.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.
1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
5. Controls with external control power connections.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Emergency system boxes and enclosures.
   e. Enclosed switches.
   f. Enclosed circuit breakers.
   g. Enclosed controllers.
   h. Push-button stations.
   i. Contactors.
   j. Monitoring and control equipment.
   k. UPS equipment.

END OF SECTION 260553

SECTION 262913 - MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Enclosed full-voltage magnetic motor controllers.
   2. Enclosures.
   3. Accessories.
   4. Identification.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of magnetic controller.

   1. Include plans, elevations, sections, and mounting details.
   2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
   3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
   4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE 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 use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.2 ENCLOSED FULL-VOLTAGE MAGNETIC MOTOR CONTROLLERS

A. Description: Across-the-line start, electrically held, for nominal system voltage of 600-V ac and less.

B. Standard: Comply with NEMA ICS 2, general purpose, Class A.

C. Configuration: Non-reversing, combination thermal-magnetic circuit breaker type.

D. Contactor Coils: Pressure-encapsulated type.

1. Operating Voltage: Manufacturer's standard, unless indicated.

E. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.

F. Overload Relays:

1. Thermal Overload Relays:

a. Inverse-time-current characteristic.
b. Class 10 tripping characteristic.
c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

2.3 ENCLOSURES

A. Comply with NEMA 250, type 12, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

2.4 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oil-tight.

a. Push Buttons: Hand Off-Auto.
b. Pilot Lights: Running indication.

2. Elapsed Time Meters: Heavy duty with digital readout in hours; non-resettable.

2.5 IDENTIFICATION

A. Controller Nameplates: Laminated acrylic or melamine plastic signs, as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
2. Visual and Mechanical Inspection:

    a. Compare equipment nameplate data with drawings and specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, and grounding.
    d. Verify the unit is clean.
    e. Inspect contactors:

1) Verify mechanical operation.
2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

f. Motor-Running Protection:

1) Verify overload element rating is correct for its application.
2) If motor-running protection is provided by fuses, verify correct fuse rating.

g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

3. Electrical Tests:

a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data or NETA ATS Table 100.1. In the absence of manufacturer's published data, use Table 100.5. Values of insulation resistance less than those of this table or manufacturer's recommendations shall be investigated and corrected.
b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
c. Test motor protection devices according to manufacturer's published data.
d. Test circuit breakers as follows:

1) Operate the circuit breaker to ensure smooth operation.
2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.

e. Perform operational tests by initiating control devices.

C. Motor controller will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controller will be considered defective if it does not pass the system function tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 262913

DIVISION 27

COMMUNICATIONS

SECTION 27 13 23 COMMUNICATIONS FIBER OPTIC BACKBONE CABLING

PART 1 – GENERAL

1.1 GENERAL

1. The Contractor's scope for fiber optic related work is limited to trenching, conduit installation, handhole installation, building entry, and fiber optic cable pulling, and related work only. NPS will complete cable splicing and connecting hardware related work separately from this contract.

1.2 SECTION INCLUDES

A. Single mode fiber optic cable for outdoor and indoor use.

1.3 RELATED REQUIREMENTS

A. Section 26 00 00 Basic Electrical Materials and Methods

1.4 ACTION SUBMITTALS

A. Prior to construction:

1. Manufacturer's catalog data for all materials used.

1.5 QUALITY ASSURANCE

A. All work shall be in accordance with best practices within the industry and all manufacturer's published directions.

B. The cables shall be from same manufacturer, of same type, and of same size.

C. Prior to cable installation, visually inspect cable to ensure that the cable outer jacket is continuous, free of pinholes, splits, blisters, or other imperfections. The jacket shall have a uniform, consistent thickness and have a smooth texture. Ensure that the cable is not bend at a radius smaller than the minimum bend radius – the cable shall not be kinked or bent.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation: Ship cable on reel. Radius of reel drum shall be greater than minimum bend radius of fiber.

B. Wind cable on reel so unwinding can be done without kinking cable. 2 meters of cable at both ends of cable shall be accessible for testing.

C. Provide water-resistant label and indelible writing on labels.

D. Fiber shall be packaged under sufficient low tension to avoid degradation of fiber strength due to static fatigue.

PART 2 – PRODUCTS

2.1 FIBER OPTIC CABLE

A. The fiber optic cable shall meet or exceed the specifications of the COMMSCOPE 760053280 D-012-LA-8W-F12NS Fiber OSP Cable, TerraSPEED Single Jacket/Single Armor, Gel-Free, Stranded Loose Tube, 12-Fibers, Singlemode G.652.D and G657.A1, Feet jacket marking, black jacket color - https://www.commscope.com/product-type/cables/fiber-cables/outside-plant-cables/item760053280/. A durable cable rated for indoor, buried, and above use.

1. Armor Type – Corrugated Steel
2. Cable Type – Stranded loose tube
3. Construction Type – Armored
4. Subunit Type – Gel-free
5. Filler, quantity – 4
6. Jacket Color – Black
7. Jacket Marking – Feet
8. Subunit, quantity – 1
9. Fibers per Subunit – 12
10. Total Fibers Count – 12
11. Outer Jacket Material – MDPE, smooth texture
12. Bend Radius – 6.8” loaded, 4.5” unloaded
13. Maximum Tensile Load – 800 N long term, 2700 N short term
14. Fiber Type – G.652.D and G.657.A1 TerraSPEED OS2

2.2 HANDHOLES

A. The basis of design handhole for all fiber optic, electric, and communications applications shall be the Oldcastle Duralite 1118-18, an 11” x 18” x 18” ANSI / SCTE Tier 22 Heavy Duty Handhole with hex head coil thread bolt. Matching cover to include marking plate with “COMMUNICATIONS” or “ELECTRIC” accordingly.

PART 3 – EXECUTION

3.1 FIELD WIRING

A. Cable Slack

a. Provide 50 feet of slack at each end of a cable in each building. Zip tie cables for neat organization.

b. Provide 50 feet of slack in every handhole. Zip tie cables for neat organization.

c. Splices shall only be allowed inside of buildings – do not splice a cable in a handhole.

B. Cable and Conduit Routing Between Buildings

a. One continuous cable between B#1455 Ranger Station and B#1576 Radio Shed

b. One continuous cable between B#1576 Radio Shed and B#353 Ranger Office

c. One continuous cable B#353 Ranger Office and B#97 Ranger Residence

d. One continuous cable between B#97 Ranger Residence and B#1451 Strissel Cabin

e. Empty conduit between B#1451 Strissel Cabin and the handhole located near B#1594 Dorm and B#1865 School to Park Cabin, and empty conduit routed from this handhole into the crawlspace of B#1594 and B#1865. There is no need to provide a fiber optic cable in this run; this work is included for ease of future improvements.

f. Note – some conduits will have multiple cables.

C. Cable Pulling

1. Reels: Mount firmly on portable stand and secure against displacement.

2. Lubrication: Use an approved cable pulling lubricant with maximum coefficient of friction of 0.15.

D. Cut fiber optic cables by recommended mechanical means only. Make clean cuts.

E. Remove fiber coating material by mechanical means only.

F. Cable bending radius: strictly adhere to manufacturer's specifications for allowable bend radius.

G. Install fiber optic cables in dedicated conduit.

H. Identification and labeling:

1. Identification tags or labels shall be provided for each cable.

2. Markers, tags, and labels shall use indelible ink or etching which will not fade in sunlight, or in buried or underground applications.

3. Markers, tags, and labels shall not become brittle or deteriorate for period of 20 years.

4. Labeling format shall be identified, and complete record shall be provided to Owner with final documentation.

5. Each cable shall be identified with type of signal being carried and termination points.

3.2 CONDUIT INSTALLATION

A. Underground conduit, below grade building entries, and above grade building entries per Civil Plans.

END OF SECTION 27 13 23

DIVISION 31

EARTHWORK

SECTION 31 05 13 - SOILS FOR EARTHWORK

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. Subsoil materials.
   2. Topsoil materials.

B. Related Sections:
   1. Section 01 11 00 – Summary of Work, Geotechnical Investigations including bore hole and test pit findings of existing subsurface soils.
   2. Section 01 57 23 – Temporary Storm Water Pollution Prevention.
   3. Section 31 05 16 – Aggregates for Earthwork.
   4. Section 31 10 00 – Site Clearing
   5. Section 31 23 17 – Trenching.
   6. Section 31 23 23 – Fill.
   7. Section 32 91 19.13 – Topsoil Placement and Grading.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.4 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials source.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements**.**

D. Weed-free certification for imported materials from a park approved source.

1.5 QUALITY ASSURANCE

A. Furnish each subsoil materials from single source throughout the Work.

B. Perform Work in accordance with authorities having jurisdiction.

C. All imported materials shall be certified weed free from a park approved source.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Contractor shall maximize the use excavated onsite soils.

B. Subsoil Type A: Trench Fill as specified in Section 31 23 17 – Trenching.

C. Subsoil Type B: Trench Fill Under Roadways as specified in Section 31 23 17 – Trenching.

D. Subsoil Type S1: Select Fill
   1. Excavated material for re-use during backfill.
   2. Graded.
   3. Native soils free of lumps and rocks greater than 12 inches, organic debris and foreign matter.

E. Subsoil Type S2: Landscaping Fill
   1. Excavated material for re-use during backfill.
   2. Graded.
   3. Native soils free of lumps greater than 12 inches and rocks larger than 48 inches, organic debris and foreign matter.

F. Topsoil Type S3: Native Topsoil
   1. Excavated and reused material, unless otherwise required to waste.
   2. Graded.
   3. Free of roots, rocks larger than 2 inch, subsoil, large weeds and foreign matter.
      a. Screening: Single screened.

G. Topsoil Type S4: Imported Topsoil
   1. All imported topsoil shall be sourced from an NPS-approved weed-free source. Coordinate with Contracting Officer for approved sources.
   2. Imported topsoil may be required to supplement stockpiled topsoil to meet the minimum 4” depth across areas to received topsoil. Mix the imported and stockpiled topsoils together prior to placement.

H. Topsoil Type S5: Embankment Material
   1. All embankment material shall be approved before use and be free from cinders, ashes, ice, frozen material, debris, muck, detrimental quantities of organic materials, and other unsuitable materials.

2. If moisture content or material characteristics are not conducive to proper compaction and installation of the embankment during construction, the CO may disapprove further use of the fill material.

2.2 SOURCE QUALITY CONTROL

A. Contractor shall obtain imported subsoil or topsoil materials from a source approved by the Contracting Officer (CO) and Park Ecologist. See current approved list of suppliers attached to this specification.

B. Submit samples of imported materials when requested by CO.

C. Section 01 40 00 - Quality Requirements**:** Testing and Inspection Services.

D. Testing and Analysis of Insitu and Imported Subsoil Material: Perform in accordance with ASTM D698.

E. When tests indicate materials do not meet specified requirements, change material and retest.

F. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to a minimum depth of 3-inches and maximum depth of 24-inches in areas subject to disturbance. Comply with Section 31 10 00 – Site Clearing.

B. Remove excess subsoil, not intended for reuse outside the Park.

C. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site and OFF NPS LANDS and dispose of in a lawful manner. Removal of unusable materials shall include oversized rock excavation and cobble material, as well as, grubbed organic materials such as rootwads and slash.

D. Excavate, stockpile and replace wetland soils according to Section 01 12 00 – Natural Features Protection.

3.2 STOCKPILING

A. Stockpile excavated native materials.
   1. Topsoil: Comply with Section 31 10 00 – Site Clearing for stripping, stockpiling and reclamation.
      a. Stockpile topsoil to a maximum height of 3 vertical feet.
   2. Subsoil:
      a. Water Transmission/Distribution Line Trenching: Place native trench cuttings used for backfill adjacent to the trench.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers, or stockpile apart to prevent intermixing of soil types, or contamination.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. Reclaim areas in accordance with Section 32 91 19.13 – Topsoil Placement and Grading.

END OF SECTION 31 05 13

APPROVED GRAVEL and TOPSOIL SOURCES - as of 6/23/2025.

Please note that <u>some of the pits have conditions for import</u>, some are fully acceptable. **Only those pits listed are approved, other pits belonging to the same vendor were not approved. <u>Pits must be reinspected at least annually and some more frequently than that.</u>**

Please call Matt Kennedy for questions about gravel or soil sources that you want to be inspected. 888-7984

Topsoil

Creston Topsoil
Kalispell, Mt
Contact: Tom Gorton 756-8217
Approved for topsoil.

Sand & Gravel

West side:

Spoklie's West Glacier Canyon Gravel
1252 Belton Stage Rd
West Glacier, MT 406-756-0165/ 250-6727 cell
Contact: Grant Spoklie, owner
658 White Basin Rd
Kalispell, MT 59901
Approved for sand & gravel.

LaSalle Sand & Gravel
315 Pioneer Rd.
Kalispell, Mt
Contact: Justin Sherman 756-9070 / 261-2337
Approved for gravel & sand.

Sandry Construction
Bigfork, MT 406-752-2419
Contact: Mitch Hill
Cell 406-250-2544
Pioneer Rd. Pit, Kalispell
Approved for sand & gravel.

Schellinger Sand & Gravel
PO Box 39
Columbia Falls, MT 59912 406-892-3101
Carlson Pit: Whitefish St. Rd. Whitefish
Approved for sand & gravel.

Schellinger Sand & Gravel
PO Box 39

Columbia Falls, MT 59912 406-892-3101
Tutvedt Pit: Farm to Market Rd. Kalispell
Approved for sand & gravel.

Schellinger Sand & Gravel
PO Box 39
Columbia Falls, MT 59912 406-892-3101
Essex Pit: Hwy 2 just east of Essex
Approved for gravel and large rock.

Schellinger Sand & Gravel
PO Box 39
Columbia Falls, MT 59912 406-892-3101
Jellison Pit: Jellison Rd. Kalispell
Approved for sand & gravel.

Grizzly Logging & Gravel
1082 Batavia Lane
Kalispell, MT
Contact: Michelle 406-261-3250
Approved for gravel.

East side

Kingsbury Colony
600 Kingsbury Colony Road
Valier, MT
Contact: Mike 406-231-0066

Approved for crushed gravel & sand. Must be hauled ASAP after crushing.

SECTION 31 05 16 - AGGREGATES FOR EARTHWORK

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. Aggregate for Drains
2. Imported and Reclaimed Aggregate Base Course
3. Pit Run Aggregate (Structural Fill)
4. Cobble Rock
5. Granular Fill
6. Aggregate for Pervious Backfill Material
7. Aggregate for Riprap
8. Type 1 Pipe Bedding Material
9. Type 2 Pipe Bedding Material

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork: Fill and grading materials.
2. Section 31 23 17 - Trenching.
3. Section 31 23 23 - Fill.
4. Division 33 Utilities

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
5. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Aggregate source information including weed free certification.

C. Product Data: Submit data on all materials specified herein.
   1. Aggregates for Drainage -Submit lab analysis and tests under ASTM C136 as required to assure material meets requirements specified below.
   2. Type 1 Pipe Bedding Material: If imported, submit lab analysis and tests under ASTM D-2487 as required to assure material meets USCS soil classification requirements specified below.
   3. Type 2 Pipe Bedding Material: If imported, submit lab performed gradation analysis.
   4. Imported Aggregate Base Course: Submit lab performed gradation analysis and moisture density relationship curve utilizing ASTM D698 (Standard Proctor).
   5. Granular Fill: Submit lab analysis and tests under ASTM C136 as required to assure material meets requirements specified below.
   6. At the discretion of the Contracting Officer (CO), observed variability in imported materials from previously submitted product data will result in additional testing at the Contractor's expense.

D. When requested, submit samples of materials to the CO.

1.5 QUALITY ASSURANCE

A. If aggregate is imported, furnish all aggregate material from a single source throughout the Work.

B. If Type 1 and/or Type 2 Pipe Bedding is to be processed from native onsite material, provide periodic lab analysis and tests under ASTM D-2487 as required to assure material meets USCS soil classification requirements specified below. Frequency of periodic laboratory analysis shall be at the discretion of the Contracting Officer (CO). Laboratory testing costs shall be paid by the Contractor.

PART 2 PRODUCTS

2.1 DEFINITIONS

A. Coarse Aggregate: Materials retained on a No. 4 sieve.

B. Fine Aggregate: Materials passing a No. 4 sieve.

C. Gradation Requirements: Based on percentage of material by weight passing laboratory sieves having square openings.

2.2 SOURCE QUALITY CONTROL

A. Imported Aggregates: Aggregates shall come from a weed free source approved by the Contracting Office, or be sterilized through a heating process.

1. Upon delivery of imported materials, Contractor shall furnish weigh tickets with the aggregate source information and weed-free certification.

B. Comply with Section 01 40 00 - Quality Requirements for testing and inspection services.

C. When tests indicate materials do not meet specified requirements, change material and retest.

2.3 AGGREGATE FOR DRAINS

A. Gravel for drains shall be crushed or natural sand and gravel or other approved free-draining material. The material shall be uniformly graded from coarse to fine within the following gradation requirements for the material type indicated. Where the grading is not indicated, Grading A shall be used.

Sieve	% by Weight Passing		
Designation	Grading A	Grading B	Grading C
2”	100	---	---
1 1/2"	95 – 100	100	---
1”	---	95 – 100	---
3/4"	35 – 75	---	100
3/8”	10 – 30	---	95 – 100
#4	0 – 5	0 – 10	---
#8	---	---	65 – 95
#16	---	---	5 – 30
#100	---	---	0 – 10

2.4 IMPORTED AGGREGATE BASE COURSE

A. Imported Aggregate Base Course for Roads: In accordance with requirements below.
   1. The composite materials shall be free from clay balls, vegetable matter, and other deleterious substances, and shall not contain an excess of thin or elongated pieces.
   2. Crushed sub-base and crushed base shall be crushed stone or crushed gravel and an approved soil binder or natural filler, where required, conforming to the following requirements:
      a. Coarse aggregate shall consist of hard, durable particles or fragments of stone or gravel. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used. Unless otherwise specified, the coarse aggregate shall have a percentage of wear of not more than 50.
      b. Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. The fraction passing the #200 sieve shall not be greater than two-thirds of the fraction passing the #40 sieve. The fraction passing the #40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6 except that, when the plasticity index is nonplastic (NP), the liquid limit shall not be more than 30.
      Crushed base and crushed sub-base shall meet one of the following gradation requirements:

Sieve Designation	Percent Passing by Dry Weight
3/4"	100
#4	40 – 70
#10	25 – 55
#200	2 – 12

2.5 STRUCTURAL FILL

A. Well-graded sand, sandy gravel, gravel, or fine cobble used for Structural Fill

B. USCS classification GW or GP.

C. Maximum plasticity index of a 6 as determined by AASHTO Designations T-89 and T-90.

2.6 COBBLE ROCK

A. Random sized, smooth, round aggregate.

B. 6 to 12-inches-diameter.

2.7 GRANULAR FILL

A. Natural gravel, crushed stone, or sand meeting the following gradation requirements as determined by ASTM D422-63(1998):

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
3-inch	100
No. 8	10

2.8 AGGREGATE FOR PERVIOUS BACKFILL MATERIAL

A. Pervious Backfill Material shall consist of gravel, crushed gravel, crushed rock, natural sands, manufactured sands, or combinations thereof, and shall meet the following gradation requirements:

Sieve Designation	% by Weight Passing
2"	100
#4	0 – 50
#40	0 – 30
#100	0 – 10
#200	0 – 4

B. The fraction passing the #40 sieve shall be nonplastic (NP) and shall have a liquid limit not greater than 30.

2.9 AGGREGATE FOR RIPRAP

A. Aggregate for riprap shall be hard, durable, crushed, quarried, or natural stone, or broken concrete having an apparent specific gravity of 2.4 or greater. The absorption shall not exceed 4 % unless otherwise approved by ENGINEER in the Special Provisions. The stone shall be free of weak laminations and cleavages, and shall be of a quality that will not disintegrate on exposure to water or weathering. The aggregate for the various types of riprap shall meet the following additional requirements:

1. Class l Riprap aggregate shall consist of two sizes of stone.
   a. Primary stones shall be not less than 3" thick and shall weigh not less than 50 pounds. At least 60 percent of the stones shall weigh more than 80 pounds each.
   b. Choke stones shall be fragments or spalls of the proper size to satisfactorily wedge between the primary stones as placed.
2. Class 2 Riprap aggregate shall be graded with a sufficient amount of smaller stones uniformly distributed throughout. At least 60 percent of the stones shall weigh more than 80 pounds each.
3. Grouted Riprap aggregate shall conform to the specifications for Class 1 or Class 2 Riprap. If not specified, Class 1 Riprap shall be used.
4. Wire Enclosed Riprap aggregate shall be round or angular stones. Not less than 95% of the stone shall be retained on a screen or wire having 2" square openings.
5. Sacked Concrete Riprap aggregate shall consist of either a sandy or gravelly pit-run material. This material shall be clean and free from roots, vegetable matter, or other deleterious substances. The aggregate shall meet the following gradation requirements:

Sieve Designation	% by Weight Passing
2"	80 – 100
#200	0 – 4

B. Aggregate Filler for Riprap: Filter aggregates for riprap shall be hard, durable particles or fragments of crushed stone or natural gravel, screened or crushed to meet the following gradation requirements:

Sieve Designation	% by Weight Passing
3"	100
#4	20 – 50
#200	0 – 10

2.10 TYPE 1 PIPE BEDDING MATERIAL

A. Bedding material around pipes shall extend four (4) inches under the pipe to six (6) inches over the pipe and consist of select coarse-grained soils with a maximum particle size of 3/4”. Pipe bedding shall meet Unified Soil Classifications GW, GW-GM, GP, GP-GM, SW,SP, or SM, or as specifically approved by the CO. Bedding material shall be free from clods or frozen material, and when installed/compacted shall be within ±2% of optimum moisture content as determined by ASTM D698. Contractor may be required to sort or screen trench cutting material or procure adequate native pipe bedding material from areas of open trench elsewhere throughout the project, or import satisfactory material from offsite.

2.11 TYPE 2 PIPE BEDDING MATERIAL

A. Type 2 Pipe Bedding Material-granular 1½" - 6" diameter granular aggregate as required for foundation in over-excavated trenches from 6" under the pipe and down.

B. Unsuitable material may be loose, unstable, expansive, have a high organic content, have pour drainage, or other undesirable properties, as determined by the CO.

PART 3 EXECUTION

3.1 STOCKPILING EXCAVATED AGGREGATE

A. Stockpile excavated material meeting requirements of Part 2, above, that are intended for reuse.

B. Remove excess excavated materials not intended for reuse, from site.

3.2 STOCKPILING

A. Stockpile materials on site at staging areas designated in the drawings, or other areas approved by the CO.

B. Sites for aggregate stockpiles shall be grubbed, stripped of topsoil and cleaned prior to storing aggregates, and the site shall be firm and smooth and well drained. A bed of aggregate suitable to avoid the inclusion of soil or foreign material shall be maintained.

C. Stockpile in sufficient quantities to meet Project schedule and requirements.

D. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

F. The aggregates shall meet applicable parts of this section for the type of material required.

G. The stockpiles shall be built in layers not exceeding four feet in height, and each layer shall be completely in place before the next layer is started so as to prevent segregation. The material shall be deposited in such manner as to prevent coning, except in the case of fine aggregate composed of material approximately 90% finer than a #4 sieve.

H. Dumping, casting, or pushing over sides of stockpiles is prohibited except in the case of fine aggregate materials.

I. Any stockpiling of materials derived by wet pit or dredging operations, other than those stockpiles previously mentioned, are subject to prior approval of the CO and must be specified and submitted in the Contractor's plan of operations.

J. When it is necessary to operate trucks or other equipment on the stockpile in the process of building that stockpile, it should be done in a manner approved by CO. Any method of stockpiling aggregate which allows the stockpile to become contaminated with foreign matter or

causes excessive degradation of the aggregate will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has operated. Failure of such samples to meet all grading requirements for the aggregate shall be considered cause for discontinuance of such stockpiling procedures.

K. The aggregate shall be transferred from the stockpiles in such a way as to obtain a material having a uniform grading.

3.3 PROTECTION FOR AGGREGATE

A. The equipment and methods utilized in the production, storage, transportation and final placement of aggregate materials shall be such as to provide in-place materials meeting all requirements as specified.

3.4 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 31 05 16

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Protecting existing resources including trees, shrubs, groundcovers, plants, grass, and other vegetation described in the contract documents and by the Contracting Officer (CO) during pre-construction conference.
   2. Removing existing trees, shrubs, groundcovers, plants, grass, and other vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above and below-grade site improvements.
   6. Removal and disposal or reuse of existing concrete and asphalt surfacing.
   7. Removing existing fill.

B. Related Sections:
   1. Section 01 57 23 – Temporary Storm Water Pollution Prevention.
   2. Section 01 74 19 – Construction Waste Management and Disposal.
   3. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 3 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

   1. In areas where insitu soils do not appear to meet the definition above, the Contractor shall treat the top 4 to 6 inches of material as topsoil and strip it according to this specification.

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

1.4 MATERIAL OWNERSHIP

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

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing. Comply with Section 01 32 33 – Photographic Documentation.

B. Record drawings identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions. Additional requirements for project record documents are included in Section 01 77 00 – Closeout Procedures.

1.6 QUALITY ASSURANCE

A. Preconstruction Conference: Conduct conference at Project site as directed by CO prior to start of construction. Contractor shall comply with requirements of Section 01 31 00 – Project Management and Coordination.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations. Comply with Section 01 55 26 – Traffic Control.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from CO and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction (AHJ's).

B. Protect improvements on Park property.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Park premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing. Comply with Section 01 73 40 – Execution, for locating buried utilities.

E. Unless otherwise stated, do not commence site clearing operations until temporary erosion and sedimentation control measures are in place. Comply with Section 01 57 23 – Temporary Storm Water Pollution Prevention.

F. Restore damaged improvements to their original condition, as acceptable to CO.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: As specified in Section 31 05 13 – Soils for Earthwork.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks, survey control points, monuments, property line pins and other reference points from disturbance during construction. If disturbed or destroyed, restore or replace at no cost to Government.

B. Prior to construction activities, Contractor shall clearly mark the limit of disturbance boundary with highly visible orange plastic fencing and steel posts and/or lath and flagging as required. The location of the marked boundary shall be approved by the CO.
   1. Impacts to vegetation, shrubs and trees shall be limited to areas that lie within the construction corridor (limits of disturbance). Do not operate equipment or disturb areas outside the "limits of disturbance" without prior written approval from the CO.
   2. Prior to clearing and grubbing activities, mark trees that are within the construction corridor. Contractor shall coordinate the removal of marked trees with the CO, or representative thereof. When feasible, CO may request Contractor to protect certain trees, and may provide Contractor additional space in order to do so.

C. Provide erosion control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust from leaving project site. Use erosion control best management practices to minimize soil erosion. Comply with Section 01 57 23 – Temporary Storm Water Pollution Prevention.

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

E. Protect existing site improvements to remain from damage during construction.
   1. Restore or replace damaged improvements to their original condition, as acceptable to the Government.

F. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

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

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

3.2 TREE PROTECTION

A. Unless authorized by the CO, do not remove trees outside fill or excavated areas unless approved by the CO.

B. Protect trees left standing from permanent damage by construction operation.

C. Trim standing trees as directed by the CO.

D. With approval and coordination of the CO, cut dead snags that may be outside the construction limits, but pose a falling hazard to the Work site

E. Erect and maintain temporary fencing around drip line of individual trees or around perimeter drip line of groups of trees to remain before starting site clearing. Remove fence when construction is complete.
   1. Do not store construction materials, debris, or excavated material within fenced area.
   2. Do not permit vehicles, equipment, or foot traffic within fenced area.
   3. Maintain fenced area free of weeds and trash.

F. Unless otherwise indicated, do not excavate within tree protection zones.

G. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
   3. Cover exposed roots with wet burlap to prevent roots from drying and backfill with soil as soon as possible.

H. Repair or replace trees and vegetation damaged due to Contractor's negligence, in a manner approved by CO.
   1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.3 UTILITIES

A. Contractor will locate, identify, arrange for disconnect and seal or cap off utilities indicated to be removed before site clearing as indicated on the drawings.
   1. Verify that utilities indicated as abandoned have been disconnected and capped before proceeding with site clearing.
   2. Arrange with utility companies having jurisdiction to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving occupied Park facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify CO not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without CO's written permission.

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

D. Removal of underground utilities may also be included in Division 2 Sections covering site utilities.

E. After removal of underground utilities, properly cap and/or plug existing lines to remain in accordance with AHJ's.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated, unless as noted above.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Completely remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
   4. Use only hand methods for grubbing within drip line of remaining trees.
   5. Chip removed tree branches and stockpile in areas approved by CO. Chipped organics shall be used as a soil amendment and incorporated into the topsoil during final surface restoration.
   6. Dispose of all slash, trees, root material not designated to be chipped on site, OFF NPS LANDS, at an approved landfill and in a lawful manner or other approved areas.

B. Prior to construction, the Contractor shall mulch/mow vegetation within the construction corridor along the water transmission line alignment.
   1. If the length of this Contract permits, complete Work between the months of August and October to prevent nesting birds from occupying the construction corridor the following year when waterline construction will take place.
   2. Mow vegetation to an average height of 1 to 2 inches, and a maximum height of 3 inches.
   3. Mulched material shall be removed with the topsoil during stripping.

C. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earth moving is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Facilitate revegetation of disturbed soil areas by salvaging and storing existing topsoil and reuse it in restoration efforts in accordance with NPS policies and guidance.

B. Waste topsoil in locations described in the drawings. Place topsoil materials at least 24 inches below finished grade to prevent germination of noxious seed base.

C. Stripping:
   1. Strip topsoil in areas impacted by construction, including, but not limited to, staging areas, trench sections and in the vicinity of new structures.
   2. Strip topsoil to a depth of 4 to 24 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   3. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, and other waste materials. Native organics, not including exotic weeds, can be incorporated into the topsoil.
   4. Surplus topsoil stripped beyond a depth of 6-inches shall be hauled to locations within the project area that are deficient in topsoil and utilized for final surface restoration.
   5. Strip topsoil within staging or material stockpile areas.

D. Whenever possible, salvage and preserve disturbed vegetation for reuse.

3.6 TOPSOIL STOCKPILING

A. Store topsoil for as short a time as possible to prevent loss of seed and root viability, loss of organic matter, and degradation of the soil microbial community.

B. Stockpile separately ecologically specific topsoil. Topsoil originating from sagebrush, wetland or lodgepole dominate habitat type shall be separated. Install temporary signs identifying each type of topsoil and location of origination. Redistribution of topsoil types shall be synonymous with the habitat type from which it originated.

C. Do not compact, or operate equipment on stripped topsoil windrows or stockpiles. Use best management practices (BMP) to prevent topsoil contaminations and wasting.

D. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 36 inches.
   2. Grade and shape stockpiles to allow unimpeded drainage of surface water.
   3. Do not stockpile topsoil within drip line of existing trees.
   4. Stockpile surplus topsoil to allow for re-spreading a thicker layer of topsoil, or utilization in areas with a topsoil deficit
   5. Stockpile topsoil away from excavations and future work and protect it from mixing with other materials and the subsoil.

3.7 DISPOSAL

D. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them outside the Park.
   1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.
   2. Concrete and Asphaltic Paving: Comply with recycling requirements in Section 01 74 19 – Construction Waste Management and Disposal.

END OF SECTION 31 10 00

SECTION 31 23 16 - EXCAVATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. 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. Section Includes:
1. Soil densification.
2. Excavating for building foundations.
3. Excavating for paving and roads
4. Excavating for slabs-on-grade.
5. Excavating for site structures.

B. Related Sections:
1. Section 01 11 00 – Summary of Work, Geotechnical Investigations including bore hole and test pit findings of existing subsurface materials.
2. Section 01 57 23 – Temporary Storm Water Pollution Prevention
3. Section 31 05 13 - Soils for Earthwork: Stockpiling excavated materials.
4. Section 31 05 16 - Aggregates for Earthwork.
5. Section 31 10 00 – Site Clearing: Vegetation, topsoil and paved surface removal, stockpiling, reuse and disposal.
6. Section 31 23 17 - Trenching: Excavating for utility trenches.
7. Section 31 23 18 - Rock Removal: Removal of rock during excavating.
8. Section 31 23 23 - Fill.
9. Section 33 14 13 – Bowman Creek Infiltration Gallery
10. Section 33 14 16 – Water Distribution
11. Section 33 16 61 – Buried Storage Tank

1.3 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with:
1. State standards.
2. Applicable provisions of 20 CFR 1910 and 1926 (OSHA).

1.5 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

(Not Used.)

PART 3 EXECUTION

3.1 PREPARATION

A. Locating Utilities: Comply with Section 01 73 40 – Execution, for utility location.

B. Identify required lines, levels, contours, and datum.

C. Protect utilities indicated to remain from damage.

D. Notify applicable utility companies to remove, abandon, and/or relocate utilities interfering with excavation.

E. Protect plant life, wetlands and other features remaining as portion of final landscaping. Comply with Section 01 12 00 – Natural Features Protection.

F. Protect bench marks, survey control points, existing structures, fences, paving, and curbs from excavating equipment and vehicular traffic.

G. Maintain stream channels and/or flow diversion channels to allow for passage of storm water runoff without adversely increasing upstream water levels and causing erosion outside limits of disturbance indicated on the drawings.

H. Complete clearing, tree removal and soil stripping in accordance with Section 31 10 00 – Site Clearing.

3.2 EXCAVATION

A. Blasting of rock is prohibited in the Park.

B. Underpin adjacent structures which may be damaged by excavation work.

C. Excavation cuts and utility trenches shall be laid back to safe slopes or properly shored. Excavations and shoring operations should be conducted in accordance with the most recent versions of the OSHA Construction Standards for Excavations, Part 1926, Subpart P and Wyoming Public Works Standard Specifications. Safety of construction personnel is the responsibility of the Contractor. Excavations for utilities shall be shored if the proper slope cannot be maintained.

D. Excavate to lines and grades shown. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving and site structures.
   1. Correct over-excavation according to Section 31 23 23 – Fill.

E. Excavated material under this project is unclassified in nature and includes any and all materials encountered, regardless of their consistency or the manner in which they are removed.

F. Excavate rock to a minimum depth of 6 inches and a maximum depth of 12 inches below subgrade.

G. When required, excavate to working elevations for temporary earth support. Coordinate special requirements for temporary earth support.

H. Excavation cut not to interfere with normal 45 degree bearing splay of foundation, unless appropriate temporary earth support is designed and provided and cut slope is stable and maintained.

I. Slope banks with machine to slopes indicated in excavation plans provided in the drawings and/or to angle of repose until shored if not provided.

J. Provide adequate working space and clearances for Work performed within excavations and for installation and removal of concrete forms.

K. Manholes and Vaults: Excavate at least 6 inches below bottom of base to establish subgrade to 98 percent of maximum density and place approved select backfill and granular fill for leveling to the elevation required for manhole or vault base installation in accordance with Section 31 23 23 – Fill.

L. Provide dewatering or bypassing of water flow as necessary and according to Section 31 23 19 – Dewatering.
   1. For below ground structures including foundations, dewater excavation to a depth of 6-inches below the structure foundation, and install 6-inches of leveling course granular fill. Continue with dewatering operations until the structure is ready to be backfilled.

M. Grade top perimeter of excavation to prevent surface water from draining into excavation.

N. Trim excavation. Remove loose matter and rocks. Remove lumped subsoil, boulders, and rock as specified in Section 31 23 23 – Fill.

O. Work around bracing while maintaining integrity of temporary earth support system or temporary shoring.

P. Notify CO of unexpected subsurface conditions.

Q. If, in the opinion of the CO, unsuitable foundation material is encountered, the Contractor shall repair the area by over excavating, filling with granular fill material, and compacting to 95 percent of the maximum density at no additional expense to the Government.

R. Remove excess and unsuitable material from site.

S. Correct areas over excavated with pit run, granular material or select structural fill as directed by the CO. Comply with Section 31 05 16 – Aggregates for Earthwork,

T. Stockpile excavated material in area designated on-site in accordance with Section 31 05 13 – Soils for Earthwork and 31 05 16 – Aggregates for Earthwork.

U. Repair or replace items indicated to remain damaged by excavation.

3.3 SHEETING, SHORING, AND BRACING

A. Provide proper and substantial sheeting, shoring, and bracing, as required, to prevent caving or sliding, to protect workmen and the Work, to protect existing structures and facilities, to limit the area of excavation, and as required by state and federal laws including 29 CFR 1910 and 1926.

B. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure, and to be rigid, maintaining shape and position under all circumstances.

C. For excavations over 5 feet deep, provide suitable barricades for worker protection.

D. When Work area is left open and unattended by the Contractor, provide suitable barricades for public safety and to prevent animal entry, regardless of depth.

E. For excavation over 4 feet deep, provide suitable exit means in accordance with applicable provisions of 20 CFR 1910 and 1926.

3.4 FIELD QUALITY CONTROL

A. Comply with Sections 01 40 00 – Quality Requirements and 31 23 23 – Fill, for field inspection and testing.

B. Request visual inspection of bearing surfaces by qualified inspection agency and CO before installing subsequent work.

C. All excavations and temporary earth support systems shall comply with all federal, state and local regulations.

3.5 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation. Provide temporary shoring for utility trench excavation as required by federal laws including 29 CFR 1910 and 1926.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 31 23 16

SECTION 31 23 17 - TRENCHING

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. Excavating trenches for utilities to include water, drainage, and waste pipelines; underground electrical conduit; culverts; vaults; infiltration gallery; water storage tanks; manholes; hydrants, pull boxes; and all related appurtenances.
   2. Installation of Type 1 and Type 2 bedding around pipes.
   3. Compacted Final Trench Backfill from top of Type 1 Pipe Bedding to the proposed bottom of replaced topsoil or Imported Aggregate Base Course.
   4. Installation of Imported Aggregate Base Course.
   5. Underground Warning Tape.

B. Related Sections:
   1. Section 01 11 00 – Summary of Work, Geotechnical Investigations including bore hole and test pit findings of existing subsurface materials.
   2. Section 01 57 23 – Temporary Storm Water Pollution Prevention: Slope protection and erosion control.
   3. Section 31 05 13 - Soils for Earthwork: Stockpiling excavated materials.
   4. Section 31 05 16 - Aggregates for Earthwork.
   5. Section 31 23 18 – Rock Removal.
   6. Section 31 23 24 – Flowable Fill.
   7. Division 33 - Utilities

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D6913 – Standard Test Methods for Particle-Size Distribution of Soils Using Sieve Analysis.
   3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

A. Utility: Any buried pipe, culvert, duct, conduit, or cable, including related appurtenances such as concrete vaults, hydrants, or pullboxes.

B. Trench Excavation is categorized as follows:
   1. **Type 1 Trench Excavation** does not mandate shoring or sheathing, unless desired by the Contractor. The sides of all trenches may be sloped back to preclude collapse in accordance with OSHA regulations, provided that the excavation does not encroach outside of established limits of disturbance.
   2. **Type 2 Trench Excavation** shall be adequately shored or sheathed in accordance with the requirements of OSHA regulations. Portable trench boxes or sliding trench shields may be used for performing Type 2 Trench Excavation in lieu of a shoring system provided that they are designed and maintained in a manner which will provide protection equal to or greater than the sheathing or shoring required for the trench. Trench boxes or sheathing used shall extend to the full height of the trench excavation.
   3. Areas of pipeline alignments where **Type 2 Excavation** is mandated are indicated on the drawings. If undesignated, the Contractor may select his preferred excavation type, based on soil type, groundwater depth, available space to complete the work, and proximity to adjacent structures or utilities.

1.5 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for Underground Warning Tape and Cement Treated Flowable Fill.

C. Provide a construction plan for the infiltration gallery and well to return soil conditions back to pre construction conditions following placement.

D. Soil Testing: Submit gradation tests, moisture-density relationship tests and compaction tests completed in paragraph 3.6 – “Field Quality Control”, below.

E. For Type A Trench Backfill: One in-place compaction test as specified in ASTM D2922-96e1 and ASTM D3017-96e1 for every 100 lineal feet of trench in the compacted embedment zone and at every 1½ feet of vertical lift of backfill materials. Complete a minimum of two tests per location.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Type 1 and Type 2 Pipe Bedding and Imported Aggregate Road Base material requirements are specified in Section 31 05 16 – Aggregates for Earthwork. Reclaimed aggregate base course containing bituminous materials shall not be used as pipe bedding.

B. Final Trench Backfill shall consist of native trench cuttings not containing debris, frozen material, unstable material or large clods. Stones greater than three inches shall not be placed within two feet of the pipe.

C. Cement Treated Flowable Fill: Comply with Section 31 23 24 – Flowable Fill.

2.2 ACCESSORIES

A. When underground warning tape for existing utilities is damaged or removed, Contractor shall obtain warning tape from Utility Owner for replacement, or procure and replace warning tape suitable to utility Owner and Contracting Officer (CO).

B. Underground Warning Tape: Utilitape brand, 6" wide, premium grade or equal, blue in color, with the message "Caution-Water Pipe Below."

C. Underground Warning Tape: Utilitape brand, 6" wide, premium grade or equal, orange in color, with the message "Caution - Fiber Optic Below."

D. Underground Warning Tape: Utilitape brand, 6" wide, premium grade or equal, red in color, with the message "Caution-Electrical Below."

E. Underground Warning Tape: Utilitape brand, 6" wide, premium grade or equal, green in color, with the message "Caution-Drainage Pipe Below."

F. Buried Tracer Wire: Comply with Section 33 11 33 – Public Water Utility Distribution Piping.

G. Insulation: Insulation for waterline frost protection shall be 2-inch thick with minimum dimensions as shown on the drawings. Insulation board shall have a 100 psi compressive strength, and an R Value of at least 10.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Trenching shall be provided to allow for installation of utilities to lines and grades indicated on Drawings.
   1. CO reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Minimum water line pipe cover from finish grade shall be no less than six (6) feet. If water line depth is less than six (6) feet, install insulation for frost protection.

3.2 PREPARATION

A. Comply with requirements specified in Section 01 73 40 – Execution, for locating and verifying existing utilities.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life and other features remaining as portion of final landscaping.

D. Protect bench marks and all permanent and temporary survey monuments within work area. Disturbance will require replacement at the Contractor's expense.

E. Protect all existing resources located outside work limits from excavating equipment and vehicular traffic.

F. Maintain structures and protect above and below grade utilities indicated to remain.

G. Establish temporary pedestrian and vehicular traffic control when trenching is performed in public right-of-way. Relocate controls as required during progress of Work. Comply with requirements of the Traffic Control Plan and Section 01 55 26 – Traffic Control.

3.3 TRENCHING

A. Trench-excavated material under this Project is unclassified in nature and includes any and all materials encountered, regardless of their consistency or the manner in which they are removed.

B. Site clearing requirements along waterline alignments is provided under Section 31 10 00 – Site Clearing.

C. Complete all trenching and subsidiary operations within the "limit of disturbance" (LOD) work boundaries shown on the drawings.

D. Perform large rock removal resulting from trench excavation as indicated in Section 31 23 18 – Rock Removal.

E. Perform excavation within 48 inches of existing utilities in accordance with Utility Owner's requirements.

F. When Work area is left open and unattended by the Contractor, provide suitable barricades for public safety and to prevent animal entry, regardless of depth. There is no restriction on allowable length of open trench during the day, however, no more than 50 feet of trench shall remain un-backfilled to finish grade at the end of each working day. Install orange plastic construction fencing around unbackfilled trench at the end of each day.
   1. On weekends, maximum allowable open trench shall be 25 feet.

G. For all pipe, cut trenches to a minimum width as noted on the drawings depending on the number of pipes within the trench; the CO may require a greater minimum width if necessary to successfully consolidate Type 1 Pipe Bedding material around the pipe, depending on the Contractor's method of bedding installation.

H. Excavate trenches to depth indicated on Drawings, 4-inches below pipe bottom. Provide uniform and continuous bearing and support for bedding material.

I. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by the CO until suitable material is encountered. Cut out soft areas of subgrade not

capable of compaction in place. Backfill with Type 2 Pipe Bedding and compact to density equal to or greater than requirements for subsequent backfill material.

J. Grade site accordingly to prevent surface water from flowing into excavations.

K. Adequate provisions shall be made for maintaining the flow of sewers, water pipes, drains, and water courses encountered during construction.

L. In trench areas where groundwater is encountered, groundwater shall be removed from the trench to a level of at least proposed pipe bottom prior to installation. In no case will pipe installation in free water be allowed. Trench dewatering, when required, shall be continued until backfill above the water surface can be completed without sacrificing required backfill compaction.

M. Whether utilizing Type 1 or Type 2 Trench Excavation, the Contractor shall be solely responsible to insure that all trench excavations are completed in a manner conforming to OSHA. The Contractor shall employ a qualified and properly trained onsite "responsible person" to perform safety inspections of the trenches, and supervise the handling of all operations involving safety procedures, as prescribed by OSHA (29 CFR 1910 and 1926).

N. Comply with Section 01 35 23 – Safety Equipments.

O. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

P. Correct areas over excavated with compacted Type 2 Pipe Bedding, or suitable material approved by the CO.

Q. Remove excess subsoil not intended for backfill from the Work site.

R. Stockpile excavated material in area designated on-site in accordance with the drawings, or as directed by the CO.

S. The Bowman Creek Infiltration Gallery shall be excavated in a manner to maintain existing soil material types so that backfilling can be completed in a way to match the existing soil strata in the crossing.

3.4 SHEETING AND SHORING

A. Provide temporary shoring for utility trench excavation as required by federal laws including 29 CFR 1910 and 1926.

B. For excavation over 4 feet deep, provide suitable exit means in accordance with applicable provisions of 20 CFR 1910 and 1926.

C. Where required, sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Type 1 Pipe Bedding Material
   1. Processed or imported Type 1 Pipe Bedding Material shall be moisture conditioned, installed in the trench bottom, leveled and consolidated to a 4 inch thickness with multiple passes of a vibratory plate compactor prior to pipe placement within the trench. Type 1 Pipe Bedding Material shall be consolidated to at least 95% Standard Proctor Density (ASTM D698).
   2. The interface between the pipe bottom and installed bedding material shall be constructed to provide uniform and stable support for the full length of the pipe. Excavation for each bell shall be provided at each bell location.
   3. Remaining bedding material shall be moisture conditioned, installed, leveled, and consolidated in maximum six inch lifts to a finish elevation of six inches above the pipe crown by use of mechanical or hand methods capable of assuring complete and uniform soil support around the pipe haunches without damage to the pipe. The Contractor will be required to partially re-excavate installed bedding by pothole excavation on a periodic basis to demonstrate that adequate soil support around the pipe haunches is being provided.
   4. Trench boxes, if utilized, shall be installed with their base no lower than the proposed top of pipe bedding to insure that trench box removal does not loosen the installed bedding material.

B. Type 2 Pipe Bedding Material-Used in areas of soft or unstable trench bottom.
   1. Install across entire trench width to a depth dictated by the CO.
   2. Consolidate material as required to provide a stable base for the pipe. Finish top of Type 2 material shall be six inches below the pipe bottom.
   3. If consolidation results in repeating soft or unstable subgrade, re-excavate and replace bedding material.

C. Cement Treated Flowable Fill
   1. Install according to details provided in the plans, or as required by the CO. Refer to the detail sheets for typical trench sections for utility crossings.

D. Pipe Insulation
   1. Install 2 feet wide boards centered 6” above the pipe crown. Install insulation in accordance with details in the drawings.
   2. Bed insulation board in 3-inch minus native soil.
   3. Install insulation where water line depth is less than 6 feet bury in roads.

E. Final Trench Backfill
   1. All trenches shall be backfilled immediately after Type 1 Pipe Bedding is installed. Leakage or pressure testing of water lines shall be performed after backfill.
   2. Final Trench Backfill shall be free of cinders, ashes, refuse, organic and frozen material, or other materials that are unsuitable. No stone larger than 3” shall be placed within one foot of any utility line.
   3. Final trench backfill beneath roadways and walks shall be considered Type A Trench Backfill. Type A Trench Backfill shall be moisture conditioned to ±2% of optimum moisture content, deposited in compacted lifts not to exceed twelve inches in thickness and

mechanically compacted to at least 95% of maximum density as determined by ASTM D698 (Standard Proctor). In areas where Type A Trench Backfill is required, the Contractor shall, for a minimum period of one year after final completion, repair any trench settlement which may occur, and shall make suitable repairs to any pavement, sidewalks, or other structures which may become damaged as a result of backfill settlement.

4. Final trench backfill in areas other than beneath roadways and walks shall be considered Type B Trench Backfill. Type B Trench Backfill shall be moisture conditioned to ±2% of optimum moisture content, deposited in compacted lifts not to exceed twelve inches in thickness and mechanically compacted to at least 90% of maximum density as determined by ASTM D698 (Standard Proctor).

F. Underground Warning Tape:
   1. Install as shown on the typical waterline trench details provided in the drawings.
   2. Replace underground warning tape that is damaged, or has been removed during construction for existing utilities to remain. Obtain replacement warning tape from Utility Owner, or re-install with approved alternative.

G. Imported Aggregate Base Course
   1. In streets, sidewalks, driveways and other travel ways, the Contractor shall provide a minimum six inch thick of grading H or W temporary gravel surface flush with existing pavement or concrete until the disturbed surface can be restored. The Contractor is responsible for maintaining a smooth travel way in areas receiving temporary surfacing. The Contractor is obligated to fulfill requests made by the CO regarding maintenance of temporary surfaces.
   2. Final surfacing for existing gravel driveways shall consist of a minimum of four compacted inches of Imported Aggregate Base Course.
   3. Imported Aggregate Base Course utilized as subbase beneath asphalt paving shall be a minimum of six compacted inches thick.
   4. Imported Aggregate Base Course utilized as temporary or final surfacing or subbase shall be installed to 95% of maximum density as determined by ASTM D698 (Standard Proctor).

H. The entire trench alignment, upon completion of backfilling operations, shall be machine graded to a surface contour condition ready for topsoil or asphalt replacement to pre-existing contours. Remove excess material not utilized for trench backfill from the site.

I. Backfilling of the Bowman Creek Infiltration Gallery shall be completed in a manner that matches the existing soil strata as much as possible with soil types being separated and placed to match existing.

3.6 FIELD QUALITY CONTROL

A. Contractor shall supply an independent and accredited testing firm to provide lab proctors and field test final trench backfill compaction.
   1. Two initial gradation tests for each type of material plus one additional test for each 500 cubic yards of each material
   2. Two moisture-density relationship tests as specified in ASTM D698-91(1998), or two relative density tests as specified in ASTM D4253-93(1996) and ASTM D4254-91(1996), as appropriate for each type of embedment or backfill material proposed, except granular embedment material.

3. For Type A Trench Backfill: One in-place compaction test as specified in ASTM D2922-96e1 and ASTM D3017-96e1 for every 100 lineal feet of trench in the compacted embedment zone and at every 1½ feet of vertical lift of backfill materials. In addition, complete a minimum of two per location, or one in-place compaction test every 100 lineal feet on final surface of compacted subgrade and base course located in roads, sidewalks or other travel ways.
4. For Type B Trench Backfill: One in-place compaction test as specified in ASTM D2922-96e1 and ASTM D3017-96e1 for every 300 lineal feet of trench in the compacted embedment zone and at every 1½ feet of vertical lift of backfill materials.
5. One in-place compaction test as specified in ASTM D2922-96e1 and ASTM D3017-96e1 near the top of the trench every 100 lineal feet (Type A Trench Backfill) and 300 lineal feet (Type B Trench Backfill) for trench depths of 2 feet or less
6. Ten additional in-place compaction tests as specified in ASTM D2922-96e1 and ASTM D3017-96e1, at the discretion of the CO.
7. Maximum density of material containing more than 30% oversize (greater than ¾" diameter) cannot be determined by use of the ASTM Designation D698. In this case, a field maximum density may be determined by a test strip method. The material shall be compacted at or near optimum moisture content and a field density test, as specified in ASTM D2922-96e1 and ASTM D3017-96e, shall be taken after each pass of the compaction equipment. This sequence shall continue until the maximum field density is achieved. This maximum field density shall be used for subsequent field compaction tests. Enough density tests should be taken to monitor proper compaction.

B. Proof roll compacted fill surfaces under slabs-on-grade, paving and foundations with heavy equipment (loader or haul truck) supplied by the Contractor at the request of the CO.

1. Remove and repair areas of unstable material when requested by CO at no additional cost to the Government.

C. Conform to Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

D. When tests indicate Work does not meet specified requirements, remove defective Work, replace, compact, and retest.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 73 40 - Execution: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION 31 23 17

SECTION 31 23 18 - ROCK REMOVAL

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. Removing discovered rock during excavation.
   2. Expansive tools to assist rock removal.

B. Related Sections:
   1. Section 31 23 17 - Trenching: Trenching and backfilling for utilities.
   2. Section 31 23 23 - Fill: Backfill materials.

1.3 DEFINITIONS

A. Rock: This description is for classification purposes only. If rock is encountered, it will be addressed by a modification process. Excavated materials will be classified as rock only if it is in accordance with all of the following conditions:
   1. Rock shall be described as solid masses that are homogeneous, interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, considered “hard material” as determined by the Contracting Officer (CO).
   2. Excavation and removal of solid masses, as defined in item 1 above, which requires a track excavator larger than the latest model of a Caterpillar Model 325B L equipped with rock bucket, or equal.
   3. Rock bucket: Entek Model 55, 36 inch, cast iron lip, three rock tooth configuration, or equal.
   4. Excavator must be operated by a person experienced in rock excavation similar to project conditions encountered.
   5. The Contractor may use a larger excavator than a Caterpillar Model 325B L for excavation. However, for materials to be classified as “rock”, the Contractor is required to demonstrate that the material cannot be excavated by a Caterpillar Model 325B L, larger excavator, or equal. In the event a disagreement arises regarding classification of material in conjunction with larger, more powerful excavation equipment, the CO reserves the right to require the Contractor to mobilize a Caterpillar Model 325B L or equal, and to conduct excavation of the material in question. If the material is excavatable, the mobilization and demonstration cost for the Caterpillar Model 325B L or equal will be incurred by the Contractor. If it is determined that the material is not excavatable by a Caterpillar Model 325B L, or equal, the Government will pay cost for mobilization and demonstration of the equipment.
      a. Hard materials that require excavation and removal with track excavator larger than specified above, or hard materials that require excavation and removal with systematic drilling and blasting, drilling and the use of expansion jacks or feather edges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers will be classified as “rock”.

b. Contractor is responsible for demonstrating, to the satisfaction of the CO, that the track excavator specified above is not capable of excavating the material and that the excavated material will need to be classified as "rock" by the CO.
c. Contractor shall notify CO when "rock" is encountered. CO will authorize "rock" removal prior to beginning rock excavation.

B. Earth: All material not classified as rock, including all rock, stones, or boulders that can be reasonably broken, plowed, or removed with the power driven equipment described above. No additional payment or modifications will be made for the excavation or "earth."

1.4 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate intended rock removal method and equipment.

C. Survey Report: Submit survey report on conditions of buildings near locations of rock removal.

1.5 SCHEDULING

A. Section 01 31 00 – Project Management: Coordination and project conditions.

B. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management: Coordination and project conditions.

B. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method.
1. Drill holes and use expansive tools and wedges to fracture rock.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove shaled layers to provide sound and unshattered base for footings and foundations.

D. In utility trenches, excavate to 6-inches below invert elevation of pipe and 12-inches wider than outside diameter of the pipe.

E. Remove excavated materials from site, or reuse for site landscaping including riprap revetments and retaining walls.

F. Correct unauthorized rock removal by backfilling with granular fill or with other suitable material as directed by the CO.
   1. Deposited fill in compacted lifts not to exceed eight inches in thickness, and mechanically compacted to at least 95% of maximum density as determined by ASTM D698 (Standard Proctor).

G. Excess rock material not suitable for embankment or backfill shall be removed and disposed of off NPS Lands at an approved location and in a lawful manner.

3.4 FIELD QUALITY CONTROL

A. Trenches: One in-place compaction test as specified in ASTM D2922-96e1 and ASTM D3017-96e1 for every 100 lineal feet of trench in the compacted embedment zone and at every 1½ feet of vertical lift of backfill materials. In addition, complete a minimum of two per location, or one in-place compaction test every 100 lineal feet on final surface of compacted subgrade and base course located in roads, sidewalks or other travel ways.

B. Foundations: Complete compaction tests as specified in ASTM D2922-96e1 and ASTM D3017-96e1 in over excavated areas.
   1. Test every 400 square feet and every 1½ feet of vertical lift.

C. Request visual inspection of foundation bearing surfaces by CO before installing subsequent work.

END OF SECTION 31 23 18

SECTION 31 23 19 - DEWATERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Dewatering systems.
   2. Trench Dewatering
   3. Surface water control system.
   4. System operation and maintenance.
   5. Water disposal.

B. Related Sections:
   1. Section 01 11 00 - Summary of Work: Available Project Information: Subsurface investigation report including boring logs, soil profiles, and laboratory soils analyses.
   2. Section 01 57 23 – Temporary Storm Water Pollution Prevention: Surface water runoff control.
   3. Section 31 05 16 - Aggregates for Earthwork: Aggregates for drains.
   4. Section 31 23 17 - Trenching: Trenching for utilities below ground water table.
   5. Division 33- Utilities

1.3 DEFINITIONS

A. Dewatering includes the following:
   1. Lowering of ground water table and intercepting horizontal water seepage to prevent ground water from entering excavations and trenches.
   2. Reducing piezometric pressure within strata to prevent failure or heaving of excavations and trenches.
   3. Disposing of removed water.

B. Surface Water Control: Removal of surface water within open excavations.

1.4 SYSTEM DESCRIPTION

A. Provide and construct dewatering and surface water control systems to permit Work to be completed on dry and stable subgrade.
   1. Provide dewatering facilities, including hoses, pipe, valves, fittings, portable pumps, to lower groundwater elevation in trenches during utility line construction.

B. Monitor groundwater in open excavations to obtain meaningful observations of conditions affecting excavation. When practical, coordinate construction schedule to avoid seasonal groundwater.

1.5 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Provide a dewatering, diversion, and construction plan for the Bowman Creek Infiltration Gallery for approval prior to construction.

C. Product Data: Submit data for each of the following:
   1. Dewatering Pumps: Indicate sizes, capacities, priming method, engine, and motor characteristics.

D. Field Reports: Test and monitoring reports as specified in Field Quality Control article.

1.6 QUALITY ASSURANCE

A. Comply with authorities having jurisdiction for the following:
   1. Drilling and abandoning of wells used for dewatering systems.
   2. Water discharge and disposal from pumping operations.

B. Obtain permit from the Montana Department of Environmental Quality (MTDEQ) for storm water discharge from construction sites according to the EPA's National Pollutant Discharge Elimination System (NPDES).

C. Perform Work in accordance with Federal and State standards.

1.7 FIELD CONDITIONS

A. According to groundwater monitoring data obtained during the Project design phase and provided in the drawings, there is a low potential that groundwater will affect construction if the Contractor can schedule work to avoid seasonal variations of groundwater. Locations that may be of concern include:
   1. Bowman Creek Infiltration Gallery: Groundwater in proximity to the creek is likely.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. The Government is not responsible for interpretations or conclusions drawn from this data.
      1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
      2. The geotechnical report is attached at the end of Section 01 11 00 – Summary of Work.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey any adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Pre-installation conferences.
   1. Convene minimum one week prior to commencing work of this section.
   2. Discuss locations of the excavations to be dewatered, means and methods of dewatering, discharge locations and sediment control.
   3. Comply with NPDES permit and authorities having jurisdiction.

1.9 SEQUENCING

A. Sequence work to obtain required permits before start of dewatering operations.

B. Sequence work to install and test monitoring systems minimum 7 days before testing and operating dewatering systems.

C. Sequence work to install and test dewatering and surface water control systems minimum 3 days before starting excavation or trenching.

1.10 COORDINATION

A. Coordinate work to permit the following construction operations to be completed on dry stable substrate.
   1. Excavation for structures including buildings, vaults, manholes and tanks specified in Section 31 23 16 – Excavation.
   2. Trenching for utilities specified in Section 31 23 17 – Trenching.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades. Employ dewatering devices in accordance with the following criteria:
   1. When required by CO, design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
   2. Lower water table within areas of excavation to a minimum elevation of 6” below bottom of excavation to permit Work to be completed on dry and stable subgrade.
   3. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.
   4. Prevent loss of fines, quick condition, or softening of foundation subgrade.
   5. Maintain stability of sides and bottoms of excavations and trenches.

6. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
7. Prevent surface water from entering excavations by grading, dikes, or other means.
8. Prevent damage to adjacent properties, buildings, structures, utilities, and facilities from construction operations.
9. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

2.2 ACCESSORIES

A. Provide a necessary valves, fittings, pipe, hose, pumps, generators, filtering devices and erosion control required to successfully execute dewatering of excavations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Verification of existing conditions before starting work.

B. When necessary, conduct additional investigations to supplement subsurface investigations identified in Section 01 11 00 as required for completing dewatering system design.

C. Call Local Utility Line Information service and notify GLAC NPS in accordance with Section 01 11 00 – Summary of Work before performing Work.
1. Request underground utilities to be located and marked within and surrounding construction areas.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from CO and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways when required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls as specified in Section 01 57 23 – Temporary Storm Water Pollution Prevention during dewatering operations.

3.3 DEWATERING SYSTEMS

A. Locate system components to allow continuous dewatering operations without interfering with installation of permanent Work and existing public rights-of-way, sidewalks, and adjacent buildings, structures, and improvements.

B. Temporary Dewatering Systems: Install Work in accordance with the Performance Requirement article above, State and Government standards.

3.4 SURFACE WATER CONTROL SYSTEMS.

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 01 57 23 – Temporary Storm Water Pollution Prevention.

B. Divert surface water and seepage water within excavation areas into sumps and pump water into drainage channels and settling basins in accordance with requirements of agencies having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

D. Comply with requirements of Section 01 57 23 – Temporary Storm Water Pollution Prevention.

3.5 SYSTEM OPERATION AND MAINTENANCE

A. Operate dewatering system continuously until permanent utilities are installed and backfill is a minimum of 2 feet above normal ground water table elevation.

B. For systems with generators and pumps, provide 24-hour supervision of dewatering system by personnel skilled in operation, maintenance, and replacement of system components.

C. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
   1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
   2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

D. Conduct daily observation of dewatering system and monitoring system. Make required repairs and perform scheduled maintenance.

E. Fill fuel tanks before tanks reach less than 25 percent capacity.
   1. Comply with requirements of the Hazardous Spill Plan, Section 01 11 00 - Summary of Work.

F. Start emergency generators at least twice each week to check operating condition.

G. When dewatering system cannot control water within excavation, notify CO and stop excavation work.
   1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
   2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

H. Modify dewatering and surface water control systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

I. Correct unanticipated pressure conditions affecting dewatering system performance.

J. Do not discontinue dewatering operations without CO's approval.

3.6 WATER DISPOSAL

A. Discharge water into constructed settling basins or other locations approved of by the CO.

B. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

C. Do not pump or discharge water emanating from dewatering activities into classified wetlands, or any natural water body, including those defined by the State of Montana

3.7 SYSTEM REMOVAL

A. Remove dewatering and surface water control systems after dewatering operations are discontinued.

B. Remove piezometers and monitoring wells in accordance with requirements of the State of Montana.

C. Fill abandoned piping with grout.

D. Repair damage caused by dewatering and surface water control systems or resulting from failure of systems to protect property.

E. Reclaim site to pre-construction condition and in accordance with Section 32 91 19.13 – Topsoil Placement and Grading.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. After dewatering system is installed, perform pumping test to determine when selected pumping rate lowers water level in well below pump intake. Adjust pump speed, discharge volume, or both to ensure proper operation of each pump.

C. Comply with all requirements of the NPDES permit including sediment control and water quality monitoring at discharge when required.

D. When required by CO, submit initial installation reports including the following:
   1. Installation reports for pumps.
   2. Installation and baseline reports for monitoring wells and piezometers.
   3. Test reports of monitoring well water analysis.
   4. Initial dewatering flow rates.

E. Submit weekly monitoring reports including the following:
   1. Dewatering flow rates.
   2. Piezometer readings.
   3. Test reports of discharge water analysis.
   4. Maintenance records for dewatering and surface water control systems.

F. Prepare reports with pictures and daily notes of observations.

END OF SECTION 31 23 19

SECTION 31 23 23 - FILL

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. Backfilling site structures to subgrade elevations.
   2. Fill for over-excavation.
   3. Fill for conduits and drains.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Concrete materials.
   2. Section 31 05 13 - Soils for Earthwork: Soils for fill.
   3. Section 31 05 16 - Aggregates for Earthwork: Aggregates for fill.
   4. Section 31 23 16 - Excavation.
   5. Section 31 23 17 - Trenching: Backfilling of utility trenches.
   6. Section 31 23 24 - Flowable Fill.
   7. Section 32 91 19.13 – Topsoil Placement and Grading: Filling of topsoil to finish grade elevation.
   8. Division 33 - Utilities

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

C. Samples: Submit, in air-tight containers, 5 gallon bucket samples of each type of imported fill to testing laboratory.

D. Materials Source: Submit name of imported fill materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Submit weed free certification for all imported materials.

G. Contractor shall be responsible for ensuring all samples of imported soils are submitted for approval well in advance of commencement of Work.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State standards.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: As specified in Section 31 05 13 – Soils for Earthwork.
   1. Type S1: Select Fill.
   2. Type S2: Landscaping Fill.
   3. Type S3: Native Topsoil.
   4. Type S4: Imported Topsoil.
   5. Type S5: Embankment Material.

B. Aggregates: As specified in Section 31 05 16 – Aggregates for Earthwork.
   1. Aggregate for Drains.
   2. Imported Aggregate Base Course.
   3. Pit Run Aggregate (Structural Fill).
   4. Cobble Rock.
   5. Granular Fill.
   6. Aggregate for Pervious Backfill Material.
   7. Aggregate for Riprap.
   8. Type 1: Pipe Bedding Material.
   9. Type 2: Pipe Bedding Material.

C. Material for Trenching: As specified in Section 31 23 17 – Trenching.
   1. Type A: Trench Backfill.
   2. Type B: Trench Backfill.

D. Flowable Fill: As specified in Section 31 23 24 – Flowable Fill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Prior to placement of fill material, compact subgrade at the bottom of each excavation to 98% percent of maximum density or equal to insitu densities at the same depth being tested.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with pit run, granular fill or other approved structural fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 4 inches to provide adequate bond between old and new material.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

A. Maintain optimum moisture content of backfill materials to attain required compaction density.

B. Comply with the following for backfill around structures, vaults, manholes, septic tanks and other miscellaneous structures.
   1. Excavate at least 6 inches below bottom of base to establish subgrade to 98 percent of maximum density and place granular fill to the elevation required for manhole or vault base.
   2. Place additional granular fill to a uniform level around the manhole or vault and to at least one foot above the top of the highest utility connection to the structure.
   3. Backfill around utility lines is specified in Section 31 23 17 – Trenching.

C. Comply with the following for backfill of depressions or structures resulting from demolition Work.
   1. Backfill depression or structures with native material to finished grade.
   2. Unless otherwise noted, backfill material shall be free of demolition waste.
   3. Moisture condition and place fill in uniform lifts not to exceed 8-inches loose measurement.
   4. Compact each layer before placing the next layer. As the compaction of each layer progresses, continually level and manipulate to ensure uniform moisture and density.

D. Construct embankments according to the following:

1. Before placing embankment, scarify ground surface to provide ample bond between old and new material.
2. Place select or landscaping fill in lifts not exceeding 8 inches loose measurement.
3. Compact each layer before placing the next layer. As the compaction of each layer progresses, continually level and manipulate to ensure uniform moisture and density.
4. All embankment side slopes shall be as indicated on the drawings.

E. General Backfill Requirements:
1. Backfill areas to contours and elevations with unfrozen materials.
2. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
3. Place separation fabric according to the drawings and manufacturer's recommendations.
4. Place fill material in continuous layers and compact in accordance with schedule at end of this section.
5. Employ placement method that does not disturb or damage other work.
6. Maintain optimum moisture content of backfill materials to attain required compaction density.
7. Backfill against supported foundation walls according to the plans.
8. Do not backfill against unsupported foundation walls. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
9. Do not place backfill against concrete until concrete has cured for a minimum of 14 days or longer to sufficiently accept the load.
10. If a trench passes through a structure backfill, compact backfill to an elevation of 12 inches above top of pipe before trenching.
11. Slope grade away from building minimum 5 percent slope for minimum distance of 10 ft, unless noted otherwise.
12. Make gradual grade changes. Blend slope into level areas.
13. Remove surplus backfill materials from site.
14. Leave fill material stockpile areas free of excess fill materials.

3.4 COMPACTION

A. Compact with mechanical, platform-type tampers.

B. Use roller for compaction, if necessary, to prevent damage to structure and desired density can be obtained.

C. Compaction by inundation with water shall not be permitted.

D. Do not compact backfill in water.

E. Moisture density control will not apply to portions of embankment that are identified as rock embankment.

F. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity.

3.5 SURFACE FINISH WORK

A. Decompact the top 18 to 24 inches of subgrade in areas to be reclaimed with native seed and plants. Subsequent to decompaction, remove rocks in excess of 3 inches in diameter from the top of subgrade. Areas to be decompacted include access routes, staging areas, and excavations within LOD where soil has been compacted by equipment and vehicle traffic, rip to a depth of 18-24 inches prior to topsoil replacement.

B. Grading: Grade and finish subgrade to required levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas. Eliminate uneven areas and low spots, ensuring positive drainage.

3.6 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top Surface of General Backfill: Plus or minus 1.5 inches from required elevations.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with the following:
   1. Particle Size Distribution (Gradation): ASTM D6913.
   2. Moisture Density Relationship: ASTM D698-91.
   3. Maximum Relative Density: ASTM D4253-93.
   4. Minimum Relative Density: ASTM D4254-91.

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D2922-96e1.
   2. Moisture Tests: ASTM D3017-96e1.

D. Contractor shall supply an independent and accredited testing firm to provide the following lab proctors and field testing of backfill compaction.
   1. Two initial gradation tests for each type of material plus one additional test for each 500 cubic yards of each material
   2. Two moisture-density relationship tests or two relative density tests, as appropriate for each type of embedment or backfill material proposed, except granular embedment material.
   3. For Type A Trench Backfill: As specified in Section 31 23 17 – Trenching.
   4. For Type B Trench Backfill: As specified in Section 31 23 17 – Trenching.
   5. Embankments: Test once per 100 square feet per 2 feet maximum of vertical lift for each different material.
   6. Maximum density of material containing more than 30% oversize (greater than ¾" diameter) cannot be determined by use of the ASTM Designation D698. In this case, a field maximum density may be determined by a test strip method. The material shall be compacted at or near optimum moisture content and a field density (compaction) test shall be taken after each pass of the compaction equipment. This sequence shall continue until the maximum field density is achieved. This maximum field density shall

be used for subsequent field compaction tests. Enough density tests should be taken to monitor proper compaction.

E. Proof roll compacted fill surfaces under slabs-on-grade, paving and foundations with fully loaded heavy equipment (loader or haul truck) supplied by the Contractor at the request of the CO. Remove and repair areas of unstable material when requested by CO.

F. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Government.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 73 40 - Execution: Protection of installed construction.

B. Reshape and re-compact fills subjected to vehicular traffic.

3.9 SCHEDULE

A. Exterior Side of Foundation Walls, Retaining Walls, Granular Drain Material, and Foundation Perimeter Drainage.
   1. Fill Type S1(Select Fill) or S2(Landscaping Fill) as specified in the drawings to subgrade elevation. 6-inch thick each lift, compact uniformly Type S1 material to 95% and Type S2 to 90% percent of maximum density.

B. Underground Tanks: Backfill in accordance with Slabs-On-Grade and Exterior Side and Foundation Walls above.

C. Foundation Drainage Pipe Bedding and Geotextile Separation Fabric, furnish and install in accordance with the drawings.
   1. Aggregates for Drains : Grading A

D. Fill to Correct Over-excavation:
   1. Flowable Fill in accordance with Section 31 23 24. Install in locations described in the drawings, or as required by the CO.
   2. Fill Granular or Pit Run to 18 inches below bottom of base course or pipe bedding and flush to required elevation, compact uniformly to 95% percent of maximum density.

END OF SECTION 31 23 23

SECTION 31 23 24 - FLOWABLE FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flowable fill for:
      a. Structure backfill.
      b. Utility bedding.
      c. Utility backfill.
      d. Filling abandoned utilities.

B. Related Sections:
   1. Section 31 23 16 - Excavation: General building excavation.
   2. Section 31 23 17 - Trenching: Soil and aggregate backfill for utility trenches.
   3. Section 31 23 23 - Fill: Correction of over-excavations.
   4. Section 32 91 19.13 – Topsoil Placement and Grading: Filling of topsoil over backfilled trenches to finish grade elevation.
   5. Section 33 11 13 - Public Water Utility Distribution Piping: Utility service water piping and bedding.

1.2 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.

B. Excavatable Flowable Fill: Lean cement concrete fill used where future excavation may be required, such as fill for utility trenches, bridge abutments, and culverts.

C. Non-excavatable Flowable Fill: Lean cement concrete fill used where future excavation is not anticipated, such as fill below structure foundations and filling abandoned utilities.

1.3 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM C33 - Standard Specification for Concrete Aggregates.
   2. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   3. ASTM C150 - Standard Specification for Portland Cement.
   4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   5. ASTM C403/C403M - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
   6. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
   7. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
   8. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
   9. ASTM C1040 - Standard Test Methods for Density of Unhardened and Hardened Concrete in Place By Nuclear Methods.

10. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

1.4 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Field Quality-Control Submittals:
   1. Mix Design:
      a. Furnish flowable fill mix design for each specified strength.
      b. Furnish separate mix designs when admixtures are require for the following:
         1) Flowable fill Work during hot and cold weather.
         2) Air entrained flowable fill Work.
      c. Identify design mix ingredients, proportions, properties, admixtures, and tests.
   2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.

D. Qualifications Statements:
   1. Submit qualifications for supplier.

1.5 QUALITY ASSURANCE

A. Perform Work according to State standards and authorities having jurisdiction (AHJ's).

1.6 QUALIFICATIONS

A. Supplier:
   1. Company specializing in supplying products specified in this Section with minimum three years' experience.
   2. Product source approved by AHJ's.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 50 00 - Temporary Facilities and Controls specifies ambient condition control facilities for product storage and installation.

B. Minimum Conditions: Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F.

1.8 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 PRODUCTS

2.1 FLOWABLE FILL

A. Flowable Fill: Excavatable type and non-excavatable type.

2.2 MATERIALS

A. Portland Cement: ASTM C150 Type II or Type V.

B. Coarse Aggregate: AASHTO Size No. 57

C. Fine Aggregates: ASTM C33.

D. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Manufacturers:
   1. BASF Corporation, Cortex Corporation or equal.

B. Air Entrainment: ASTM C260.

C. Chemical Admixture: ASTM C494/C494M.

D. Fly Ash: ASTM C618 Class C or F obtained from residue of electric generating plant using ground or powdered coal.

E. Plasticizing: ASTM C1017/C1017M Type I, plasticizing.

2.4 MIXES

A. Mix and deliver flowable fill according to ASTM C94/C94M, Option C.

B. Flowable Fill Design Mix:

ITEM	EXCAVATABLE	NON-EXCAVATABLE
Cement Content	45 lb/cu yd	100 to 150 lb/cu yd
Fly Ash Content	None	150-600 pcf
Water Content	45 gal/cu yd (or as needed)	45 gal/cu yd (or as needed)
Air Entrainment	5 to 35 percent	5 to 15 percent
28-Day Compressive Strength	Maximum 60 psi.	Minimum 125 psi
Unit Mass (Wet)	80 to 110 pcf	100 to 125 pcf
Temperature, Minimum at Point of Delivery	50 degrees F	50 degrees F

C. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.5 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test and analyze properties of flowable fill design mix and certify results for the following:
   1. Design mix proportions by weight of each material.
   2. Aggregate: ASTM C33 and AASHTO No. 75 for material properties and gradation.
   3. Properties of plastic flowable fill design mix including:
      a. Temperature.
      b. Slump.
      c. Air entrainment.
      d. Wet unit mass.
      e. Yield.
      f. Cement factor.
   4. Properties of hardened flowable fill design mix including:
      a. Compressive strength at 1 day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.
      b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Verification of existing conditions before starting Work.

B. Verify excavation specified in Section 31 23 16 and trenching specified in Section 31 23 17 is complete.

C. Verify utility installation as specified in Division 33 is complete and tested before placing flowable fill.

D. Verify excavation is dry and dewatering system(s) is operating.

3.2 PREPARATION

A. Place excavatable type and non-excavatable type flowable fill as directed by the CO. In general:
   1. Place excavatable-type flowable fill around buried utility lines and equipment.
   2. Place non-excavatable-type flowable fill under building slabs and areas where future maintenance/access is not anticipated.

B. Section 01 73 40 - Execution: Requirements for installation preparation.

C. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

D. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

E. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

A. Place flowable fill by chute, pumping or other methods approved by the Contracting Officer (CO).
   1. When required, place flowable fill under water using tremie procedure.
   2. Do not place flowable fill through flowing water.

B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

C. Place flowable fill evenly on both sides of utilities to maintain alignment.

D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 INSTALLATION - FILLING ABANDONED UTILITIES

A. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.

B. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.

C. Place flowable fill using method to ensure there are no voids.
   1. Fill pipes and conduits from high end.
   2. Fill manholes, tanks, and other structures from grade level access points.

D. After filling pipes and conduits seal both ends.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Perform inspection and testing according to ASTM C94/C94M.
   1. Take samples for tests for every 20 cu yd of flowable fill, or fraction thereof, installed each day.
   2. Sample, prepare and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.
   3. Measure temperature at point of delivery when samples are prepared.

C. Perform in-place density tests using nuclear test device according to ASTM C1040.

1. Perform tests at locations as directed by CO.

D. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.
   1. Test Requirements:
      a. Minimum temperature at point of delivery.
      b. Compressive strength requirements for each type of fill.
   2. Documentation: Duplicate delivery tickets.

3.6 CLEANING

A. Perform washout of concrete-based mixtures in designated areas in accordance with Section 01 50 00 – Temporary Facilities and Controls.

B. Remove spilled and excess flowable fill from Project Site.

C. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION 31 23 24

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 32 91 19.13 – TOPSOIL PLACEMENT AND GRADING

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. This Work consists of placing of topsoil upon constructed cut and fill slopes or in designated areas after subsoil grading operations are complete.

B. Related Sections:
   1. Section 01 57 23 – Temporary Storm Water Pollution Prevention.
   2. Section 31 05 13 – Soils for Earthwork: Topsoil material.
   3. Section 31 10 00 – Site Clearing: Topsoil stripping and stockpiling.
   4. Section 31 23 17 – Trenching: Topsoil stripping.
   5. Section 31 23 23 – Fill: Backfill of subgrade.

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
   2. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and other Organic Soils.
   3. D5268, Standard Specification for Topsoil Used for Landscaping Purposes.
   4. D557-91 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

1.4 DEFINITIONS

A. Finished Grades: The required final soil surface grade elevations indicated on the Drawings.

B. Flow Lines: Refer to plans for flow lines.

C. Acceptance: Wherever the terms “acceptance,” “accepted,” or “acceptable” are used herein, they mean acceptance by the Contracting Officer (CO) in writing.

1.5 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Product Data: For all products specified.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Weed-free certification for all products and materials, from a Park approved source.

1.6 QUALITY ASSURANCE

A. Furnish imported topsoil from the same approved source throughout the Work.

B. Perform Work in accordance with authorities having jurisdiction.

C. All imported materials shall be certified weed-free, from a Park approved source.

1.7 DELIVERY, STORAGE AND HANDLING

A. Topsoil shall be stripped and stockpiled in accordance with Sections 31 10 00 – Site Clearing.

B. Storage and handling of imported topsoil shall be completed in a similar manner as native topsoil.

1.8 SITE CONDITIONS

A. Environmental Requirements:
   1. Do not work soil when moisture content is so great that excessive compaction will occur, when it is muddy, when it is so dry that dust will form in the air, or when clods will not break readily and when it is frozen.
   2. Apply water, if necessary, to bring soil to an optimum moisture content for grading.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Comply with requirements of Section 31 05 13 – Soils for Earthwork.

B. In general, use native topsoil previously stripped and stockpiled under this Contract. Contractor shall be responsible for estimating quantity of stockpiled topsoil available on-site for reclamation Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine site and verify that conditions are suitable for finish grading Work, and that no defects or errors are present which would interfere with or cause incorrect finish grading Work to occur. Contractor shall advise CO, in writing, of any conditions or defects encountered

on site before or during construction upon which the work of this section depends and which may adversely affect its performance.

B. Notification of Unsuitable Conditions: Before proceeding with Work, notify CO of unsuitable conditions, discrepancies or conflicts. Do not commence work until unsuitable conditions or defects have been evaluated by the CO and corrective measures have been taken.

C. Soil Preparation: Verify that subsoil preparation Work is complete prior to commencing with topsoil placement.

3.2 PREPARATION

A. Existing Conditions:
   1. Comply with requirements specified in Section 01 73 40 – Execution, for locating and verifying existing utilities.
   2. Inspect and verify that rough subgrade preparation and elevations conform to Section 31 23 23 – Fill, before proceeding with Work of this section.

B. Protection of Existing Conditions:
   1. Use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the Work.
   2. Provide barricades, fences or other barriers to protect existing conditions to remain from damage during construction.
   3. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of existing plants to remain.
   4. Submit written notification of conditions damaged during construction to the CO.

C. Topsoil shall be keyed to the underlying material by scarifying the top 8 inches of subgrade. Remove materials larger than 3 inches from the subsoil surface prior to topsoil placement.

D. Do not place topsoil on surfaces without prior approval from the CO.

E. Prior to placement of topsoil, screen topsoil to remove material that is larger than 2 inches in any direction.

3.3 FIELD ENGINEERING

A. General:
   1. Establish lines and levels, locate, and lay out by instrumentation and similar appropriate means for planting area finish grades.
   2. Provide grade stakes and string lines to achieve smooth finish grades with positive surface drainage acceptable to the CO.

B. Swale Flow Lines, Bottom of Slopes, Top of Slopes and Grade Breaks: Install grade stakes at maximum 20 feet on center.

C. High Points and Low Points: Provide grade stakes at high points and low points including top of berms, catch basin rims and area drain rims.

3.4 TOPSOIL PLACEMENT AND GRADING

A. Placement:
   1. Conditions: Do not place topsoil when either the topsoil or subgrade are frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading.
   2. Where possible, promptly re-distribute stripped topsoil and vegetation so that plants will reestablish and limit the opportunity for exotic invasive species to propagate.
   3. Distribution:
      a. Distribution of topsoil shall be ecologically specific. Stripped and stockpile topsoil shall be distributed according to the dominate habitat (sagebrush, lodgepole, wetland, etc.) from which they originated. Placement of topsoil in as near to its original location will help preserve microorganisms and seeds of native plants.
      b. Uniformly distribute topsoil in a loose condition at a depth of at least 4 inches over decompacted subsoil areas to provide an effective rooting medium.
      c. If imported topsoil is required, the imported and stockpiled topsoil shall be mixed prior to placement.
      d. Ensure that all subsurface materials are placed first, then topsoil materials placed on top for final surface.

B. After the topsoil has been spread, large stiff clods, stones, or other foreign material that would seriously affect the effectiveness or appearance of the topsoil, shall be raked up and removed from the area.

C. Grading:
   1. Complete final topsoil grading to:
      a. The designated lines and grades as shown in the plans, or
      b. To match adjoining surface elevations and profiles.
   2. Grade soil surface with smooth uniform slope between points where elevations are given.
   3. Unless indicated otherwise, slope finish grades to drain surface water away from buildings, walks, paving, and other structures.
   4. Slope finish grades to drain surface water to catch basins, area drains, and along indicated flow lines.
   5. Grade soil surface smooth to be free of high and low areas that may inhibit surface drainage.
   6. Do not cover or slope finish grades toward valve covers, manholes, vaults, hand holes, pull boxes, tracer wire boxes or any other surface feature or structure utilized by the Government.
   7. Cut smooth falls to catch basin rim, finish flush.
   8. Provide smooth transitions at top and bottom of slopes.

D. Excessive Compaction:
   1. Take precautions and use appropriate equipment to prevent topsoil and subgrade compaction.
   2. Topsoil shall be loosely placed and free of any compaction from spreading or handling equipment including pickups, heavy equipment, etc., for the full depth.
   3. Scarify and re-grade areas showing any visible compaction from spreading or handling equipment.

E. Equipment: Use equipment of appropriate size and type to achieve the profiles and smooth soil surface free of high areas, depressions and equipment tracks.

F. Depressions and Loose Material: Fill and compact any depressions, and remove loose material to finish surface true to line and grade, presenting a smooth, compacted, and unyielding surface.

3.5 TOLERANCES

A. Hand Graded Areas:
   1. Grate to existing surface and maintain drainage patterns.

B. Allowances: Make proper allowances for settlement.

3.7 SOIL TREATMENT

A. Dust Control: Install a Government approved tackifier in all areas where topsoil is applied. Comply with product requirements of Section 01 57 23 – Temporary Storm Water Pollution Prevention, and dust control requirements in Section 01 50 00 – Temporary Facilities and Controls.

3.8 MAINTENANCE

A. In accordance with Section 01 57 23 – Temporary Storm Water Pollution Prevention, employ erosion and sediment control practices as necessary to prevent soil erosion.
   1. Install erosion control measure immediately after placing topsoil.

3.6 FIELD QUALITY CONTROL

A. Aesthetic Acceptance of Grades:
   1. Upon completion of finish grading Work, schedule with CO a review to obtain aesthetic acceptance. Provide five-days advance written notification.

END OF SECTION 32 91 19.13

DIVISION 33

UTILITIES

SECTION 33 05 17 - PRECAST CONCRETE STRUCTURES

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. Precast concrete vaults, including watermain drains.
   2. Concrete vault accessories.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork: Soil for backfill in trenches
   2. Section 31 05 16 – Aggregates for Earthwork.
   3. Section 31 23 17 – Trenching.
   4. Section 31 23 23 – Fill.
   5. Section 33 14 00 – Water Distribution

1.3 REFERENCES

A. ASTM International:
   1. C270: Standard Specification for Mortar for Unit Masonry.
   2. C476: Standard Specification for Grout for Masonry.
   3. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
   4. ASTM C857 – Practice for Minimum Design Loading for Underground Precast Utility Structures.
   5. ASTM C858 – Specification for Underground Precast Concrete Utility Structures.

1.4 DESIGN REQUIREMENTS

A. Design Criteria:
   1. Watertight precast reinforced air-entrained concrete structures designed to AASHTO HS20 - 16 kip wheel live loading and installation conditions, plus any other dead or live loads indicated on the drawings.
   2. Minimum 28-day Compressive Strength: 5,000 psi.
   3. Honeycombed or retempered concrete is not permitted.

B. Equivalent strength: Based on structural design of reinforced concrete as outlined in ACI 318.

C. Design of Lifting Devices for Precast Components: In accordance with ASTM C913.

1.5 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Shop Drawing: Indicate plan, location and inverts of connecting piping.

C. Product Data: Submit data on vaults, frames, covers, steps, pipe boots, eye bolts, grout and sealants.

D. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from materials suppliers attesting that precast concrete vaults provided meet or exceed ASTM referenced Standards and AASHTO HS-20 loading.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Closeout Procedures: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations and inverts of buried pipe, components and connections.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 67 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Transport and handle precast concrete units with equipment designed to protect units from damage.

C. Do not place concrete units in position to cause overstress, warp or twist. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.

D. Store precast concrete manholes and structures to prevent damage to Government property or other public or private property. Repair property damaged from materials storage.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 67 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

C. Maintain materials and surrounding air temperature to manufacturer's recommended minimum for each product applied or installed in the field.

1.9 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Requirements for coordination.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE VAULTS

A. Materials:
   1. Portland Cement: ASTM C150, Modified Type II or Type V- low alkali with tri-calcium aluminate not more than five percent (5%).
   2. Coarse Aggregates: ASTM C33; Graded 1 inch to No. 4 Sieve.
   3. Sand: ASTM C33; 2.35 fineness modulus.
   4. Water: Potable; clean and free of injurious amounts of acids, alkalis, salts, organic materials, and substances incompatible with concrete or steel.
   5. Air-Entraining Admixtures: ASTM C260.
   6. Reinforcing Steel:
      a. Deformed Bars: ASTM A615/A615M, Grade 60.
      b. Welded Wire Fabric: ASTM A185/A185M.
   7. Joint Sealant:
      a. ASTM C990.

B. Mixes:
   1. Design concrete mix to produce required concrete strength, air-entrainment, watertight properties, and loading requirements.
   2. Chambers shall utilize a type 10 or 30+ Fly Ash in their manufacturing to reduce concrete deterioration from sulphate attacks.
   3. All pre-cast chamber shall be produced by a manufacturer certified to ISO 9001:2008.

2.2 VAULT ACCESSORIES

A. Manhole Ring and Covers:
   1. Manufacture/Model: D&L Model A-1018, or approved equal.
   2. Material : Cast iron conforming to ASTM A-48-93 Class 35B meeting
   3. Opening: Minimum 24 inch wide diameter opening and a maximum cover diameter opening of 26 inches.
   4. Loading: HS-20 wheel loading.
   5. Pick: 1 ½”x1” closed pick marked
   6. Identification: Word “WATER” casted into the lid.

B. Grade Rings: Grade rings shall be manufactured for pre-case manholes and vaults.
   1. Material: Precast concrete conforming to ASTM C478.
   2. Sizes: 24 inch, or 30 inch diameter as required by ring and cover opening.
   3. Thickness: 2 inch to 6 inch

C. Grout:
   1. Type: Cementitious, non-shrink.
   2. Compressive Strength: 3000 psi.

D. Joint Sealant:
   1. Manufacturer/Type: K.T Snyder Company, Kent Seal, or approved equal.
   2. Material: Flexible, butyl rubber joint sealant.

E. Eye Bolts:
   1. Material: 316 S.S.
   2. Load Capacity: Per plans.
   3. Minimum Eye Opening: 1.5 inches
   4. Attachment: Designed by vault manufacturer.

2.3 BEDDING MATERIALS

A. Type 1 Pipe Bedding and Granular Fill Material as specified in Section 31 05 16 – Aggregates for Earthwork**.**

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Verification of existing conditions before starting work.

B. Verify piping connection, size, location and invert are as indicated on Drawings.

3.2 PREPARATION

A. Establish invert elevations for each component in system.

3.3 VAULT INSTALLATION

A. Excavate in accordance with Section 31 23 17 - Trenching. Hand trim excavation for accurate placement of vaults to elevations indicated.

B. With exception of covers, seal joints components in such a manner to make the vault watertight.

C. Backfill in accordance with Section 31 23 23 – Fill.

3.4 INSTALLATION OF ACCESSORIES

A. Install vault accessories in accordance with manufacturer's recommendations.
   1. Grout: Install between vault and grade rings, and annulus between pipes and pipe boots.
   2. Butyl Rubber Joint Sealant: Seal
      a. Joint between each vault/manhole section.
      b. Space between cast iron ring and precast grade ring.
      c. Space between aluminum hatch and concrete curb.
   3. Eye Bolt: Installed by vault manufacturer.

3.5 VAULT INSULATION

A. Insure a clean and dry concrete surface for adhesion of insulation. Insure environmental conditions and surfaces receiving insulation are prepared in accordance with the polyurethane foam manufacturer's recommendations.

B. Replace damaged insulation prior to backfilling. Do not backfill against insulation until it is fully cured.

C. Place aggregate bedding as indicated on the drawings.

3.6 CONNECTING PIPING

A. Connect piping in accordance with the drawings.

3.7 FIELD QUALITY CONTROL

A. Compaction Testing: In accordance with ASTM D698. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 73 40 - Execution: Protecting finished construction.

END OF SECTION 33 05 17

SECTION 33 14 13 – BOWMAN CREEK INFILTRATION GALLERY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Perforated wall pipe and fittings, collection piping
2. Drainage Aggregate
3. Geotextile Fabric
4. Well Casing
5. Pitless Adapter
6. Column Pipe
7. Submersible Water Pump

B. Related Sections:
1. See geotechnical investigation for subsoil conditions.
2. Section 03 30 00 – Cast In Place Concrete
3. Section 31 05 13 – Soils for Earthwork
4. Section 31 05 16 - Aggregates for Earthwork.
5. Section 31 23 16 – Excavation.
6. Section 31 23 17 – Trenching.
7. Section 31 23 23 – Fill.
8. Section 32 91 19.13 – Topsoil Placement and Grading.
9. All Sections in Division 26 Electrical
10. Section 33 14 16 – Water Distribution

1.3 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Dewatering and SWPPP plans shall be provided to the CO for approval prior to construction.

C. Product Data: Submit data on all materials specified herein.
1. Collection Pipe
2. Dran Aggregate
3. Geotextile Fabric
4. Well Casing
5. VEE Pack Screen
6. Submersible Water Pump

D. Technical data sheets and documentation from NSF or other certifying bodies showing that all system components that come into contact with water are ANSI/NSF 61 certified.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Closeout Procedures: Requirements for closeout procedures.

B. Project Record Documents:
   1. Comply with requirements specified in Section 01 77 00 – Closeout Procedures.
      a. Record actual locations of piping, pump, and screen.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 67 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE

A. PVC pipe and fittings shall be SCH 80 PVC at the sizes indicated on the drawings.

2.2 PVC PRE PACKED SCREEN – Infiltration Gallery Pipe

A. Product
   1. Manufacturer: Johnson Screens or Equal
   2. Size: 4-inch
   3. Standard Length: 10 feet
   4. Open Area (sq. in./ft): 9.4 (40x60 Pack 8 slot)
   5. Strength
      a. Collapse – 150 psi
      b. Tensile – 2100 lbs
      c. Hanging – 520 lbx
   6. Minimum Length:3’
   7. Minimum Rows of Slots: 6
   8. Minimum Slot Length: 1.5”
   9. Minimum Slot Width: .25”
   10. Slots per Row Per Foot: 12
   11. Minimum Slot Spacing: .75

2.3 SOIL AND BACKFILL MATERIALS

A. Soil materials are specified in Section 31 05 13 – Soils for Earthwork.

B. Backfill materials including drainage pipe bedding as specified in Section 31 23 23 – Fill.

C. Collection system drain aggregate as specified in Section 31 05 16 Aggregates for Earthwork, Grading A, Aggregate for Drains and Collection Springs.

2.4 GEOTEXTILE FILTER/SEPARATION FABRICS

A. Manufacturer: Mirafi 180 N or equal.

B. Structure Type: Nonwoven, needle-punched geotextile composed of polypropylene fibers, formed into a stable network such that the fibers retain relative position.
   1. Survivability: AASHTO M 288 Class 1 for Elongation of greater than 50%.
   2. Minimum Tensile Strength per ASTM D4632: 205 lbs
   3. Trapezoid Tear Strength per ASTM 4533: 80 lbs
   4. CBR Puncture Strength per ASTM D6241: 500 lbs
   5. Apparent Opening Size: 80mm
   6. Flow Rate: 95 gal/min/sqft

2.5 MATERIALS

A. Casing shall be steel meeting ASTM A53 at the size and dimensions as indicated on the drawings.

B. Steel shall be SCH 80 galvanized pipe with a pitless adaptor and ventilated well cap.

C. Column pipe shall be SCH 80 galvanized pipe at the size indicated on the drawings.

D. Concrete shall meet the requirements of Section 03 30 00.

2.6 PUMP

A. Pump shall be a Franklin 22FS1P4-2W230 or equal.

B. Type
   1. Stainless steel submersible pump
   2. Suction and discharge ports in line

C. Motor: 1 HP single phase

D. Individual Pump Operating Conditions: 18 gpm at 217 feet of head.

2.7 PUMP CONTROLS

A. See Division 26 specifications for control and electrical requirements.

2.8 WELL CAP

A. Well seal shall be a Maass Midwest Watertight Well Seal with screened vent or equal.

B. Vent type:
   1. Screened with corrosion resistant material to prevent entry of insects and
   2. Oriented to prevent entry of rainwater

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 40 - Execution: Requirements for installation examination.

3.2 PREPARATION

A. Section 01 73 40 - Execution: Requirements for installation preparation.

3.3 EARTHWORK

A. Excavating as specified in Section 31 23 16 – Excavation.

B. Trenching as specified in Section 31 23 17 – Trenching.

C. Backfilling as specified in Section 31 23 23 – Fill.

D. Maintain dewatering in conformance with Section 31 23 19 - Dewatering

3.4 INFILTRATION GALLERY INSTALLATION

A. Excavate collection area to the dimensions and elevations indicated on the Drawings.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides a minimum of 24 inches.

C. Place supporting layer of drainage course (aggregate) over compacted subgrade and geotextile filter fabric, to a minimum compacted depth as indicated on the Drawings.

D. Install well casing and screens as indicated on the Drawings.

E. Finish backfilling to ground surface according to Section 31 23 23 – Fill.

F. Install pumps and accessories in accordance with manufacturer's instructions.

G. Collection System Pump Testing Requirements
   1. Pump testing will be conducted and will consist of up to 4 hours of pumping at the maximum design rate of 18 gpm. During pump testing, water level measurements shall be recorded simultaneously in the pumped well with an approved water-level detector. Level detector shall be placed in the well by the Contractor to record data. The test may be terminated after level has stabilized for 4 hours as determined by the CO.
   2. If testing through the system is not achievable, Contractor must provide a test pump system that accommodates the requirements above and is approved by the CO.

H. Contractor shall disinfect casing and screens on site under observation of the CO in accordance with AAWA A-100, Section 4.9.

END OF SECTION 33 14 13

SECTION 33 14 16 – WATER DISTRIBUTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes

1. This section includes water distribution piping and specialties including piping, valves, meters, and fittings.

2. The work shall include the furnishing of all labor, tools, equipment, materials and performing all operations required to provide a complete item in accordance with the project Plans and these Specifications.

B. Related Sections

1. Section 31 05 13 - Soils for Earthwork: Subsoil for backfill.

2. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill.

3. Section 31 23 17 - Trenching: Trenching for buried pipe installation.

4. Section 33 05 17 - Precast Concrete Vaults.

5. Section 33 14 13 – Bowman Creek Infiltration Gallery.

6. Section 33 14 16 – Water Distribution.

7. Section 33 14 17 – Testing of Water Distribution

8. Section 33 16 61 –Buried Storage Tanks

1.3 REFERENCE STANDARDS AND SPECIFICATIONS

A. "AWWA Standards," American Water Works Association, Denver, Colorado, latest edition.

B. This section references the appropriate American Water Works Association Standards relating to gate valves, manufacturing, linings, coatings, pipe joints, and fittings for ductile iron, PVC, and HDPE water pressure pipe and miscellaneous pipe and fittings. The Standards are a part of this Section as specified and modified and shall reflect each Standard's latest edition.

1. High Density Polyethylene (HDPE) Pipe:

a. ANSI/AWWA C906 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission

b. AWWA M55 Manual of Water Supply Practices, PE Pipe–Design and Installation

c. ASTM D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping

d. ASTM D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

e. ASTM F3183 Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joint

f. ASTM F3190 Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings

g. ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

h. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

i. ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock

j. ASTM F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

k. ASTM F3124 Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings

l. PPI TR-4 PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength Ratings for Thermoplastic Piping Materials for Pipe

m. PPI TN-38 Bolt Torque for Polyethylene Flanged Joints

n. PPI TN-42 Recommended Minimum Training Guidelines for PE Butt Fusion Joining Operators for Municipal and Industrial Projects

2. Valves:

a. AWWA C509: Resilient-Seated Gate Valves for Water Supply Service

b. AWWA C515: Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

c. AWWA C550: Protective Epoxy Interior Coatings for Valves and Hydrants

1.4 SUBMITTALS

A. Product data for the following:

1. Water Mains

2. Fittings, Nuts & Bolts, Gaskets

3. Valves and Appurtenances

4. Service Saddles & Materials

5. Precast Concrete Vaults (including covers)

6. Tracer Wire

7. Blow Off Hydrants

8. Yard Hydrants

9. Fire Hydrants

10. HDPE Pipe and Fittings: The following information shall be submitted:

    a. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.

    b. Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be provided by manufacturer.

    c. Pipe and fitting product data indicating conformance with this specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.

    d. At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this specification and applicable pipe and fitting standards specified herein.

    e. Installation Manual which outlines guidelines for handling, joining, installing, embedding and testing of polyethylene pipe.

    f. HDPE Fusion Certification, HDPE Fusion Machine, HDPE Fusion Machine Data Logger and Processor.

    g. Corrosion protection products including, but not limited to, Mastic Coating and/or Tape, Polyethylene Encasement, and Protective Coatings for Nuts and Bolts.

11. HDPE Fusion technician and fusion process submittals:

    a. Documentation that each fusion technician has met requirements for joining proficiency for each type of fusion joint performed by the fusion technician under this specification.

        1) Provide documentation indicating that the fusion technician meets the training and experience requirements listed in 1.05.C.

2) Provide a copy of the fusion technician's standard operating procedures manual for the fusion machine and datalogger to be used on this project.

b. Documentation of conformance with this specification and applicable standards, including written documentation regarding any intended variance from this specification and applicable standards. This will include fusion joint warranty information and recommended project specific fusion parameters, including criteria logged and recorded by data logger.

c. As-Recorded fusion technician joint reports for each fusion joint (via McElroy DataLogger 5, 6 or 7) performed on the project, including joints that were rejected. Specific requirements of the fusion technician's joint report shall include:

1) Pipe or fitting size and DR or pressure class rating

2) Fusion equipment size and identification

3) Fusion Technician Identification

4) Job Identification Number

5) Fusion Number/Joint Identification Number

6) Fusion joining parameters

7) Ambient temperature

B. Water System Operations During Construction

1. Pipe connection and tie in sequencing plan

C. Field quality control test reports.

D. Operation and maintenance data for the following:

1. Valves including but not limited to Gate Valves, Check Valves, and Air Release Valves.

E. Technical data sheets and documentation from NSF or other certifying bodies showing that all system components that come into contact with water are ANSI/NSF 61 certified.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data, such as thickness for piping.

C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in Section 33 01 12 – Testing of Water Distribution.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Pipe and related materials shall be manufactured, fabricated, handled, loaded, shipped, unloaded, and stored in such a manner as to be undamaged and in sound condition.

B. Products with visible damage are subject to rejection.

C. Store pipe, fittings, valves, and appurtenances off ground using sound wood blocks placed on stable foundation or using other appropriate means. Allow space between rows, individual pieces, and bundles with clearance below and above to allow full view for inspection purposes.

1. Store in well-drained area away from brush and accessible for inspection.

2. Do not stack pipe higher than recommended by pipe manufacturer.

3. Keep interior of pipe and fittings free from dirt or other foreign matter.

4. Keep spigot ends of pipe clean and clear for dimensioning purposes.

5. Store gaskets for mechanical and push-on joints in a cool dark place at all times until ready for use.

6. Do not place excavated or other material over or against stored material.

D. Unload and handle materials with crane, backhoe, or equipment of adequate capacity, equipped with appropriate slings or padding to protect materials from damage.

E. Repair or replacement

1. Repair damages or defects following approved manufacturer's recommendations.

2. Remove and replace materials deemed not repairable at no cost to the Contracting Officer.

1.7 SITE CONDITIONS

A. Corrosion protection shall be provided for all buried pipe, fittings, nuts and bolts, valves, and appurtenances constructed with ferrous or copper alloy metals.

PART 2 – PRODUCTS

2.1 HIGH DENSITY POLYETHLENE (HDPE) PIPE

A. High density polyethylene pipe shall meet or exceed the most current version of AWWA C901, AWWA C906, and ASTM D3350 and be purchased from an approved manufacturer.

B. HDPE pipe shall be Ductile Iron Pipe Size (O.D.) with a dimension ratio (DR) of DR11.

C. Furnish HDPE pipe in lengths as follows:

1. Smaller than 4” diameter shall be furnished in long coils on spool.

1. Nominal straight lengths of 3 inch and larger pipe shall be 40 ft. or 50 ft.

2. Nominal coil lengths of 4-inch and smaller pipe shall be 500 ft. Longer or shorter coils such as 800 ft for 4-inch pipe, 1000 ft for 3-inch pipe, or 2000 ft for 2 inch or smaller pipe shall be acceptable. Pipe shall be black.

    3. Pipe shall be permanently marked using heated indent printing in accordance with ASTM D3035 as applicable for the pipe size including:

        a. Nominal size and sizing system, e.g., IPS or DIOD

        b. DR or SDR

        c. Standard Designation, ASTM D3035, material designation, and pressure rating or pressure class for water at 73°F.

        d. Extrusion production-record code

        e. Manufacturer's Trademark or trade name

D. Resin and Material Requirements

1. All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D 3350 with a minimum cell classification of 445474C. The manufacturer of the HDPE resin shall certify the cell classification indicated.

2. HDPE material compound shall have a hydrostatic design basis (HDB) rating at 140°F (60°C) of not less than 1000 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer.

3. HDPE material (compound) shall conform to material requirements specified in ASTM D3035 and ASTM D3261 as applicable for the pipe or fitting.

4. HDPE material compound shall have a hydrostatic design stress (HDS) rating for water at 73°F (23°C) of not less than 1000 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer.

5. HDPE pipe and fitting material (compound) in PE4710 pipe and fittings shall contain ultraviolet (UV) stabilizer meeting the requirements of Code C per ASTM D3350. Code C material shall contain 2 to 3 percent carbon black to provide indefinite protection against UV degradation when material from the pipe is tested in accordance with ASTM D1603 or ASTM D4218.

6. Clean rework materials derived from pipe production by the same manufacturer are acceptable as part of a blend with new material for the production of new pipe provided that the rework material is the same PE4710 material designation as the new material (compound) to which it is added. Finished products containing rework material shall meet the requirements this specification.

7. Pipe sizes 4” and larger shall have a manufacturing standard of ASTM F 714, while pipe smaller than 3” shall be manufactured to the dimensional requirements listed in ASTM D 3035.

8. Pipe shall meet or exceed AWWA C901 (1/2” to 3”) or AWWA C906 (4” to 63”).

9. Pipe shall be color coded for the intended service. The color coding shall be permanently co-extruded stripes on the pipe outside surface as part of the pipe’s manufacturing process. Color coding shall be blue for potable water.

2.2 HIGH DENSITY POLYETHLENE (HDPE) FITTINGS

A. Butt Fusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification of 445474C. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by Contracting Officer. All fittings shall meet the requirements of AWWA C901 or C906.

1. Shall comply with ASTM D3261 for molded butt fusion and saddle fusion fittings, flange adapters and MJ adapters, or shall comply with ASTM F2206 for fabricated butt fusion fittings, or shall comply with ASTM F1055 for electrofusion fittings.

2. Shall comply with the marking requirements of ASTM D3261 for molded butt and saddle fusion fittings, flange adapters and MJ adapters or shall comply with the marking requirements of ASTM F2206 for fabricated butt fusion fittings, or shall comply with the marking requirements of ASTM F1055 for electrofusion fittings.

3. Shall have pressure class ratings not less than the pressure class rating of the pipe to which they are joined.

B. Bolted Connections - Flanges shall be fused onto the pipe and have a minimum pressure rating equal to or greater than the pipe unless otherwise specified on the plans.

1. MJ Adapter Assembly: MJ adapter shall incorporate factory fabricated MJ adapter for butt fusion to plain end HDPE pipe. The outside diameter of the adapter for insertion into the MJ fitting shall be ductile iron pipe size (DIPS). Fittings shall meet AWWAC901/906, NSF-61 and be manufactured with resin meeting the material designation for PE3408, PF3608, PE4710 and PE100. Adapters shall incorporate 316 stainless steel stiffeners. The gland rings shall be fusion bond epoxy coated ductile iron. All bolts, nuts and washers shall be series 300 stainless steel.

2. Bolted Flange Adapter: Flange adapter connections shall be assembled, installed and tightened in accordance with the flange adapter manufacturer’s instructions. Flange bolt tightening shall be in accordance with PPI TN-38. Flange adapters shall employ stainless steel backup rings. Metallic back-up rings (Van-Stone style lap joint flanges) shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class E (generically known as 150-pound patterns). Flange gaskets shall be used in all flanged connections. All bolts, nuts and washers shall be series 300 stainless steel.

2.3 GATE VALVES

A. Gate valves shall be resilient seated wedge type, fusion bonded epoxy external and internal surfaces conforming to AWWA C550, ductile iron or cast iron body design, non-rising stem (NRS) valves.

B. The design pressure shall be 250 psi cold water working pressure.

C. Valve stem operation shall be counterclockwise to open. The valves shall comply with AWWA C509 or C515, latest revision.

D. Ends shall be designed for direct connection to the type of pipe which the valve is joined to, or as indicated on the Plans.

1. Flanged ends and drilling shall comply with ANSI B16.1, Class 125.

2. Mechanical Joint ends shall comply with AWWA C111.

E. Buried gate valves shall be equipped with standard 2-inch operating nuts.

F. Valve boxes shall be 5.25” diameter, domestic cast iron, two piece, screw type, stamped water in the lid.

2.4 CURB STOP VALVES – USED ON SERVICE LINES AND TRANSMSSION PIPELINE

A. Furnish curb stop valves with bronze plug, tee head key with Minneapolis pattern and screw box mount. End connections to be packed joint. Curb stops shall be NFS 61 Certified.

1. For use with PE pipe, provide and install solid 304 tubular stainless steel stiffeners with dimpled and compression connections, as directed by manufacturer.

2.5 CURB BOXES

A. Furnish extension type, steel, curb boxes with cast iron lids and bases, having a 7 foot extended length and plug style lid with standard pentagon nut, 1-1/2” upper section.

2.6 FLANGE COUPLING ADAPTERS

A. Flange coupling adaptors shall meet the requirements of AWWA C219.

B. Sleeve material shall be carbon steel with NSF-61 certified fusion-bonded epoxy coating.

C. Bolts and nuts for buried service applications shall be Type 304 stainless steel.

D. Flanged coupling adapters shall be designed specifically for the pipe material/size and application and shall feature a maximum of one bolt on the compression end for installation.

2.7 COUPLINGS AND SLEEVES

A. Couplings shall meet the requirements of AWWA C219 and shall meet or exceed pressure rating of the main material.

B. Sleeve material shall be carbon steel or ductile iron with NSF-61 certified fusion bonded epoxy coating.

C. Gaskets shall be resilient material coupling gaskets approved for water applications.

D. Followers and middle rings shall be fusion bonded epoxy coated in accordance with NSF-61.

E. Bolts and nuts for buried service shall be Type 304 stainless steel.

F. Castings shall be ductile iron conforming to ASTM A536, Grade 65-45-12.

G. Clamping bolts and nuts shall conform to ANSI B 18.2.2.

H. Restraining rods shall conform to AWWA C111.

I. Pipe sleeves shall be ductile iron long style compact fitting, MJ x MJ with restrained glands at each end, conforming to AWWA C153.

J. Couplings to connect existing galvanized pipe to new HDPE shall be brass compression type.

2.8 FLANGE AND MECHANICAL JOINT T-HEAD BOLTS AND NUTS

A. Flange Bolts and Nuts

1. Grade 304 Stainless Steel with minimum yield strength of 45 ksi.

2. Bolts shall be standard ANSI B1.1, Class 2A coarse threads.

3. Nuts shall conform to ASTM A563 and be standard ANSI B1.1, Class 2A coarse threads.

4. Bolt heads and nuts shall be hexagonal.

5. Identification of the head of the bolt shall be: A 307 A.

B. Mechanical Joint T-Head Bolts and Nuts

1. Grade 304 Stainless Steel with minimum yield strength of 45 ksi.

2. T-Head bolts and nuts shall be threaded in accordance with ANSI B 1.1, Class 2A coarse threads.

3. Heavy hex nuts shall be used.

4. Bolt heads shall be in accordance with the dimensions of AWWA C111.

C. Finish

1. Flange bolts and nuts, and mechanical joint T-Head bolts and nuts, shall be finished with the a coating system to significantly reduce the effects of corrosion.

2. A multi-step process shall be utilized to chemically clean, abrasive blast, and prime with zinc/nickel phosphate primer prior to application of the xylan fluoropolymer. Wear resistance (K-Factor) shall be in the range of 6 to 8 (excellent) and minimal effects should be seen after a 3,000-hour salt spray test conforming to ASTM B 117.

3. Bolts and nuts finished with an approved coating system do not require coating with mastic.

2.9 WATER SERVICES

1. Service Pipe

   a. Pipe: HDPE SDR 11 CTS pipe with 200 psi rating.

   b. Insert Stiffeners: Stainless Steel match pipe size.

2. Service Saddle

   a. Provide stainless steel saddles specifically for use with the HDPE pipe, unless otherwise required of the connecting pipe. Service saddle shall be NSF 61 Certified.

   b. Manufacturers: Romac 306-H, or approved equal.

   c. 304 stainless steel shell, gauges ranging from 24 ga. for smaller pipe o.d.s to 18 ga. for larger pipe o.d.s.

   d. Dual sidebars of heavy gauge 304 stainless steel, gtaw welded to form permanent fusion with shell. lugs 304 stainless steel, fused to sidebars by gmaw welding.

   e. Provide 304 stainless steel bolts, 1/2" or 5/8" rolled thread. bolts are mig welded to sidebar.

   f. Provide 304 stainless steel nuts, 1/2" or 5/8" unc thread. nuts coated to prevent galling.

   g. Lifter bars 304 stainless steel, lip curved to hold position while tightening. heavy gauge serves as bearing surface for nuts.

   h. Provide 1/2” or 5/8" 304 stainless steel spring washers manufactured from a special grade of stainless steel used in the making of springs.

   i. Provide 1/2" or 5/8" plastic washer prevents galling between spring washer and lifter bar.

j. Gasket to be made from Nitrile Butadiene Rubber (NBR) compounded for water and sewer service and a tolerance of petroleum products in accordance with ASTM D 2000 MBC 610. Other compounds available for special applications.

k. Outlet connections for use with MIPT corporation stop valves.

3. Corporation Stops

a. Corporation stops shall be ball valve, brass conforming to AWWA C800 and ASTM B-62, and suitable for a working pressure of 300 psi. Corporation stops shall be NSF 61 Certified.

b. Inlet end shall be male iron pipe thread (MIP) and outlet end shall be compression connection suitable for connection to IPS O.D. PE tubing.

c. For use with PE pipe, provide and install solid 304 tubular stainless steel stiffeners with dimpled and flanged end to retain placement within the service line, as directed by manufacturer.

4. Curb Stop Valve and Curb Box

1) Per Sections 2.7 and 2.8 above

5. Pump Out Drains

1) Pipe and fittings to be galvanized SCH 40 as indicated on the plans.

2.10 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Kennedy Guardian K81D Fire Hydrant; No Equal - Sole Source.

C. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrants have cast-iron body, compression-type valve opening against pressure and closing with pressure.

D. Standard: AWWA C502.

E. Pressure Rating: 150 psig minimum.

F. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

G. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.

H. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.

I. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.11 FLUSHING HYDRANT

A. Hydrants shall be non-freezing, self-draining type with bury depth as required in the drawings. Hydrants shall be furnished with 2" FIPT horizontal inlet. A turning rod shall open left. Bronze operating mechanism and aluminum plunger design shall be serviceable from above grade with no digging. The outlet shall also be bronze with 2-1/2" NST. Hydrants shall be lockable to prevent unauthorized use. Provide hydrants per Model #77 Mainguard post hydrants by Kupferle Foundry Company, or approved equal.

2.12 INSULATION BOARD

A. As indicated in the drawings and/or where a minimum depth of 6 feet of cover cannot be maintained over the water line, rigid, extruded polystyrene insulation board is to be provided. The board is to comply with ASTM C578 Type IV. The board shall have a minimum aged R-value per inch of 5.0 per ASTM C518, a minimum compressive strength of 25 psi per ASTM D1621; a maximum water absorption per ASTM C272 of 0.2% by volume, and a maximum linear change according to ASTM D2126 of 3%. The board is to be 2 inches thick. The board is to be Dow Styrofoam Brand, or approved equal.

2.13 MASTIC COATING

A. All exposed buried steel surfaces (rebar, c-clamps, tie-rods, uncoated non-stainless bolts hardware, pressure plates…) that are not fusion coated or provided with a corrosion resistant coating shall receive two 12 mil coats equal mastic. Allow for sufficient cure time between coats and prior to backfill (at a minimum, 1 hour minimum at or above 60-degree F with low humidity, 2 hours total below 60-degree F with low humidity), refer to minimum cure times per the manufactures recommendations for cold weather application. Cure time is a function of temperature, UV exposure and humidity, so minimum time to allow backfill shall be as deemed required by the Inspector.

2.14 INCIDENTAL ITEMS

A. The Contractor shall furnish all incidental items required to complete the work that are not specifically referred to herein. Incidental items which shall be furnished by the Contractor include but are not limited to gaskets, test station anodes/wires, nuts, bolts, tape wrap, brass plugs, hardware for temporary flush assemblies, etc.

2.15 TRACER WIRE

A. Tracer wire shall be a minimum of 10-gauge, insulated copper wire suitable for buried pipeline conditions attached to all pipelines and services lines. The tracer wire shall be terminated and brought to the surface prior to entering buildings or vaults, located in a tracer wire access/termination box or valve box. Tracer wire access boxes shall be rated for light or heavy duty traffic, having a cast iron lid with stainless steel terminal ends mounted to the lid and indicate the type of use, i.e. "Water", "Sewer". Access boxes shall be manufactured by Valvco, Copperhead, or equal.

2.16 SANITARY YARD HYDRANT:

A. Hydrant shall be freezeless, sanitary type with back flow prevention. Supplied for 7' of bury with 1" NPT inlet and maximum operating pressure of 120psi.

B. Fiberglass grating shall be Mcnichols Fiberglass or equal. Spaces shall be 1"x1.625" with .375" clear space sloped at 2% max.

C. Wood post shall be cedar at the dimension indicated on the plans with stainless steel pipe fasteners.

2.17 DRAIN DRYWELL AND TANK DRAINS

A. DI Pipe shall meet the requirements noted above.

B. Precast concrete manhole per specification 33 05 17.

C. Flanged Flapper Valve

1. Troy Model A2540, or equal, with cast iron body, bronze seat and disc ring with a 125# flange. All iron parts shall be coated in a 2 part epoxy with 3-4 mils dry film thickness.

D. Mesh screen shall be #4 stainless steel cut to match the OD of the flange.

E. All hardware to be SS 304.

PART 3 – EXECUTION

3.1 GENERAL

A. All work shall be completed in conformance with the appropriate AWWA or ASTM standards, the manufacturer's requirements, the Plans, and these Specifications.

B. All work shall comply with the installation requirements of the International Plumbing Code where applicable.

C. The Contractor shall not install any pipe when the temperature drops below freezing, nor until trenches have been thoroughly and properly dewatered.

D. The Contractor shall not install any pipe when, in the opinion of the Resident Project Representative (Construction Observer), trench conditions are unsuitable.

3.2 UTILITY DEMOLITION AND ABANDONMENT

A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

B. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping.

C. Piping to Be Abandoned in Place: Existing piping shall be drained, and contents shall be discharged or disposed of in accordance with regulatory requirements. Plug piping ends with concrete plugs per the specifications. Caps may be permitted in place of concrete plugs; Contractor shall submit alternatives to Contracting Officer for review and approval.

D. Equipment to Be Removed: Disconnect and cap services and remove equipment.

E. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

F. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment. Deliver to Contracting Officer for storage.

G. Asbestos Concrete Pipe

1. Removal (handling and disposal) of existing asbestos concrete pipe shall be performed in accordance with all applicable standards; not limited to OSHA, MT DEQ and EPA. The contractor shall be required to obtain all necessary waste release permits and pay all associated fees and cost related to legal handling, transportation, and disposal. Proper safety equipment shall be utilized by workers and by transport equipment and no fugitive dust will be allowed during this work. The contractor shall provide written documentation to the Contracting Officer for chain of custody for said disposal. The Contractor shall be responsible for protecting traffic and the public from removal areas including detours, fencing, etc. as needed.

   a. Coordinate handling requirements with the Montana Asbestos Control Program. (406) 444-5300; deqacponline@mt.gov

2. If a new water main is to be connected to an existing asbestos concrete pipe, asbestos sampling of the water and flushing of the main is required to be performed and approved prior to making connection per AWWA C651.

H. Fire Hydrants to Be Removed: Contractor shall notify governing fire agency in advance of fire hydrants affected during construction.

3.3 LAYOUT

A. See General Conditions for Construction Surveys

3.4 POTHOLING

A. Potholing involving exploratory excavation in areas of possible conflicts, marked utility crossings, locations of connections to existing water facilities, and other areas is required prior to construction. Contractor shall immediately notify the Contracting Officer of discrepancies between the existing field conditions and the information shown on the Plans, Contractor shall pothole sufficiently in advance of construction to allow a minimum of three (3) working days for the Contracting Officer to prepare a re-design plan should a conflict be encountered. Absolutely no stand-by time will be paid to the Contractor during this three (3) day re-design period.

B. The locations, depths, sizes, and materials of existing utilities shown on the Plans are approximate. This information has been obtained from utility maps furnished by the various agencies involved and is not guaranteed as to accuracy or completeness.

C. It shall be the responsibility of the Contractor to locate all existing utilities and utility structures, whether shown or not, and to notify utility providers to verify in the field the location of their installations prior to construction. The Contractor shall protect all utilities and utility structures from damage. The expense of repair or replacement shall be borne by the Contractor.

D. The Contractor will be required to acquire the following information from these investigations:

1. Verification of pipe location, type, material, size (i.e., outside diameter), and depth to existing surface for all connections to existing water facilities.

2. Verification of type, material, size, and location for all known utility crossings.

3. List of utilities that will require relocation. Contractor shall coordinate existing utility relocation plan with Contracting Officer for approval.

4. Information required for surveying and staking of pipe alignment.

E. Potholing shall be considered incidental to the Project cost and there will be no direct payment for existing utility verification.

3.5 TRENCH EXCAVATION, BEDDING, AND BACKFILL

A. Perform trench excavation, bedding, and backfill in accordance with Section 31 23 00 – Trench Excavation and Backfill.

3.6 PIPE DELIVERY, HANDLING AND STORAGE

A. Before off-loading, pipe shall be inspected for damage. Any pipe damaged in shipment shall be assessed and either accepted or rejected as directed by the Owner or Engineer, and the pipe supplier shall be notified of rejected pipe within 7 days of delivery at the site. Rejected pipe shall be quarantined for disposition. Each pipe shipment shall be checked for quantity and conformance with these specifications.

B. Pipe lengths should be placed and stored on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

3.7 PIPING INSTALLATION

A. All pipe shall be installed in conformance with manufacturer's recommended procedures for the pipe being installed. In addition, comply with the installation requirements of the Uniform Plumbing Code.

B. Do not install any piping until trenches have been thoroughly and properly dewatered.

C. Pipe shall be firmly and properly bedded and then partially backfilled between pipe joints and valves.

D. Pipe ends shall be neatly and squarely cut, all burrs removed, and reamed inside to provide a tight joint and clean, smooth flow line.

E. The Contractor shall be responsible for determining appropriate and correct radii of curves in the lines and providing whatever combination of pipe lengths and/or standard and special couplings are necessary for proper completion of the work. No pipe shall be installed under tension.

3.8 HDPE PIPE

A. The installation of HDPE pipes shall be in compliance with these Specifications and the most current version of AWWA C901 or C906.

1. If there is a conflict, the more conservative shall apply.

2. Contractor shall consult with the Contracting Officer in the event of a conflict.

B. Direct Burial

1. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D 2321 or ASTM D 2774 for pressure systems and AWWA Manual of Practice M55 Chapter 8. The Design Window identified in AWWA M55 Chapter 5 (page 65 of 2006 version) shall be considered acceptable design and installation conditions.

2. Unless required by the Contracting Officer, or specifically required in the drawings, no thrust blocks shall be placed in the HDPE pipe system since the fused system is fully restrained.

C. Fusion Joining Requirements:

1. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, seal, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.

2. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the Contracting Officer.

3. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290, PPI TN 34, and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence

electrofusion training within the past year on the equipment to be utilized for this project.

D. HDPE Fusion Technician Requirements:

1. The fusion technician shall have fused by the butt fusion joining process within the past 36 months a minimum of 400 joints of pipe utilizing the similar size and type of fusion machine and data logger proposed for use on this project.

2. The fusion technician must have been formally trained and certified, within the past 36 months, in the making of butt fusion joints in accordance with ASTM F2620 by HDPE pipe, fitting fusion equipment manufacturers or ASTM F3190 …qualified "HFE" operator training instructor having the skill / experience described in Annex A1."

3. The fusion technician must have an in-house Standard Operating Procedure (SOP) Manual for the fusion machine and data logger proposed for use on this project.

4. Each Fusion Technician making butt fusion joints shall be qualified to make butt fusion joints in accordance with ASTM F2620. Qualification shall have occurred not more than 12 months before performing fusion joining on site in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620 that are proved to be satisfactory by destructive testing in accordance with ASTM F2620.

5. Each Fusion Technician making electrofusion fitting joints shall be qualified to make electrofusion fitting joints in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure. Qualification shall have occurred not more than 12 months before performing on-site fusion joining in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure that are proved to be satisfactory by destructive testing in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.

E. Fusion Equipment Requirements:

1. Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gage and thermometer should be checked for accuracy. When requested by the Contracting Officer, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.

2. Electrofusion Processors shall be maintained and calibrated per manufacturer's requirements and recommendations.

3. Butt fusion machines shall incorporate the following properties, including the following elements:

   a. Heat Plate – Heat plates and the non-stick coatings on heating surfaces shall be in good condition without heating surface gouges or scratches. The non-

stick coating shall be intact, clean and free of any contamination. Heater controls and temperature indicators shall function properly, and electrical cords and connections shall be in good condition. The heat plate shall maintain a uniform and consistent temperature on all areas of the heating surfaces on both sides of the heat plate.

b. Carriage – Carriage shall travel smoothly with no binding at less than 50 psi for hydraulic fusion machines. Clamps shall be in good condition with proper inserts for the pipe size being fused.

c. General Machine – Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

d. Data Logger – The current version of the pipe supplier's recommended and compatible software shall be used. Protective case shall be utilized for the handheld wireless portion of the unit. Data logger operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

e. Other equipment specifically required for fusion processes shall include the following:

1) Pipe rollers shall be used to support pipe to either side of the butt fusion machine and provide for vertical and lateral pipe alignment straight through the butt fusion machine.

2) A protective enclosure that provides for full machine motion of the clamps, heat plate, fusion assembly and carriage shall be provided for fusion in inclement and/or windy weather. Pipe ends shall be covered or blocked where open pipe ends could allow prevailing winds to blow through the pipe.

3) The fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

F. HDPE Pipe Fusion Process:

1. Butt and saddle fusion of HDPE pipe and fittings shall be in accordance with ASTM F2620 and the manufacturer's recommended joining procedure.

2. Electrofusion of HDPE pipe and fittings shall be performed in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.

3. HDPE pipe and fittings shall be fused by qualified fusion technicians, as documented by the fusion provider. Training records for qualified fusion technicians shall be available to Owner or Engineer upon request.

4. As each fusion joint is constructed, pressure, time and temperature parameters shall be recorded and logged by an electronic monitoring device via McElroy Data Logger 5, 6 or 7 affixed to the fusion machine. Joint data shall be submitted as part of the As-Recorded information, in accordance with this specification.

5. On each day butt fusions are to be made, the first fusion of the day shall be a trial fusion.

    a. The trial fusion shall be allowed to cool completely, and then fusion test straps shall be cut out. 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).

    b. 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.

    c. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed this test. This requirement may be waived at the discretion of the Engineer and Owner.

G. Joint Recording: Each fusion joint shall be recorded and logged by an electronic monitoring device (McElroy Data Logger 5, 6 or 7) connected to the fusion machine that shall register and/or record the parameters required by the manufacturer and these specifications. Data not logged by the data logger shall be logged manually and be included in the fusion technician's joint report.

H. Fusion Joint Logging: Fusion joint data logging to include the following:

1. General Information

    a. Date

    b. Technician name

    c. Technician ID #

    d. General contractor / Owner name & contact info

    e. Project name

    f. Project Number **Must correspond with Electronic Data Recording Device**

    g. Location

2. Fusion Equipment

    a. Fusion equipment used

    b. Total Effective Piston Area (TEPA)

    c. Interfacial Pressure (IFP)

    d. Electronic data recording device used

3. Pipe Information

    a. Pipe manufacturer

    b. Pipe Material Designation Code (PMDC)

c. Fusion specification / procedure used

d. Pipe Size & DR

4. Each Fusion Joint

a. Time of each fusion

b. Sequential Joint Number **Must correspond with Electronic Data Recording Device**

c. Drag pressure

d. Calculated fusion PSI

e. Heater temperature

f. Heat soak time

g. Cool Time

h. Must include cut-out joints

5. Daily Production Summary

a. Total lineal feet fused

b. List fittings installed

c. Technician's hours on jobsite

6. Daily General Information

a. General weather conditions: ambient temperature, wind speed, use of a shelter.

b. Change of conditions or scope of work

c. Field information: fitting description, job set-up issues, in-trench fusion etc.

d. Document relevant events or circumstances

I. Installation of pipe shall be as described herein and in accordance with the project plans Standard Drawings.

1. Material inspections: Pipe, fittings, and accessories shall be carefully inspected, before and after installation, in accordance with Chapter 2; Inspections, Tests and Safety Considerations; of the Handbook of PE Pipe, published by the Plastic Pipe Institute. Pipe and fittings shall be free from fins and burrs. Damage is defined as cuts or gouges exceeding 10% of the pipe wall thickness, kinked pipe sections, pipe sections flattened to more than 5% of the original diameter, or any abrasion or cutting of the inside surface of the piping. If defects penetrate deeper than 10% of the minimum wall thickness, the defect(s) will be considered as excessive damage. Excessive damage cannot be repaired using hot gas or extrusion welding to fill the

damage with new PE material. The excessively damaged section must be fully removed from the pipe (i.e., two, full circumferential cuts), and the undamaged sections of the pipe may be butt fused back together.

2. The handling of the joined pipeline shall be in such a manner that the pipe is not damaged. Ropes, fabric or rubber-protected slings, or straps, shall be used when handling pipes. Chains, or hooks inserted into the pipe ends shall not be allowed. Two slings spread apart shall be used for lifting each length of pipe. Slings for handling the pipeline shall not be positioned at butt-fused joints.

3. The horizontal bending radius for HDPE piping shall not be less than the minimum radius recommended by the piping manufacturer.

4. HDPE pipe can be subject to length dimension changes induced by temperature changes before, during and after installation. The contractor is advised to contact the pipe manufacturers' representative for recommendations to mitigate the effects of this material characteristic in order to minimize stress placed on pipe. The Contractor shall adhere to the Manufacturer's recommendations for pipe installation and anchorage.

3.9 GATE VALVES INSTALLATION

A. Install in accordance with AWWA C600.

B. Install valves in conjunction with pipe laying; set valves plumb.

C. Provide buried valves with valve boxes installed flush with finished grade. Remove all dirt and debris from inside box, install stem extension, and concrete collar as shown on the plan details

D. Provide thrust blocking, or mechanical thrust restraint for valve anchorage as provided in the details for non-restrained valves. Provide concrete pad below all gate valves.

3.10 THRUST RESTRAINT

A. All tees, valves and hydrants shall be provided with thrust blocks for thrust restraint.

B. Thrust blocks shall conform with requirements in the Plans.

C. Thrust blocks shall be made of concrete delivered by an approved supplier.

1. Thrust block concrete shall have a compressive strength of not less than 4,000 psi after 28 days.

2. Bag concrete is not acceptable.

D. High-early strength concrete shall be used for thrust blocks at all tie-in, cut and cap and other locations deemed necessary by the Contracting Officer and/or as specified on the Plans.

E. Restrained pipe joints shall be provided as indicated on the Plans.

3.11 CONNECTION TO EXISTING FACILITIES

A. Connections to existing water pipe facilities are required at the locations noted on the Plans.

B. Contractor shall verify the existing pipe conditions at connection locations prior to initiating the distribution tap operations or connection to existing water mains. See Potholing above.

C. Connection to existing water mains will require isolation of the existing water mains and disruption of water service. Contractor shall coordinate all connections to existing water facilities with the Contracting Officer and Using Agency. Contractor shall provide one week notice minimum prior to service disruptions.

D. Connection to existing steel mains requiring welding shall be done by a qualified welder. No exceptions.

E. Existing water services are to be transferred to the new water mains after testing, disinfection, and flushing of the new main. Contractor shall coordinate the transfer of these services with the Contracting Officer.

F. Contractor shall coordinate with the Contracting Officer to ensure that existing isolation valves applicable to the designated work areas are operational prior to initiating work on connections to existing water mains. Contractor is not permitted to operate existing valves. Coordinate all valve operation and modification with the Using Agency.

G. Contractor shall limit service outages to a minimum.

   1. Where service outages are necessary, Contractor shall construct entire assemblies for the connections prior to cutting or tapping into the existing pipe to expedite installation of the assembly with minimum disruption of service.

   2. Disruptions to fire protection piping and fire hydrants shall be scheduled in advance and approved by the Using Agency to ensure adequate staffing is allocated for fire watch detail.

H. Contractor shall use caution when excavating near existing active utilities to ensure no damage is done. Contractor is responsible for repairs of any damaged facilities caused as a result of excavation incidental to construction of the water facilities.

3.12 WARNING TAPE AND TRACER WIRE

A. Warning tape shall be installed approximately 12-inches below grade above all direct buried water pipe.

B. Tracer wire shall be installed along the entire length of all water pipe, including individual service laterals, and taped to the pipe every 10 feet as shown on the Plans.

3.13 INCIDENTAL ITEMS

A. The Contractor shall furnish all incidental items required to complete the work that is not specifically referred to herein as provided by the Contracting Officer.

B. Incidental items, which shall be furnished by the Contractor, include but are not limited to potholing, pipe locator tape, tracer wire, flange gaskets, bolts, nuts, pipe coatings, corrosion protection, etc.

3.14 PRESSURE TESTING OF WATER MAINS

A. See Section 33 01 12 – Testing of Water Distribution.

END OF SECTION 33 14 16

SECTION 33 14 17 – TESTING OF WATER DISTRIBUTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work of this Section includes furnishing all labor, materials, and equipment for:

1. Pressure and leakage testing of piping.

2. Disinfection of Water Piping.

B. Related Sections

1. Section 33 14 16 – Water Distribution

C. All work included in testing of the pipeline shall be included in the price for pipe installation, and no separate payment will be made.

1.3 SUBMITTALS

A. Submit a written testing plan covering all Project elements that are to be tested. The plan shall cover:

1. Proposed method to fill piping.

2. Disposal of water and permits for discharge of water used in pressure testing (if necessary).

3. Pressure and leakage test procedures including line segments, fill locations, air release locations, and locations for pressure measurements.

4. Submit procedures, proposed chemicals, and treatment levels for review. Indicate results comparative to specified requirements. A disinfection plan, meeting the disinfection requirements listed in this specification, and discharge of the disinfectant concentrated water must be submitted for review. The Contracting Officer will receive and approve 2 calendar days before disinfection commences.

1.4 PERMITS

A. Contractor is responsible to obtain, pay for, and conform to the requirements of any permits necessary for testing operations.

1.5 SITE CONDITIONS

A. Valve operation shall be coordinated with the Contracting Officer. The Contractor shall not operate any valves.

B. Water for testing will be available at no charge to the Contractor. Contractor to coordinate with Contracting Officer and Using Agency to determine acceptable location for use of water and must abide by Contracting Officer's requirements for connection.

C. Provide at least 48 hours' notice to the Contracting Officer prior to beginning pressure testing procedures.

D. All components, fittings, appurtenances, and materials necessary to complete testing shall be supplied by the Contractor.

E. Temporary connections intended for abandonment following testing activities are not permitted. Contractor shall carefully plan construction testing work to occur without resulting in abandoned connection points.

1.6 DISINFECTION REQUIREMENTS

A. Disinfection Report:

1. Name of the person administrating the disinfectant
2. Type and form of disinfectant used.
3. Date and time of disinfectant injection start and time of completion.
4. Sample locations.
5. Name of person collecting samples.
6. Initial and 24-hour disinfectant concentration and residuals in treated water in ppm for each outlet sampled.
7. Date and time of flushing start and completion.
8. Disinfectant residual after flushing in ppm for each outlet sampled.
9. Information of the State Approved Laboratory certified to conduct the test of the samples.
10. Copies of the analytical reports from the laboratory.

B. Bacteriological Report:

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples. Sampling Firm to be certified by the State of Montana in testing potable water systems. Submit bacteriologist's signature and authority associated with testing of samples.
4. Sample locations.
5. Initial and 24-hour disinfectant concentration and residuals in ppm for each

outlet sampled.

6. Coliform bacteria test results for each outlet sampled.

7. Certify water conforms, or fails to conform, to bacterial standards for potable water.

1.7 PRESSURE TESTING REQUIREMENTS

A. All water mains shall be hydrostatically tested. Water for testing must be obtained by the Contractor by arrangement with the Contracting Officer. Testing shall be in accordance with AWWA 906.

B. A positive displacement type pump shall be furnished by the Contractor for the testing. Feed for the pump shall be from a clean container, wherein the actual amount of "makeup" water can be measured.

1. The Contractor shall furnish calibrated gauges for measurement of test pressures.

2. Pumps and metering equipment for leakage testing shall be furnished by the Contractor.

C. The Contractor shall pressure test portions of a line as it is installed before the entire line is completed.

1. No more than 1,000 linear feet of water main shall be subjected to a pressure test of 150 pounds per square inch, or twice the system pressure, using the greater value for a period of not less than 2 hours.

2. All parts of the underground pipeline must be backfilled and braced sufficiently to prevent movement under pressure.

3. Thrust blocks and fittings shall also be subjected to the test pressure.

4. Contractor shall allow a minimum of 24 hours for thrust block concrete to set before pressure testing of water mains.

D. Allowable leakage shall be measured in gallon per hour as defined in AWWA C906 HDPE pipe.

PART 2 – PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, and AWWAB303, Sodium Chlorite.

PART 3 – EXECUTION

3.1 HYDROSTATIC PRESSURE TESTING – HDPE PIPE

A. All pressure pipe testing shall be accomplished with water pressure (hydrostatic testing) and in accordance AWWA Manual M55 and ASTM F2164 as appropriate. Air-pressure testing will not be permitted for acceptance testing.

B. CONTRACTOR shall perform quality control pressure testing of installed pipe at intervals not to exceed 1,000 feet of installed pipe, or from valve to valve, whichever is more often, or as otherwise approved by the CONTRACTING OFFICIER. Temporary plugs, thrust restraint, air release and means of filling with water, shall be provided by the CONTRACTOR as required.

C. Quality control testing shall be preliminary and will not be considered for Substantial Completion or final acceptance. Sections passing the quality control test shall be retested, along with the balance of the pipeline, prior to issuance of Substantial Completion. Payment for this quality control (preliminary) testing and final testing per this section of the Contract Documents shall be subsidiary to the pipe bid items.

D. Air Test Procedure (Quality Control Testing Only): As an alternative to pressure testing with water, the CONTRACTOR may perform air tests of installed pipe for quality control purposes. Air tests shall be in accordance with Uni-Bell B-6-98 or ASTM F1417-92.

E. Hydrostatic and Leakage Testing: Test pressure for all pipelines shall be 150 psi.

1. General: After the pipe has been laid with all joint restraint and/or solid thrust blocking in place and partially or fully backfilled, all newly laid pipe or any valved section thereof shall be subjected to a combination hydrostatic pressure and leakage test. CONTRACTOR shall notify the CONTRACTING OFFICIER at least twenty-four hours prior to testing. CONTRACTING OFFICIER will be present at all tests. The CONTRACTOR shall provide test equipment including test pumps, gauges, instruments, taps, piping, valves and other equipment required. Pressure gauges used shall be graduated in increments not greater than 5 psi and shall have a range of 50% more than the test pressure. Use only recently calibrated gauges and instruments. Prior to testing, remove from systems all equipment which would be damaged by test pressure. Replace removed equipment after testing. Any section of pipe provided with thrust blocks shall not be tested until 7 days after the concrete has been placed. Pressure tests shall be conducted against all new valves.

2. Where thrust restraint is required, but not part of this project, temporary thrust restraint is to be provided by the CONTRACTOR.

3. Water Test (Acceptance Test) Procedure: The pipe shall be slowly filled with water, bleeding off any trapped air. Subject the lowest element to 1.5 times the normal design operating pressure, corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the CONTRACTING OFFICIER. The pump, pipe connection, and all necessary apparatus shall be furnished by the CONTRACTOR. Before applying the specified test pressure, all air shall be expelled from the pipe. The CONTRACTOR shall make any necessary taps at points of highest elevation before the test is made and insert the plugs after the test has been completed.

4. For the first 3 hours of the test the pipe shall be maintained at a pressure of 1.5 time the design operating pressure. “Make-up” water shall be added to the line to stabilize the pressure.

5. Immediately following the 3 hour initial expansion the pressure shall be reduced by 10 psi and stop adding “make-up” water. If the pressure remains steady, within 5% of the design pressure, for one (1) hour, no leakage is indicated.

   a. Use 150 psi and 140 psi respectively for the test pressures on this project. Pressures shall be as recorded near the discharge of the force main.

   b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallon per hour per inch of nominal valve size is allowed. Repair all visible leaks regardless of the amount of leakage.

F. Test Results:

1. The cause of any leak shall be determined and leak(s) shall be acceptably repaired. Any cracked or defective pipes or fittings discovered in consequence of the pressure test shall be replaced with sound material. Should any test of pipe laid disclose leakage greater than that specified above, the CONTRACTOR shall locate and repair the defective joints, until the leakage is within the specified allowance.

2. The CONTRACTOR may, with CONTRACTING OFFICIER's approval, fully backfill the pipe trench prior to hydrostatic test if the trench is interfering with traffic flow, job site access or normal operations. However, it shall be understood to be the CONTRACTOR's risk if the pipe will not reach the test results specified herein. If this occurs he must find the leaks and do the required excavation and pipe repair even though a fully backfilled trench will make this more involved and difficult.

3. Any section of pipe which fails the leakage test shall be repaired at the CONTRACTOR's expense. This section shall be retested after repairs are made.

3.2 DISINFECTION OF WATER PIPING

A. EXAMINATION

1. Verification of existing conditions before starting work.

2. Verify piping system has been cleaned, inspected, and pressure tested.

3. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting, and balancing, demonstration procedures, including coordination with related systems.

B. INSTALLATION

1. Provide and attach required equipment to perform the Work of this section.

2. Perform disinfection of water distribution system and installation of system and pressure testing. Samples will be taken during the disinfection test as indicated by the Sampling Plan and as referenced in AWWA C651.

3. Inject treatment disinfectant into piping system.

4. Maintain disinfectant in system for 24 hours. Maximum free residual concentration shall be 20mg/L.

5. Flush, circulate, and clean until required cleanliness is achieved; water source to be coordinated with Contracting Officer.

6. Replace permanent system devices removed for disinfection.

C. FIELD QUALITY CONTROL

1. Disinfection, Flushing, and Sampling:

2. Disinfect pipeline installation in accordance with AWWA C651.

3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.

4. Legally dispose of chlorinated water. Dam and contain any accidental discharge of heavily chlorinated liquids. Prior to discharge of chlorinated water to surface water, wetlands or sewers, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.

5. If testing indicates water is not suitable, Contractor shall re-disinfect the system and retest until suitable results are obtained at the Contractor expense.

END OF SECTION 33 01 12

SECTION 33 16 61 – BURIED STORAGE TANK

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. Furnishing and installing a factory-fabricated fiberglass reinforced plastic (FRP) buried water storage tank.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork: Soil for backfill in trenches
   2. Section 31 05 16 – Aggregates for Earthwork.
   3. Section 31 23 17 – Trenching.
   4. Section 31 23 23 – Fill.
   5. Section 33 11 13 –Public Water Utility Distribution Piping.
   6. Section 33 14 16 – Water Distribution

1.3 REFERENCES

A. ASTM D4097 – Standard Specification for Contact-Molded FRP Tanks

B. ASTM D3299 – Standard Specification for Filament-Wound FRP Tanks

C. AWWA M42 – Fiberglass Pipe Design Manual

D. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.4 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Requirements for submittals.

B. Product Data: Manufacturer's technical specifications including structural calculations and certified load ratings.

C. Shop Drawing: Tank dimensions, nozzle sizes and locations, access points, installation procedures.

D. Product Data: Submit data on all equipment and materials within this section.

E. Manufacturer Certification: Showing compliance with NSF/ANSI 61

F. Warranty Documentation.

1.5 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 10 years' experience producing FRP tanks for potable and non-potable water systems.

B. Tank shall be factory-tested for hydrostatic performance prior to delivery.

C. Installers shall be certified by the tank manufacturer

1.6 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Closeout Procedures: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations and inverts of buried pipe, tank, components and connections.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 67 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Protect tank from impact damage and ultraviolet degradation.

C. Store out of direct sunlight and on flat surface prior to installation.

1.8 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Requirements for coordination.

1.9 WARRANTY

A. Manufacturer's warranty for 5 years covering structural integrity and watertightness

PART 2 PRODUCTS

2.1 FIBERGLASS WATER STORAGE TANK

A. Water storage tank shall be a single 14000 gallon minimum direct bury fiberglass reinforced plastic (FRP) tanks, manufactured by Xerxes, DARCO, or equal:

B. Tank shall be manufactured with structural ribs which are fabricated as in integral part of the tank wall.

C. Tank shall be vented to atmospheric pressure.

D. Tank shall meet the following design criteria:
   1. Internal Loads – Tank shall be designed to withstand 5 psi air pressure test with a 5:1 safety factor.

2. Surface Loads – Tank shall be designed to withstand surface H-20 axle loads.
3. External Hydrostatic Pressure – Tank shall be designed for 7 feet of overburden over the top of the tank.

E. Tank shall be constructed of material safe for drinking water, NSF/ANSI Standard 61: Drinking Water System Components.

F. Tank shall be supplied with one manway opening, manway extensions shall be FRP and supplied by tank manufacturer.

G. Tank shall each be supplied with the following accessories:
1. 4-Flanged flexible expansion joints – HD rubber for potable water.
2. 1 -6" flanged outlet and 1-2" flanged inlet.
3. 2-4" flanged outlet
4. NSF ladder
5. Manway and risers
6. Lockable hinged cover
7. 4" flanged vent with vent pipe as noted on the drawings

2.2 TANK BEDDING MATERIAL

A. Tanks bedding shall be washed pea gravel with all material ranging from 1/8" to ½" diameter, crushed rock or chips ranging from ¼" to ½" screen size. No more than 5% of the material will pass through a #8 sieve. Absolutely no particle or stones over ½" will be accepted.

2.3 WATER TANK YARD PIPING

A. All yard piping shall meet the requirements of Section 33 14 16 Water Distribution

2.4 TANK DRAIN/OVERFLOW OUTLET

A. All equipment shall meet the requirements of Section 33 14 16 Water Distribution.

B. Outfall rock shall be washed cobble 6"-12" in diameter:

2.5 TANK LEVEL CONTROL

A. Submersible Pressure Transducers:
1. Manufacturer/Model: VersaLine VL2000 Series, or approved equal.
2. Output Signal: 4 to 20mA DC, 2-wire.
3. Range: 0-20 psi
4. Supply Voltage: 10 to 35 VDC
5. Accuracy: 0.25% of full range.
6. Electrical Protection: Surge and lightening.
7. Wetted Materials: 316 SS, or equal.
8. Cable Sealing: Polyurethane, or equal.
9. Installation Accessories: Per Drawings
10. Hardware: Stainless steel unistrut, clamps, screens, bands and anchor bolts

PART 3 EXECUTION

3.1 TANK INSTALLATION

A. All excavation and embankment shall be constructed in accordance with Division 31 of the specifications. Excess material excavated from the tank site shall be utilized as fill over the main tank site. Any material not utilized on the project shall be removed from the project at Contractor's expense.

B. Tanks shall be installed according to the tank manufacturer's installation manual and operations guidelines.

C. Contractor shall be responsible for inspecting the tank at delivery and maintaining the integrity of the tank during installation.

D. Tanks shall be backfilled as indicated on the drawings and per the manufacturers recommendation. A minimum of 24" of pipe bedding must be maintained around the entire tank structure, with a minimum 12" gravel bed meeting the gradation of the aggregate base course or tank bedding. Gravel must be shoveled into place and probed to 95% density.

E. Install geotextile fabric between gravel and soil cover as indicated on the drawings.

3.2 TANK WATERTIGHNESS TESTING

A. Following installation of the tanks, each tank shall be tested for water tightness. Tanks shall be filled for a minimum of 24 hours. During that period, water level depth may only drop a maximum level of ¼".

3.3 TANK DISINFECTION

A. Approved methods of tank disinfection are provided within AWWA Standard C652-11.

3.4 CONNECTING PIPING

A. Connect piping in accordance with the drawings.

3.5 FIELD QUALITY CONTROL

A. Compaction Testing: In accordance with ASTM D698. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.6 PROTECTION OF FINISHED WORK

A. Section 01 73 40 - Execution: Protecting finished construction.

END OF SECTION 33 05 17

SECTION 33 41 00 - STORM DRAIN PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

PART 2 - PRODUCTS

2.1 CULVERT PIPE

A. Corrugated Polyethylene Pipe meeting all requirements of AASHTO M294 and having a smooth interior and annular exterior corrugations. Pipe joints shall be reinforced bell and spigot with a rubber gasket meeting the requirements of ASTM F477. Pipe joints shall have documented history of watertightness according to ASTM 3212. Pipe and fittings shall be capable of sustaining H20S traffic leadings with a minimum of 12” of cover utilizing the pipe backfill envelope shown on the drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
5. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
6. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
7. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
8. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
9. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
10. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
11. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
12. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
13. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
14. Join fiberglass sewer piping according to ASTM D 3839 for elastomeric-seal joints.
15. Join nonreinforced-concrete sewer piping according to ASTM C 14 (ASTM C 14M) and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
16. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
17. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 FIELD QUALITY CONTROL

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

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.5 CLEANING

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

END OF SECTION 33 41 00

DIVISION 40

PROCESS INTEGRATION

SECTION 406343 - PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Programmable controllers and accessories.

B. All equipment described herein shall be submitted and furnished as an integral part of control system equipment specified herein and elsewhere within other specification sections. The PLC system configuration as described in the Contract Documents was developed to list the major elements. Some variations in the configuration will be considered provided the physical and functional constraints as intended for the various system components are met. Complete PLC system design, I/O configuration, module/rack arrangement, construction and additional coordination shall be provided by the Contractor as appropriate.

C. Provide equipment, materials, software, calibrations, training, and services required to successfully interface and interconnect the system and associated equipment that is specified or designated in drawings or provisions of these specifications for providing a fully integrated and functional control system as specified.

D. Furnish and install cabling and cable accessories, including tools necessary for connecting the system and peripherals, Programmable Logic Controller (PLC), data network, and input/output devices.

E. Furnish startup, training, and system commissioning services.

F. Furnish and install all items necessary for the proper functioning of the equipment even if omitted at no additional cost to the Owner.

G. The Drawings and related Specification sections supplement this Section and provide additional details functional requirements of the system, and interaction with other equipment.

H. Coordinate and schedule all testing procedures with the General Contractor.

I. All software packages provided shall be licensed under the Owner's name and address. The Contractor shall coordinate with the Owner for correct name and address.

1.2 SUBMITTALS

A. Include a copy of this specification section; pertinent Contract Drawings; other relevant specification sections as noted above; and all addendum updates with each specification paragraph and Contract Drawing clearly check-marked to indicate compliance with specification and drawing requirements or marked to indicate requested deviations/substitutions from the specification requirements.

B. Submit catalog data for all items specified as applicable. Submittal shall include catalog data, functions, ratings, inputs, outputs, displays, etc., sufficient to confirm that the equipment provides all specified requirements. Any options or exceptions shall be clearly indicated.

C. Submit a bill of materials for each PLC clearly identifying all components and quantities.

D. Submit catalog data sheets for all software licenses provided under this specification section.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information, and terminal block layouts in controller cabinets.

B. Operation and Maintenance Data: Submit bound copies of operating and programming instructions, and include card replacement, adjustments, and preventive maintenance procedures and materials.

1.4 QUALIFICATIONS

A. The manufacturer of this equipment shall have produced similar equipment for a minimum period of five years. When requested by the Owner and/or Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.5 COMMUNICATIONS PROTOCOL

A. The PLC System shall communicate utilizing Ethernet/IP Protocol.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Configuration: Standalone programmable controller with Operator Interface Terminal (OIT).

B. Provided with UPS.

C. Sequence of Operation: As described in Section 250000.

2.2 PROGRAMMABLE CONTROLLER

A. Manufacturers:
   1. Rockwell Automation CompactLogix Series
   2. No Substitutions

B. Provide all required modules and accessories for a complete, functional PLC system in the base bid.

C. Programming Languages:
   1. Each PLC shall support IEC Standard 61131-3 including the following programming languages:
      a. Ladder (LD)
      b. Function Block Diagram (FBD)
      c. Sequential Functional Chart (SFC)
      d. Structured Text (ST)
      e. Instruction List (IL)
   2. Provide one (1) copy of the manufacturer's programming software for this class of PLC, with the highest-level capability, fully licensed in the Owner's name.
   3. PLC shall support user defined functions for customization and user defined tag structures.
   4. PLC shall have application-specific instructions for process, drive, batch, motion and safety applications built into the controller.

D. Central Processing Unit:
   1. Each processor shall be Allen Bradley CompactLogix 5609-L306ER.
   2. PLC processor must have sufficient memory for application programming.
   3. Provide PLC system hardware employing identical revisions of software and firmware throughout.
   4. Provide the ability to monitor and override I/O.
   5. Provide the ability to preselect the failure mode of each output point in the event of CPU failure.

E. Physical Construction (Rack):
   1. The PLC shall be of modular construction, consisting of plug in modules for the processor, communications modules, I/O modules and expansion modules.
   2. I/O modules shall support wiring interface devices that allow the removal and reinstallation of I/O modules without removing wires from terminals.

F. Power Supply (PS): 24 VDC

G. Communications Modules:
   1. The PLC CPU module shall contain a Ethernet/IP port with embedded switch for network connection and configuration.

H. I/O Modules
   1. Backplane Expansion Analog Inputs
      a. Manufacturer: Allen Bradley 5069-IF8, or equal
      b. Channels: 8
      c. Current Range: 0-20mA
      d. Input Impedance (current mode): <100 ohms
      e. Resolution: 16 bit
      f. Accuracy: +/- 0.1% of full scale
      g. Configuration: software
   2. Backplane Expansion Analog Outputs
      a. Manufacturer: Allen Bradley 5069-OF8, or equal
      b. Channels: 4

c. Current Range: 0-20mA
d. Resistive Load (current mode): 500 ohms
e. Resolution: 12 bit
f. Absolute Accuracy @ 25 Deg C: +/- 0.425% of full scale
g. Configuration: software

3. Backplane Expansion Discrete Inputs
   a. Manufacturer: Allen Bradley 5069-IB16
   b. Inputs: 16 sink/source
   c. Status Indicators: 16 LED
   d. Operating Voltage: 10-30VDC
   e. Max Current Draw: 170mA @ 5VDC
   f. Max Impedance: 3.9 kohm
4. Backplane Expansion Relay Outputs
   a. Manufacturer: Allen Bradley 5069-OB16
   b. Outputs: 8 relays
   c. Status Indicators: 8 LED
   d. Bus Current Draw, Max: 5VDC, 120mA, or 24VDC, 50 mA
   e. Max Load Current: 2A
   f. Relay Contact: 2A continuous, @ 120VAC, or 1A continuous @ 24VDC

I. Active Spare Requirement:
   1. Provide a minimum of 20 percent wired spare I/O channels of each type furnished. All I/O points provided shall be wired to DIN rail mounted terminals labeled consistently with other existing I/O.

2.3 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid state, uninterruptible power system. The uninterruptible power system, hereafter referred to as the UPS, shall provide regulated DC power for electronic equipment loads.

B. The UPS shall utilize a microprocessor-based control and monitoring system. Battery charging shall occur automatically when AC power is applied without need to reset or switch ON the UPS. The UPS shall include an automatic self-test feature to test the UPS function and battery condition. When the battery is not suitable for proper system operation, the UPS will sound an audible alarm and provide visual indication of alarm.

C. The UPS shall provide front-panel visual indication of operational mode status of the UPS. At minimum, the following conditions shall be indicated:
   1. UPS is operating on line power and functioning normally
   2. UPS overload or faulted condition
   3. UPS is operating on battery power
   4. Battery low or failed

D. <u>Manufacturers</u>:
   1. UPS shall be Phoenix Contact or approved equal.

2.4 Operator Interface Terminal (OIT)

A. Manufacturers:
   1. Rockwell Automation PanelView 2711P-RDT12C
   2. Or equal PanelView model by Rockwell Automation

2.5 ENCLOSURE

A. NEMA ICS 6; Type 12.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test programmable controller according to NEMA IA 2.2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all equipment and components in accordance with the Contract Documents, approved Shop Drawings, and manufacturer's installation instructions.

B. Inspect each instrument, panel and other items for damage and defects before installation. Replace deficient items.

C. PLC components, modules, etc., shall be installed such that all LED indicators and switches are readily visible with the panel door open and such that repair and/or replacement of any component can be accomplished without disconnecting any wiring or removing any other components.

3.2 FIELD QUALITY CONTROL

A. Perform operational testing on control systems to verify proper operation and field wiring connections.

3.3 DEMONSTRATION AND TRAINING

A. Furnish 6 hours of instruction each for Park utility operators, to be conducted at Project Site with manufacturer's representative.

B. Instruction to cover overall system description, operation, adjustment, and troubleshooting.

3.4 MAINTENANCE

A. Furnish service and maintenance of programmable controllers for one year from date of Substantial Completion.

END OF SECTION 406343

SECTION 406700 – CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Supplier shall design and fabricate control panels and enclosures based on this and related specifications and the Contract Drawings. The Contract Drawings provide some typical design details, but do not include the complete panel designs. The Supplier shall maintain updated as-built drawings and furnish to the Engineer upon panel acceptance.

B. The Supplier shall furnish all necessary control panels and other enclosures complete, assembled, tested and ready for use including all necessary components, wiring, interconnecting cables, all accessories, and all appurtenances as indicated herein, on the Contract Drawings, or as required for proper operation of the system.

C. Control panels and enclosures shall be provided as specified herein and as indicated on the Contract Drawings. The panels shall be fabricated in a UL certified facility and all finished control panels shall bear a UL 508 Label.

D. Where indicated, control panels and enclosures shall be provided with all required taps, fittings, conduit entries, control wiring and alarm interlocks. Dimensions shall be in accordance with manufacturer's requirements. Elevations and horizontal spacing shall be subject to the Engineer’s approval.

E. Panels shall be fabricated, assembled, piped, and wired by fully qualified workers who are properly trained, experienced and supervised.

F. Panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be of one manufacturer.

G. List of panels to provide:

1. PLC Control Panel

H. System integrator must be experienced in panel fabrication for water systems with similar hardware and software components. Experience determined by successful completion of five or more relevant projects in the past five years.

1.2 RELATED WORK

A. Division 01—General Requirements

B. Section 255100—Integrated Automation Control of Facility Equipment

C. Section 406343—Programmable Logic Controllers

D. Division 26—Electrical

1.3 REFERENCE CODES AND STANDARDS

A. IS—All applicable standards

B. IEEE—All applicable standards

C. NEMA—All applicable standards

D. UL—All applicable sections

E. NFPA 70—National Electrical Code

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.4 SUBMITTALS

A. Submittals shall be provided as specified in Section 013323, Submittal Procedures.

B. Include a copy of this specification section; pertinent Contract Drawings; other relevant specification sections as noted above; and all addendum updates with each specification paragraph and Contract Drawing clearly check-marked to indicate compliance with specification and drawing requirements or marked to indicate requested deviations/substitutions from the specification requirements.

C. Shop Drawings:

1. Control panel fabrication drawings shall be submitted for approval prior to construction.
2. Contract Drawings supplied by the Engineer shall be redlined with any changes and returned upon acceptance of equipment.
3. Include drawings as follows:
   a. Panel Layout Drawings:
      1) Include a complete Bill of Materials for each individual control panel furnished.
      2) Include manufacturer literature for each item in the Bill of Materials with markings clearly indicating any versions, options, etc. Indicate compliance with specification requirements. Manufacturer literature for common components need only be included once, for the first panel in the submittal with references to this literature included as applicable thereafter in submittal.
      3) Drawings shall be furnished for all panels, consoles, and equipment enclosures specified. Panel assembly and elevation drawings shall detail all equipment in or on the panel. The assembly drawing shall include a bill of material on the drawing with each panel component clearly

defined. The bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.

b. Panel drawings shall be 11 "x 17" minimum in size. As a minimum, the panel drawings shall include the following:
   1) Interior and exterior panel elevation drawings to scale
   2) Nameplate schedule
   3) Conduit access locations
   4) Panel construction details

c. Submit construction details, NEMA ratings, intrinsically safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.

4. Heating and cooling calculations for each panel supplied indicating conformance of the supplied equipment with heating/cooling requirements for the environmental conditions of the installed area. Calculations shall include the recommended equipment required for both heating and cooling.

5. Panel Wiring Diagrams:
   a. Panel wiring diagrams shall include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering.
   b. Panel wiring diagrams shall be 11 "x 17" minimum in size.

D. Test Reports: Field test procedures

1.5 ENVIRONMENTAL

A. The control panel shall be rated for continuous operation under ambient environmental conditions of 32°F to 100°F dry bulb and 5 to 95 percent relative humidity, noncondensing. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

B. The control panel shall be environmentally controlled with the use of exhaust fans, heaters and AC units as required to maintain the environmental conditions specified. The heating/cooling equipment shall be sized to maintain the temperature below a maximum of 122 degrees F and above a minimum of 38 degrees F within the control panel. Heating and cooling load calculations shall be provided for review and approval. Calculations shall utilize a maximum ambient temperature of 90 degrees F for indoor application and 120 degrees F for outdoor applications. Calculations shall include watt losses for all components and solar heat gain for the area of installation. The Supplier shall determine if environmental controls are required and design the system accordingly.

C. Intake louvers shall be mounted on the lower side, rear or front section of an unobstructed panel face. Louvers shall be provided with removable and washable filter grills mounted on the interior side of the louver. Forced-ventilation exhaust fans, where used, shall be provided at an opposing

elevated location from the intake louvers. Unless otherwise indicated, fan motors shall operate on 120-volt, 60-Hz power. For control panels located in control rooms, the total audible sound level of the fans shall be less than 45 dB(A)

1.6 PANEL ASSEMBLY

A. Panel mounted equipment shall be installed with due regard to commissioning adjustments, servicing requirements and cover removal. Components, terminal blocks and equipment items shall be mounted at least 6” above the base of the control panel and a minimum of 4” below the top of the enclosure.

B. Control panel components shall be arranged on sub-panels and within the panel to optimize weight distribution, heat dissipation and component spacing for wiring and maintenance. Components and terminal strips shall be vertically and horizontally segregated with wire ducts utilizing a 2.0” minimum spacing between the wire ducts and component terminal connections.

C. All fixed position components shall be mounted utilizing stainless steel screws, brackets and fasteners such that no exterior panel protrusions occur. Screws shall be threaded into panels. Rivets or back-of-panel nuts shall not be allowed. Back panel components shall be individually identified with a unique identifier per IEEE and ISA recommended practices.

D. Component DIN rails, where applicable, shall be provided for mounting of panel components such as terminal blocks, fuse blocks, relays, timers, and signal conditioners. DIN rail shall be zinc plated, yellow chromate steel. Twenty five percent additional rail space shall be provided to allow for system expansion. Din rails shall be mounted on manufactured standoffs raised a minimum of 1.5” from the surface of the back panel.

E. Nameplates for panel-mounted devices shall be laminated plastic, black on white, with engraving through the black surface to form 3/16” high white letters. Relays and other devices mounted inside the control panels shall be identified with permanent nonferrous tags. All tags shall match device numbers shown on Contract Drawings or panel shop drawings.

F. Front panel components shall be arranged by function and group with a 2” minimum spacing for panel-mounted devices. Operator switches and pilot lights shall utilize a 2.5” on center minimum spacing for wire connections. Where future provisions are indicated on the Drawings, switch and pilot light positions shall be pre-punched and plugged with removeable knockout covers for easy modification and expansion. All front panel mounted components shall be provided with a neoprene gasket seals to maintain the overall NEMA rating of the enclosure.

G. To ensure proper grounding within the control panel a copper ground bus bar shall be provided. All grounding terminal blocks, equipment chassis and source grounds shall be connected to the ground bus bar to provide a common ground reference within the control panel. A separate ground bar shall be supplied for analog cable shield connections.

H. All panels shall be protected from internal corrosion by employing the use of corrosion-inhibiting vapor capsules and shall be manufactured by Northern Instruments Model Zerust VC, Hoffman Engineering Model A-HCI, or equal.

I. Minimum wire bending space at terminals and minimum width of wiring gutters shall comply with latest revision of the NEC.

J. Future device and component mounting space shall be provided on the door, back panel, and subpanel where detailed on the Contract Drawings. Where no detail is shown, provide a minimum of 15 percent usable future space.

K. Equipment provided with status and diagnostic displays, LED's, programming pads, buttons, dials or UPS units shall be mounted with the display and keypad facing the panel front. Shelving, brackets and associated mounting hardware shall be provided to mount the equipment in readily accessible and viewable location within the panel.

L. Provide protected dedicated branch circuits for PLC control components. Control circuits shall be segregated from branch circuits for accessory components such as lights, heaters, fans and receptacles. PLC circuits shall be fed by uninterrupted power supply.

1.7 PANEL WIRING

A. Control panel shall be wired per the latest revision of NEC, NEMA, IEEE and UL-508 standard wiring guidelines for electrical systems.

B. Wire Marking:

1. Each signal, control, alarm, and accessory circuit conductor shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every termination point using machine printed wire markers which shall be permanently marked heat shrink plastic. Markings shall be black letters on white background.

C. Control Panel Wire:

1. Panel wire size shall conform to the latest requirements of NEC and UL standards or the Specification, whichever is the most stringent. Unless otherwise specified, typical panel wire size shall be:
   a. PLC Input/Output wiring: 16 AWG minimum
   b. AC and DC Control wiring: 16 AWG minimum
   c. Panel and equipment power: 14 AWG minimum
   d. DC analog signals: 18 AWG twisted-shielded pair (TSP)
2. Control panel wiring shall be THHN or MTW.
3. Instrumentation signal cables shall be of the type used for process control with shielded pairs or triads with PVC jacket and overall shield over the multiple pairs or triads. The instrumentation cable shall be rated 300 volts at 90°C or better. The size of the

instrumentation cable shall be AWG No. 18 minimum, unless otherwise specified. All instrumentation cables shall meet all the requirements of IPCEA S-61-402 and shall be UL listed.

D. Wire Color Code:

1. Wires shall be color coded in accordance with the following table:

a.	BLACK	120 VAC power circuits
b.	WHITE	120 VAC neutral
c.	RED	AC control circuits
d.	BLUE	DC Control
e.	BLUE/WHITE	DC Power
f.	WHITE/BLUE	DC Common
g.	YELLOW	Interlock control circuits, Foreign Voltage
h.	GREEN	Equipment ground
i.	TSP – Black/Red	4-20mA Loop Positive
j.	TSP – White	4-20mA Loop Negative

E. Wire Routing and Termination:

1. All internal wiring shall be routed through plastic wire duct and spiral wrapped when transitions to front panels or additional sections are required. Wire routing shall be separated and grouped by function, voltage and signal type to minimize noise and maximize maintainability.
2. A 60 percent wire duct fill, as allowable by the NEC, shall be maintained to allow for future expansion and panel modification. A minimum 1.5-inch clearance shall be maintained in front of each wire duct cover to allow for easy access to panel wiring.
3. Wiring between components on a swing-out panel to other components on a fixed panel shall be made up in tied bundles with a “service loop” of sufficient length to allow the panel to swing without friction on the wire bundles. These shall be tied with plastic spiral wrap and shall be secured to panels at both ends of the "service loop" so that conductors are not strained at terminals or hinge points.
4. Wiring run to control devices on door panels shall be made up in tied bundles with a “service loop” of sufficient length to allow the door to swing fully open and closed without friction on the wire bundles. These shall be tied with plastic spiral wrap and shall be secured to panels at both ends of the "service loop" so that conductors are not strained at terminals or hinge points. Wiring to rear terminals on panel-mount instruments shall be run in plastic wire ducts secured to horizontal brackets run above or below the instruments in about the same plane as the rear of the instruments.

F. Wire Termination:

1. All interfacing between the control panels and the field devices shall be accomplished at a field connection terminal strip. The terminal strip shall have a dedicated field wiring side. No internal panel wiring shall be connected to terminals on the "field side" of the

terminal strip. Likewise, no field wiring shall be connected to terminals on the "panel side" of the terminal strip.

2. Terminal strips or groups shall be arranged by signal type and voltage AC and DC signals shall not terminate on the same terminal strip or group.
3. No more than two conductors shall be terminated at a single termination point. A common terminal block shall be provided for every two common or neutral conductors contained within the panel.
4. In addition to the spare power termination capacity, each panel shall be provided with four spare fused AC power and DC power terminations of each voltage type to power future equipment items and field devices.

1.8 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar equipment for a minimum period of five years. When requested by the Owner and/or Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment and materials shall be products of reputable, experienced manufacturers. All equipment shall be of industrial grade, shall be of sturdy design and manufacture, and shall be capable of long, reliable, trouble-free service. Unless otherwise indicated, all components shall be of the most recent field-proven models marketed by their manufacturers at the time of submittal of the shop drawings. Unless specifically indicated, all materials and components used in panel fabrication shall be new, of current manufacture, and shall not have been in prior service.

2.2 PROGRAMMABLE LOGIC CONTROLLER

A. Provide as indicated on the Contract Drawings

B. Reference Section 406343, Programmable Logic Controllers.

2.3 OPERATOR INTERFACE PANEL

A. Provide as indicated on the Contract Drawings

B. Reference Section 406343, Programmable Logic Controllers, as applicable.

2.4 CIRCUIT BREAKERS

A. Equipment circuit protection shall be provided as indicated on the Contract Drawings. Circuit breakers shall be sized in accordance with NEC and UL

B. Miniature Circuit Breakers:

1. Internal control panel branch circuits 120VAC and below shall be protected by UL 489 or UL 1077 listed thermal/magnetic, current-limiting circuit breakers. Trip curve shall be Type C or Type D as required. Circuit breaker shall be a fully assembled unit rated for an operating environment of 140 deg. F without derating and have a mechanical life of at least 8,000 operations. Interrupting capacity shall be 10kA.
2. The circuit breaker shall have clearly marked ON, OFF, and tripped positions.
3. Circuit breaker shall be DIN-rail mounted and have IP2X finger-safe, screw-clamp terminals.

2.5 TERMINAL BLOCKS

A. General: Terminal blocks, fuse blocks and disconnects shall be specially designed for safety, installation ease, and ruggedness. Features shall include the following:

1. Nickel-plated terminals and stainless steel screws
2. High copper content copper-alloy
3. Four-sided wire funnel guides for easy wire insertion
4. Finger-safe housings to prevent accidental contact with live circuits

B. DIN rail mount shall allow terminal blocks to be placed on the same mounting rail as relays, timers, disconnects, signal conditioners and other DIN rail-mounted control devices

C. Terminal Blocks:

1. Terminal blocks shall be DIN rail mounted, compression clamp style, UL rated for 30 amps at 300 volts. Terminal blocks shall be high-density type molded plastic with barriers and box lug terminals. Terminal marking method shall be white marking strips fastened securely to the molded sections and shall be provided with clearly legible, printed wire numbers or circuit identifications.

D. Fuse blocks for circuits 250 Volts and below, shall be DIN rail mounted, compression clamp style, rated for 15 amps at 300 VAC. Fuse blocks shall be provided to accept 5 x 20 mm fuses. Fuse blocks shall be provided with a swing arm fuse holder for easy removal of fuses. The fuse block shall be provided with blown fuse indication.

E. Ground termination blocks shall be provided for all signal grounding and shield connections. Ground terminals shall be DIN rail mounted, compression clamp style, rated for 20 amps at 300 volts. Terminal blocks shall be high-density type molded plastic with barriers and box lug terminals. Ground terminals shall be color-coded green/yellow for grounding identification.

F. DC Signal and control circuits shall be supplied with pull-apart disconnect fuse plug component terminal blocks, rated for 20 amps at 300 volts. Disconnect terminals shall be DIN rail mounted, compression clamp style, rated for 20 amps at 300 volts. Fuse plug shall accept 5 x 20 mm fuses and shall be provided with blown fuse indication. Fuse blocks shall be high-density type molded plastic with barriers and box lug terminals.

G. Terminal and fuse block manufacturer shall be Phoenix Contact or approved equal.

2.6 CONTROL RELAYS

A. Control relays shall be plug-in type general purpose relays utilizing contacts rated at 10 amps at the specified control voltage. Relay base configurations shall be DIN rail mount and selected such that AC and DC control relays are not interchangeable, thereby preventing accidental damage to relay coils resulting from incompatible voltages. Each relay shall be provided with one spare Form C contact. Relays shall be provided with an operational status LED, providing positive status of relay energization. In installations where vibration exists, hold-down wires shall be installed. Relays shall be IDEC or approved equal.

B. Control timers shall be solid state adjustable timer relays supplied as time delay on energize, or time delay on de-energize, as indicated on the drawings. Timer control voltages shall be as indicated on the drawings and shall be provided with DPDT, 10A, 240VAC contacts. Timers shall be blade style, plug-in type with dust cover and DIN rail mount sockets. Timers shall have an adjustable time range and time setting with indication of the full time range and of the time setting. Time delays shall be provided with LED status indicators for energization and timer function status. In installations where vibration exists, hold-down wires shall be installed. Solid-state timers shall be IDEC or approved equal.

C. Industrial Control Relays (ICR) shall be provided as indicated on the Contract Drawings and for loads that exceed the normal contact inrush and constant current capacity rating for plug-in type relays. Relays shall be provided with convertible cartridges for NO/NC configuration and shall be stackable to a maximum of eight (8) contacts with the addition of a top mounted expansion module. Contacts shall be 20 amp rated bifurcated spanner and nickel-silver plated. Industrial control relays shall be IDEC RJ/SJ, Square D, or approved equal.

D. PLC control relays shall be provided as indicated on the contract drawings. Interposing relays shall be 24 VDC and provide a SPDT output rated at 5 amps at 120 VAC. The relay shall be provided with a DIN rail mounted terminal base utilizing compression clamp style terminals with wire terminal labeling provisions. In installations where vibration exists, hold-down wires shall be installed. Interposing relay shall be Phoenix PLC-RSC, or equal.

2.7 SIGNAL ISOLATORS AND CONVERTERS

A. Provide signal isolators or converters where indicated on the Drawings or where necessary for proper, accurate system operation.

B. Signal isolators shall be provided in each measurement and/or control loop where multiple equipment grounding points exist with a potential to form a ground loop. An isolator may also be required to maintain loop integrity when the removal of a component of a loop is required. The isolator shall accept a 4-20mA process input signal and produce an isolated, proportional 4-20mA current output signal. The isolator shall provide a minimum of 1500V input-to-output isolation and have full three-way isolation when external power is used. The isolator must be resistant to

RFI and EMI interference per IEC EN50081. The isolator shall have an accuracy of at least 0.1% of full span, including resolution and hysteresis, and have a response time of 200ms minimum.

C. Signal converters shall be provided in each measurement and/or control loop to interface between PLCs and/or controllers and field instruments and devices where field instrumentation or device signals are not directly compatible with PLC or controller inputs or outputs. The signal converter shall accept a process signal from a field device or controller and convert that signal to a proportional output signal usable by the controller or field device connected to the output. Signal converters shall have isolated outputs with a minimum of 1500V input-to-output isolation and have full three-way isolation when external power is used. Signal converter accuracy shall be at least 0.1% of full span with a response time of 800ms or less.

D. Signal isolators and signal conditioners shall be DIN rail mount. Provide signal power supplies where needed.

E. Modules shall be Phoenix Contact, Acromag, Action Instruments, Moore Industries, or approved equal.

2.8 OPERATOR CONTROLS AND INDICATORS

A. Operator controls and indicators, including switches, pushbuttons, and pilot lights, shall be 30 mm, NEMA 4/4X rated:

1. Pushbuttons, selector switches, and indicating lights shall be heavy-duty oil-tight, manufactured to the requirements of NEMA ICS.
2. Contacts, operator types, and lamp lens colors shall be provided as indicated on the contract drawings.
3. Labels and legend plates shall be provided as indicated on the Contract Drawings.
4. Provide push-to-test type LED lamps, 120 VAC or 24 VDC LED lamps with individual transformers or resistors.
5. Contact blocks shall be rated 10 amps at 120 VAC.
6. Emergency Stop pushbuttons shall be provided with a push-pull red mushroom head operator.
7. Pushbuttons, selector switches and indicating lights shall be Square D or approved equal.

B. Operator controls and indicators shall be supplied and installed with index tabbed thrust washers to prevent switch rotation.

2.9 EMI LINE FILTER AND SURGE SUPPRESSION

A. Power Surge Protection:

1. Surge protection shall be provided at the power input of the control panel.
2. The surge protectors shall be tested in accordance with the requirements of ANSI/IEEE C62.41 standards for Categories A, B, and C environments and shall be a UL 1449 type 2/3 component.

3. Surge protection components shall be as manufactured by Phoenix Contact or approved equal.

B. Signal Surge Protection (4-20 mA):

1. Surge protection devices shall be supplied for the protection of all externally derived signal circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.
2. Communication line surge protection shall be UL-497B Listed. The surge protection device shall be sized for voltage, current and frequency requirements listed on the contract plans and shall provide independent conductor-ground surge protection.
3. Signal surge suppressors shall be Acromag 611T, Leviton 3420-9, or equal.

2.10 POWER SUPPLIES

A. DC Power Supply:

1. Control panel shall utilize NEC Class 2 DC switching power supplies for primary control power. Power supplies shall be industrial-grade with integrated current-limiting, power factor correction and indefinite automatic short-circuit, overvoltage and overtemperature protection. Power supply shall provide consistent power to high-inrush devices without shutdown or foldback and include a lighted visual indicator for power ON. Power supply shall have line and load regulation of 0.5% or less. Power supply wiring connections shall be via finger safe screw terminals.
2. Power supplies shall be DIN rail mounted and sized to power equipment as shown on Contract Drawings at maximum load with an additional 50 percent power capacity.
3. Power supply voltages shall be as required to power control panel equipment at their stated voltage and as indicated on the Contract Drawings.
4. Control panels with a PLC or Remote IO rack shall have redundant power supplies. Furnish appropriate accessories for functionality of redundant power supply system.
5. Power supplies shall be Phoenix Contact or approved equal.

2.11 EQUIPMENT ENCLOSURES (CONTROL PANELS)

A. The control panel enclosure shall be wall mounted. All enclosures shall be UL Listed manufactured items.

B. Access door(s) shall have continuous hinges and an integral neoprene gasket that provides a seal to a flanged trough around the perimeter of the door opening. Free-standing enclosures shall have three-point door hardware with key-locking handle(s) and have integral lifting eyes. Wall-mounted enclosures shall have integral mounting tabs and a hasp/staple for fitting a standard 5/16” shackle padlock. The cabinet shall be constructed from formed 12-gauge steel minimum. All exposed edges and welds on the enclosure shall be ground smooth.

C. Panel ratings shall be based on NEMA standards for the location and environment in which the panel is installed. Panel materials shall be selected for corrosive environments based on standard chemical compatibility charts. Unless otherwise indicated on the Contract Drawings, control panels shall be rated as follows:

1. Indoor: NEMA 12

D. The interior shall be provided with a formed 12-gauge steel subpanel for attaching surface-mounted components. All components shall be attached to the subpanel with screws threaded into the subpanel. Rivets or back of panel nuts shall not be allowed. The subpanel shall be painted with two coats of white powder-coat paint.

E. Enclosure shall be a manufactured item supplied by Hoffman, Saginaw or approved equal.

2.12 LIGHTING

A. Each enclosure shall be provided with LED lights that shall be activated when the enclosure door is opened.

2.13 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS

A. Power supply: Provide one (1) spare power supply of each type used.

B. Fuses: Provide 20 percent of each size and type used rounded to the next whole number, but no less than five of each size and type.

C. Spare contact blocks 5 spare NO and NC for each type of switch contact block utilized.

D. Corrosion-Inhibiting Vapor Capsules: Two-year supply.

E. Two of each type of relay.

PART 3 - EXECUTION

3.1 GENERAL

A. The Supplier shall furnish and ship all boxes and control panels per the Contract Drawings and Specifications.

B. The Contractor shall provide installation materials, labor, wiring, cabling, and terminations required for the complete installation and operation of the control panels.

C. Craftspeople skilled in the appropriate trade shall perform assembly, wiring and fabrication in a workmanlike manner. Work shall be performed in accordance with the Specifications, Contract Drawings, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance.

D. Qualified, experienced personnel who are technically skilled in their trades, are thoroughly instructed, and are competently supervised shall do all work including installation, connection, calibration, testing and adjustment. The resulting complete installation shall reflect professional quality work, employing industrial standards and methods. Any, and all defective material or inferior workmanship shall be corrected immediately to the satisfaction of the Owner's representative at no additional cost to the Owner.

E. If required, existing control panel modifications and additions shall conform to the control panel assembly and wiring specifications of this section.

3.2 INSTALLATION

A. Control panels shall be installed in accordance with the Contract Drawings, manufacturer's requirements, and all related electrical equipment installation specifications and requirements.

B. Inspect each instrument, panel and other items for damage and defects before installation. Replace deficient items.

3.3 COMMISSIONING

A. Control panels shall be field tested and commissioned in accordance with Section 019100, Testing, Startup and Commissioning Requirements.

3.4 WARRANTY

A. In addition to the warranty requirements listed elsewhere in the specifications, all necessary packaged control system devices, components, parts, and vendor service support shall be provided for a minimum of two year after the date of project acceptance

END OF SECTION 406700