

TECHNICAL SPECIFICATIONS

**SECTION 00 01 07
SEALS PAGE**



[CIVIL/MECHANICAL]



**01/30/2026
[STRUCTURAL]**

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DIVISION 01
GENERAL REQUIREMENTS

**SECTION 01 11 00
SUMMARY OF WORK**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work to be performed under this Contract consists of furnishing all tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all Work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The Work shall be complete, and all Work, materials, and services not expressly indicated or called for in the Contract Documents, which may be necessary for the complete, safe, and proper construction of the Work in good faith shall be provided by Contractor as though originally so indicated, at no increase in cost to Owner.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Contract comprises the construction of a new culvert under the Jordan Valley access road at its intersection with Wood Hollow Creek. The project includes 125 feet of new 48" diameter reinforced concrete pipe, bracketed by headwalls and a cutoff wall on the downstream side to protect the Jordan Aqueduct, which runs perpendicular to the channel. Project work also includes potholing JA, SWA, and the affiliated fiber optic conduit, demolition and removal of existing structures, site restoration, and instrumentation. The Work is primarily located at the intersection of the access road and Wood Hollow Creek, which falls between the Mountain View Corridor and Welby Jacobs Canal on the west and east, and the Jordan Valley Water Treatment Plant and Porter Rockwell Blvd on the north and south, respectively.
- B. The Work of this Contract comprises of the reconstruction of the access road in the project area.
- C. The Work is located entirely in Herriman City, in Salt Lake County, as indicated on the Drawings.

1.3 CONTRACT METHOD

- A. The Work hereunder will be constructed under a single unit price contract.

1.4 STREAMLINED SPECIFICATIONS

- A. These specifications are written in streamlined or declarative style, often using incomplete sentences. This imperative language is directed to Contractor unless specifically noted otherwise.
- B. Omissions of such words and phrases as "Contractor shall," "in conformity therewith," "shall be," "as shown on the Drawings," "a," "an," "the," and "all" are intentional in streamlined sections.
1. Omitted words shall be supplied by inference in the same manner as when a note appears on the Drawings.

2. Omission of such words shall not relieve Contractor from providing the items and work described herein or indicated on the Drawings.
3. Words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.5 WORK BY OTHERS

- A. Owner reserves the right to perform or award other work concurrent with the Work included in this Contract
 1. Work may be conducted at or adjacent to the Site by other contractors during the performance of the Work under this Contract. Conduct operations to cause a minimum of interference with the Work of such other contractors and cooperate fully with such contractors to provide continued safe access to their respective portions of the Site, as required to perform Work under their respective contracts.
- B. Interference With Work On Utilities:
 1. Cooperate and coordinate fully with all utility forces of Owner or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the Work.
 2. Schedule the Work to minimize interference with said relocation, altering, or other rearranging of facilities.

1.6 WORK SEQUENCE

- A. Schedule and perform the Work in such a manner as to result in the least possible disruption to the public's use of roadways, driveways, and utilities. Utilities may include but not be limited to water, sewer, drainage structures, ditches and canals, gas, electric, cable television, and telephone.

1.7 CONTRACTOR USE OF PROJECT SITE

- A. Use of the Project Site shall be limited to construction operations, including on-Site storage of materials, on-Site fabrication facilities, and field offices.

1.8 OWNER USE OF THE PROJECT SITE

- A. Cooperate and coordinate with Owner to facilitate Owner's operations and projects and to minimize interference with Contractor's operations at the same time. In any event, Owner shall be allowed safe access to the Project Site during the period of construction.

1.9 CONTRACTOR'S WORKING HOURS

- A. Perform work within Owner's regular working hours from Monday thru Friday, 7 AM to 5 PM. If Contractor desires to work overtime or work on a Saturday, Sunday, or any legal holiday, obtain prior approval from Owner and Engineer.

1.10 STORAGE

- A. Storage conditions shall be acceptable to Owner for all materials and equipment not incorporated into the Work but included in Applications for Payment. Such storage arrangements and conditions shall be presented in writing for Owner's review and approval

and shall afford adequate and satisfactory security and protection. Off-site storage facilities shall be accessible to Engineer. The stored materials shall be insured for full value. Certificates of liability insurance coverage must be submitted to Engineer with the request for payment by Contractor. All arrangements and costs for storage facilities shall be paid by Contractor, unless specifically designated in the Contract Documents to be furnished by Owner.

1.11 NOTICES TO OWNERS OF ADJACENT PROPERTIES AND UTILITIES

- A. Utilities and other concerned agencies shall be contacted at least seven days prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.
- B. Review with the various utility companies the construction methods, safety procedures, and Work to be done in the vicinity of utilities. When temporary relocation of utilities is necessary, provide sufficient advance notice to the utility involved.

1.12 LINES AND GRADES

- A. Perform all Work to the lines, grades, and elevations shown on the Drawings.
- B. Basic horizontal and vertical control points will be established or designated as provided in General Conditions paragraphs. Use these points as datum for the Work. Perform any additional survey, layout, or measurement work needed for proper construction of the Work as a part of the Work at no additional cost to Owner.
- C. Employ experienced instrument personnel, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, furnish, without additional charge, competent personnel and such tools, stakes, and other materials as Engineer may require in establishing or designating control points or in checking survey, layout, and measurement of Work performed.
- D. Keep Engineer informed, a reasonable time in advance, of the times and places at which Work is to be done, so that horizontal and vertical control points may be established, and any checking deemed necessary by Engineer may be done with minimum delay to the Project.
- E. Remove and reconstruct Work, which is improperly located.

1.13 PROJECT MEETINGS

- A. Preconstruction Conference
 - 1. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by Contractor's Project Manager, its Superintendent, its Safety Representative, its Public Information Manager, and its Subcontractors as Contractor deems appropriate. Other attendees will be:
 - a. Engineer
 - b. Representatives of Owner
 - c. Governmental representatives as appropriate
 - d. Others as requested by Contractor, Owner, or Engineer
 - e. Engineer's Representative

2. Bring to the conference, any submittals so indicated in Section 01 33 20 - Contractor Submittals.
3. The purpose of the conference is to designate responsible personnel, discuss contract requirements and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished by Engineer prior to the meeting date. However, be prepared to discuss all the items listed below.
 - a. Contractor's assignments for safety and first aid, including Designated Competent person(s) and Contractor's safety Representative.
 - b. Status of Contractor's insurance and bonds.
 - c. Contractor's tentative schedules.
 - d. Transmittal, review, and distribution of Contractor's submittals.
 - e. Processing applications for payment.
 - f. Maintaining record documents.
 - g. Critical Work sequencing.
 - h. Field decisions and Change Orders.
 - i. Use of project site, office and storage areas, security, housekeeping, and Owner's needs.
 - j. Major equipment deliveries and priorities.
 - k. Permits required for construction.
 - l. Utilities required for construction.
 - m. Contract Owner and channels of communication.
 - n. Coordination with others.
4. Engineer will preside at the preconstruction conference and will arrange for keeping and distributing the minutes to all persons in attendance.

B. Progress Meetings

1. Engineer will schedule and hold regular on-Site progress meetings at least weekly and at other times as deemed necessary by Engineer or as required by progress of the Work. Contractor, Engineer, and all Subcontractors active on the Site must attend each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.
2. Engineer will preside at the meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings will be to review the progress of the Work, discuss safety, maintain coordination of efforts, discuss commercial issues, discuss changes in scheduling, and resolve other problems, which may develop. During each meeting, all parties are required to present any issues, which may impact its Work, with a view toward resolving these issues expeditiously.

1.14 AVAILABLE SUPPLEMENTAL DATA

Geotechnical Report: Geotechnical data referenced in these Contract Documents are based upon the report titled "Technical Memorandum – Jordan Valley Water Conservancy District Southwest Aqueduct – Reach 1 Pipeline", prepared by Gerhart Cole Inc., dated March 20, 2017. Report is available from Owner upon request.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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**SECTION 01 14 40
CONSTRUCTION AND SCHEDULE RESTRAINTS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Schedule, sequence, and perform the Work in a manner which minimizes disruption to the public and to the operation and maintenance of existing facilities.
- B. Allow for construction and schedule constraints in preparing the construction schedules required under Section 01 32 16 – Construction Progress Schedule. Include all the activities necessary to satisfy all constraints included and referenced in the Contract Documents.

1.2 PERMITS

- A. Abide by the conditions of all permits, easements, and private agreements made and obtain written acceptance of the constructed conditions from each issuer of the permit, easement, or private agreement prior to acceptance of Work by Owner, at no additional expense to Owner.

1.3 COORDINATION WITH OTHER CONSTRUCTION

- A. Be responsible for coordinating the Work depicted in the Contract Documents with Owner, Engineer, and all other contractors or suppliers working at, or near the Project Site in accordance with the General Conditions and Supplementary General Conditions.

1.4 SCHEDULE CONSTRAINTS

- A. Be responsible to coordinate and plan the construction activities to integrate each schedule constraint into performance of the overall Work.
- B. The listing of schedule constraints below does not mean that all constraints or special conditions have been identified. The list is not a substitute for the duty to coordinate and plan for completion, all Work by the Substantial/Contract Completion Dates specified in the Contract Documents.
- C. Schedule constraints to consider include:
 - 1. Wood Hollow Creek is typically dry. But flows are expected from storm events or due to snow melt runoff. Contractor is responsible to manage flows during construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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**SECTION 01 20 00
MEASUREMENT AND PAYMENT**

PART 1 - GENERAL

1.1 GENERAL PROGRESS PAYMENT REQUIREMENTS

- A. Payment for Work performed shall be in accordance with installed quantities as assessed in comparison to the Schedule of Values and the Construction Schedule. Engineer will verify measurements and quantities. Each activity necessary to manage and complete the Work is identified on the Contract schedules. Each activity will be assigned its respective value, a portion of the Contract Price, as shown on the Schedule of Values (Roll-up), and detailed cost loaded activity schedule.
- B. Payment for all lump sum costs and services incurred on this Agreement shall be based on the earned value of Work accomplished during the reporting period. Earned value is determined by the completion percentage of each activity as determined by the Schedule of Values and the Construction Schedule applied to the total value of the activity. No construction activity shall be deemed 100 percent complete until Contractor has completed the physical check out and inspection of the completed Work and has submitted the signed inspection form to Engineer.
- C. Earned value is derived from the current status of Contractor Construction Schedule as determined by the monthly schedule status submittals. Each schedule status submittal is reviewed and approved by Engineer prior to Contractor obtaining approval for the Summary of Earned Values or quantities installed and the Application for Payment.

1.2 APPLICATION FOR PAYMENT

- A. Submit application for payment on Owner's form and be certified by signature of an Authorized Officer of Contractor.
- B. The Application for Payment shall contain all necessary references and attachments that substantiate the invoice for progress payment (e.g., certified payrolls, labor reports, progress schedule data, and Summary of Earned Values). It shall substantiate the invoice for progress payment and shall be preceded or accompanied by the schedule and status data as a condition of payment, in accordance with the Construction Schedule and the Schedule of Values.

1.3 REVIEWS/APPLICATION FOR PAYMENT

- A. Review meetings between Contractor and Engineer will be held weekly and within 7 Days prior to the payment application date designated by Engineer. Three Days prior to the last review meeting of the month, submit an updated schedule and a signed application for payment showing a Summary of Earned Values for the reporting and payment period so that Engineer can compare earned values to available status data. Make any adjustments to the Master Record Documents, updated schedule, and payment applications required by Engineer. Upon completion of the adjustments, Engineer will sign the payment request and forward it to Owner. Engineer will determine payment amounts if agreement with Contractor is not reached.

1.4 PAYMENT FOR SUPPLIES AND MATERIALS

- A. Payment based on the actual cost of supplies, materials and equipment on hand shall be made by Owner with a paid invoice. "Actual cost" of materials shall be the invoice amount, and shall not include any costs associated with installation, testing, etc. Contractor shall be entitled to payment of the actual cost of supplies, materials, and equipment only if it (1) presents an invoice to Owner with the application for payment and (2) states in the application for payment that the materials have been delivered and stored in the time and manner specified in the contract between Contractor and his Supplier or Subcontractor. If Contractor fails to comply with those conditions, Owner may withhold payment in accordance with the provisions. Owner expressly reserves the right to withhold payment until Contractor presents to Owner a paid invoice, or some other proof of payment satisfactory to Owner, for Owner's use in verifying the accuracy of the actual cost of the supplies, materials or equipment. Payment for supplies, materials or equipment on hand does not alter the responsibility of Contractor for all supplies, materials and equipment until Final Acceptance of the Work.

1.5 MEASUREMENT AND PAYMENT

- A. Unit prices or lump sum amounts to include full compensation for furnishing all labor, materials, products, tools, equipment, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit, taxes, and doing all work shown on the Drawings, defined in the Specifications, and/or stipulated herein.
- B. Payment covers the cost of incidental work which includes: progress schedule; QC program; safety procedure plan; maintaining construction schedule; submittals; manufacturer's service in accordance with the specifications; dust control; irrigation, surface water and drainage management; pipeline connections except as identified specifically in other bid items; coordination with property owners, businesses, contractors, and government agencies; all provisions required to provide and maintain access to all properties affected by construction operations; construction surveying; saw cutting, removal, and disposal of existing trench pavement; unclassified excavation; trench excavations; structure excavations; removal and disposal of waste materials; trench dewatering; compaction of backfill materials; fees from the County Surveyor for monument restoration; untreated base course at depth indicated; hauling and stockpiling of materials and equipment; stockpiling and restoration of topsoil in unimproved areas; protection and support of existing surface and subsurface features; providing assistance to other utility companies in locating and relocating service laterals, as needed; replacement and restoration of existing utilities (mains and services) and other items damaged by the CONTRACTOR's operations; removal and replacement of landscape materials and irrigation systems equal to or better than existing if damaged by the CONTRACTOR's operations; and all other necessary work, to install the Work complete in place.
- C. Contractors shall note that the information provided in this section is intended for use as a general description of the breakdown of work to be included in the Bid Schedule. **The following descriptions are NOT intended to represent a complete listing of all elements of Work required by the Contract Documents.** It is the Contractor's responsibility to make sure that costs for all Work required in the plans and specifications is accounted for in the appropriate Bid Items, whether or not specifically described in this Measurement and Payment section. The Owner is not responsible for Contractor's failure to properly coordinate

with Subcontractors and Suppliers regarding the breakdown of Work in these Contract Documents.

D. BID SCHEDULE , Measurement and Payment to be as follows:

1. Bid Item No. 1 - Mobilization, Demobilization, Temporary Facilities and Administrative Items

- a. Measurement: Mobilization, Demobilization, Temporary Facilities, and Administrative Items will be paid for on a Lump Sum basis. Payment shall be made on a percent complete basis as described below.
- b. Payment: Cost of mobilization and demobilization including but not limited to: bonds and insurance; contract administration; mobilization; demobilization; videotaping site conditions prior to construction; furnishing and erecting temporary construction facilities; project signs and obtaining any additional permits not already obtained by the OWNER. This pay item shall constitute full compensation for all labor, equipment, tools, supplies and materials required to complete this portion of the Work for this construction project.
- c. For purposes of payment, this bid item shall be paid for on a percent complete basis. The lump sum bid price for this bid item shall not exceed 10 percent of the total bid price. Any bid proposal for mobilization, demobilization, temporary facilities, and administration items that is greater than 10 percent will be adjusted to the maximum amount of 10 percent of the total bid. The bid item so adjusted will be the Contractor’s bid for that item, and the Contractor’s bid for the project will be recalculated and the revised total used to compare with other bidders to determine the low bid. The OWNER will pay the adjusted lump sum price. Bid item will be paid on a percent complete basis as summarized in the following table:

Partial Payment	Amount	When Paid
1 st	40 percent of bid item lump sum.	With 1 st pay request
2 nd	30 percent of bid item lump sum.	With 1 st pay request following completion of 10 percent of contract
3 rd	30 percent of bid item lump sum (for demobilization).	With 1 st pay request following completion of 90 percent of contract

2. Bid Item No. 2 - Demolition or Salvage of Existing Culvert

- a. Measurement: Payment for all demolition and disposal or salvage work required for the project will be made on a Lump Sum basis.
- b. Lump Sum payment shall constitute full compensation for all labor, tools, materials, and equipment required to remove and dispose of existing materials, or to salvage to Jordan Valley Water Conservancy District the following items:
 - 1) 99 linear feet of 30” ADS and pipe backfill shown on Sheet C-02 (Salvage to the District)
 - 2) Removal of access road shown on Sheet C-02 (Remove and dispose)

- 3. Bid Item No. 3 – Potholing**
- a. Measurement: Measured and paid for on a lump sum basis.
 - b. Payment covers: Costs associated with all labor, materials, and equipment required to pothole the Jordan Aqueduct, Southwest Aqueduct, and Southwest Aqueduct associated fiber optic line. Pothole data should be submitted to the engineer via email. Coordinate pothole data with engineer prior to ordering materials.
- 4. Bid Item No. 4 – 48” Reinforced Concrete Pipe**
- a. Measurement: Payment for the construction of the 48” reinforced concrete pipe will be made on a Linear Feet basis.
 - b. Payment: Payment will be made based on the diameter and thickness shown in the drawings on a linear foot basis, to the nearest foot, along the pipe with no deduction for fittings, including furnishing and installing all pipe materials, fittings, and appurtenances; coordinating with existing utility owners and supporting of existing utilities as required; site condition and construction progress surveys; excavation including all sheeting, shoring and bracing of excavations as required; dewatering; temporary coverings of pipeline ends; trench cutoff walls; supplying and installing imported pipe zone material up to 12” over the top of the pipe; management of storm water during construction; connecting new storm drain to headwall structures; field collars; field closures; cleaning new pipe prior to acceptance by owner, commissioning pipelines.
 - c. If trench stabilization material is used at the direction of the engineer, it will be paid for under Bid Item No. 9.
- 5. Bid Item No. 5 – Grading**
- a. Measurement: Measured and paid for on a lump sum basis.
 - b. Payment: Payment includes all costs associated with all labor, materials, and equipment required to grade around the access road in the areas of the culvert replacement more than 12” over the pipe; placing, preparing, grading, scarifying, and compacting subbase material; compaction density testing; excavation; and haul off.
 - c. Payment: Payment includes all costs associated with all labor, materials, and equipment required to collect and place existing boulders downstream and upstream of the concrete headwall and cutoff wall as described on sheets C-1 and C-2.
- 6. Bid Item No. 6 & 7 – Upstream and Downstream Headwall**
- a. Measurement: Measured and paid for on a lump sum basis.
 - b. Payment: Payment includes all costs associated with all labor, materials, and equipment required to install the upstream and downstream headwalls as shown on sheets S-01 and S-02, including, but not limited to:
 - 1) Excavation, removal and disposal of materials and subgrade preparation
 - 2) Furnishing, transporting, pumping, placing, compacting, finishing, and testing of the concrete
 - 3) Furnishing, installing and compaction of subgrade material

- 4) Installing joints
- 5) Steel reinforcement
- 6) All other work needed to complete this Bid Item in accordance with the Contract Documents

7. Bid Item No. 8 – Access Road Replacement

- a. Measurement: Payment for replacement of access road will be made on a lump sum basis for the extent of road that is removed during construction. Replace road to have a 12' width and shall be replaced completely in the area that is damaged or removed during construction.
- b. Payment: Payment includes all work associated with installation of new access road including: excavation, furnishing, installation and compaction of untreated base course; placement and compaction of road surface material; and matching existing access road via transitions, if necessary, to ensure a smooth transition to the existing access road.
- c. This item to be used for replacement of access road disturbed or damaged during construction where protection of and maintaining the existing road is not possible or reasonable in the opinion of the engineer.

8. Bid Item No. 9 – Trench Stabilization Material, As Directed

- a. Measurement: Measurement of trench stabilization material will be based upon Unit Price per in place cubic yard measured from the dimensions of the trench prior to installation of the material.
- b. Payment: Payment for trench stabilization material will include stabilization material with geotextile; additional over excavation of the trench; dewatering; furnishing, transporting, and installing trench stabilization in accordance with the specifications.
- c. Trench stabilization material may only be used when authorized in advance by the Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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**SECTION 01 25 10
PRODUCTS, MATERIALS, EQUIPMENT, AND SUBSTITUTIONS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for delivery and storage of products and materials specified for use in the Project. It also includes requirements for handling requests for equals and substitutions made after award of the Contract.

1.2 DEFINITIONS

- A. Definitions in this Article are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," "special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.
- B. The word "Products," as used herein, is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for the Project or taken from stock of previously purchased products.
- C. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of work.
- D. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items).
- E. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

1.3 QUALITY ASSURANCE

- A. Source Limitations: To the greatest extent possible for each unit of work, provide products, materials, and equipment of a singular generic kind from a single source.
- B. Compatibility of Options: Where more than one choice is available as options for selection of a product, material, or equipment, select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material, and equipment selections.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance
 - 1. Deliver and store products, materials, and equipment in accordance with manufacturer's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft.
 - 2. Manage delivery schedules to minimize long-term storage of products at Site and overcrowding of construction spaces. Ensure coordination to minimize holding or

storage times for flammable, hazardous, easily damaged, or sensitive materials to deterioration, theft, and other sources of loss.

B. Transportation and Handling

1. Transport products by methods to avoid damage. Deliver in undamaged condition in manufacturer's unopened containers and packaging.
2. Furnish equipment and personnel to handle products, materials, and equipment, including those provided by Owner, by methods to prevent soiling and damage.
3. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

C. Storage and Protection

1. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate-controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.
2. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.
3. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter.
4. Storage shall be arranged to provide access for inspection. Periodically inspect to assure products are undamaged and are maintained under required conditions.
5. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

D. Maintenance of Storage

1. Periodically inspect stored products on a scheduled basis. Maintain a log of inspections and make the log available on request.
2. Comply with manufacturer's product storage requirements and recommendations.
3. Maintain manufacturer-required environmental conditions continually.
4. Ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.
5. For mechanical and electrical equipment, provide a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.
6. Service products on a regularly scheduled basis. Maintain a log of services and submit as a record document prior to acceptance by Owner in accordance with the Contract Documents.

1.5 PROPOSED SUBSTITUTIONS AND "OR EQUAL" ITEMS

- A. Substitution and "or equal" determination shall be submitted and evaluated per the General Conditions included in the Contract Documents.
- B. When proposing a substitution, make written application to Engineer on the "Substitution Request Form."
- C. Unless otherwise provided by law or authorized in writing by Engineer, submit the "Substitution Request Form(s)" within 35 days after award of the Contract.

- D. Whenever products, materials, or equipment are indicated in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the manufacturer is intended to establish the type, function, and quality required. The Contract Price is understood to be based upon furnishing the item specified.
- E. If a named item is not available or a supplier is no longer doing business, the following shall apply:
1. When a named supplier is no longer doing business under the name indicated, furnish the specified product from the legal successors to the named supplier.
 2. When a named product is no longer available from the named supplier due to acquisition or sale of the given product line, but the product is available from another supplier, provide the named product. In such cases, submit a substitution request form and include certification from the supplier that the product being supplied is materially and functionally identical to the product named in the Contract Documents.
 3. When the named product is no longer available from the named supplier or any other supplier, notify Owner in writing and Owner will direct Engineer to identify suitable substitute products. Provide one of the suitable substitute products.
- F. The procedure for review by the Engineer will include the following:
1. Wherever a proposed substitution has not been submitted within said 35-day period, or wherever the submission of a proposed substitution material or equipment has been judged to be unacceptable by Engineer, provide the product, material, or equipment indicated in the Contract Documents.
 2. Certify that the proposed substitution will adequately perform the functions and achieve the results called for by the general design and be similar and of equal substance to that indicated and be suited to the same use as that indicated.
 3. Engineer will evaluate each proposed substitution within a reasonable period.
 4. As applicable, do not make shop drawing submittals for a substitution without Engineer's prior written acceptance of the request for substitution. Do not order, install, or utilize any substitution item prior to written acceptance of the request for substitution.
 5. Engineer will record the time required by Engineer in evaluating substitutions and in making changes by Contractor in the Contract Documents occasioned thereby.
- G. Application for substitution must contain the following statements and information, which will be considered by Engineer in evaluating the proposed substitution:
1. Submit "Substitution Request Form," at end of this Section, fully executed.
 2. The evaluation and acceptance of the proposed substitution shall not prejudice the achievement of substantial completion on time.
 3. Whether or not acceptance of the substitution for use in the Work will require a change in any of the Contract Documents to adapt the design to the proposed substitution.
 4. Whether or not incorporation or use of the substitution in connection with the Work is subject to payment of any license fee or royalty.
 5. All variations of the proposed substitution from the items originally specified shall be identified.
 6. Available maintenance, repair, and replacement service shall be indicated. The manufacturer shall have a local service agency (within 50 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

7. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitution, including cost of redesign and claims of other contractors affected by the resulting change.

- H. Without any increase in cost to Owner, be responsible for, and pay all costs in connection with proposed substitutions and costs of inspections and testing of equipment or materials submitted for review prior to purchase thereof for incorporation in the Work, whether or not Engineer accepts the proposed product, equipment, or material. Reimburse Owner for the charges of Engineer and other authorized representatives for evaluating each proposed substitution.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION



SUBSTITUTION REQUEST FORM

To: _____

Project: _____
Date: _____
Owner: _____

Specified Item:

Section	Page	Paragraph	Description
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The undersigned requests consideration of the following:

Proposed Substitution: _____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request. Applicable portions of the data are clearly identified.

The undersigned states that the following paragraphs, unless modified on attachments, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings and will not require a change in any of the Contract Documents.
2. The undersigned will pay for changes to the design, including engineering design, detailing, and construction costs caused by the request substitution which is estimated to be \$_____.
3. The proposed substitution will have no adverse effect on other contractors, the construction schedule (specifically the date of substantial completion), or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. The incorporation or use of the substitute in connection with the work is not subject to payment of any license fee or royalty.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Submitted by **Contractor:**

Firm: _____
By: _____
Signature: _____
Telephone: _____
Attachments: _____
Comments: _____

Reviewed by **Engineer:**

Accepted as Submitted Accepted as Noted
 Not Accepted Received too Late
By: _____
Title: _____
Date: _____
Comments: _____

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**SECTION 01 26 13
REQUESTS FOR INTERPRETATION (RFI)**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes procedures for submitting Requests for Interpretation (RFI) and limitations on use of RFI to obtain interpretation and clarification.

1.2 RELATED SECTIONS

- A. Section 01 25 10 – Products, Materials, Equipment, and Substitutions.
- B. Section 01 33 20 – Submittal Procedures.

1.3 DEFINITIONS

- A. Request for Interpretation: A document submitted to Engineer by Contractor, requesting clarification of a portion of the Contract Documents, hereinafter referred to as an RFI.

1.4 CONTRACTOR'S REQUESTS FOR INTERPRETATION (RFI)

- A. Contractor's Requests for Interpretation (RFI): Should Contractor be unable to determine from the Contract Documents, the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of Work is described differently at more than one place in the Contract Documents; request that Engineer make an interpretation of the requirements of the Contract Documents to resolve such matters. Comply with procedures specified herein to make Requests for Interpretation (RFI).
- B. Submission of RFI: Prepare RFI and submit electronically utilizing the Electronic Project Management System. Refer to Section 01 33 20 – Submittal Procedures.
 - 1. Fill in transmittal form completely, and if supplemental drawings or other information is prepared by hand, it shall be fully legible and attached with the transmittal form.
 - 2. The Project Management System will automatically assign each RFI a discrete, consecutive number. Include this number in the title of the RFI. For instance, Revision #1 to RFI 029 should be noted in the title as “original title name, Rev 1”.
 - 3. Each page of the RFI and each attachment to the RFI shall bear Owner’s project name, project number, date, RFI number and a descriptive title. Merge all into a single PDF document for attachment in the system.
 - 4. Clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, indicate presumed interpretation or understanding of the requirement along with reasons for such understanding. Include proposed solutions that may be set forth to complete the Work with associated cost and schedule impact, if any.
 - 5. Engineer will review all RFI to determine whether they are RFI within the meaning of the term. If Engineer determines that the transmittal is not an RFI, it will be returned, unreviewed as to content, for resubmittal in the proper manner.

6. Frivolous RFI or simply passing on the RFI without first vetting the RFI will be subject to reimbursement from Contractor to Owner for fees charged by Engineer and other design professionals engaged by Owner.
- C. Subcontractor-Initiated and Supplier-Initiated RFI: RFI from subcontractors and material suppliers shall be submitted through, be reviewed by, and be attached to an RFI prepared, signed, and submitted by Contractor. RFI submitted directly by subcontractors or material suppliers will be returned unanswered to Contractor.
1. Review all subcontractor- and supplier-initiated RFI and take actions to resolve issues of coordination, sequencing, and layout of the Work. Coordination of the work, sequence, and layout are not the responsibility of Owner or Engineer.
 2. RFI submitted to request clarification of issues related to means, methods, techniques, and sequences of construction or for establishing trade jurisdictions and scopes of subcontracts will be returned without interpretation. Such issues are solely Contractor's responsibility.
- D. Requested Interpretation: Carefully study the Contract Documents to ensure that information sufficient for interpretation of requirements of the Contract Documents is not included therein. RFI that request interpretation of requirements clearly indicated in the Contract Documents will be returned without interpretation.
1. In all cases in which RFI are issued to request clarification of issues related to means, methods, techniques and sequences of construction; for example, pipe and duct routing, clearances, specific locations of Work shown diagrammatically, apparent interferences and similar items, furnish all information required for Engineer or Owner to analyze and/or understand the circumstances causing the RFI and prepare a clarification or direction as to how to proceed.
 2. If information included with this type of RFI is insufficient, the RFI will be returned unanswered.
- E. Unacceptable Uses for RFI: RFI shall not be used to request the following:
1. Approval of submittals (use procedure specified in Section 01 33 20 - Submittal Procedures).
 2. Approval of substitutions (refer to Section 01 25 10 – Products, Materials, Equipment and Substitutions).
 3. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Contract General Conditions).
 4. Different methods of performing Work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Contract General Conditions).
- F. Disputed Requirements: If Engineer's response to an RFI is believed to cause a change to the requirements of the Contract Documents, immediately give written notice to Engineer stating why this is believed to be true. Failure to give such written notice immediately shall waive any right to seek additional time or compensation under the Contract.

PART 2 - PRODUCTS

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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**SECTION 01 29 73
SCHEDULE OF VALUES**

PART 1 - GENERAL

1.1 GENERAL

- A. This Section defines the process whereby the Schedule of Values shall be developed and incorporated into the Construction Progress Schedule as specified in Section 01 32 16 – Construction Progress Schedule. Monthly progress payment amounts shall be determined from the weekly progress updates of the scheduled activities. The schedule of values shall, as a minimum, list the value of every activity on the schedule, and shall include such additional breakdowns as required herein. The values in the Schedule of Values do not establish a commitment by either Contractor or Owner when negotiating changes to the Contract Documents.

1.2 DETAILED SCHEDULE OF VALUES

- A. Prepare and submit a detailed Schedule of Values to Engineer as part of the Construction Progress Schedule submittal. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts, sufficient detailed breakdown shall be provided to meet this requirement. The Schedule of Values shall have a one-to-one relationship to the work activities of the Construction Progress Schedule even though additional detailed breakdowns for the Schedule of Values may be required. Engineer will be the sole judge of acceptable breakdowns, details, and descriptions of the values established. If, in the opinion of Engineer, a greater number of Schedule of Values items than proposed is necessary, add the additional items so identified.
- B. The minimum details of a breakdown of the major Work components are indicated below. Provide greater detail when directed by Engineer.
1. Mobilization: Mobilization shall be broken down by each principal item as described in Section 01 71 00 – Mobilization.
 2. Construction Progress Schedule shall be broken down by initial submittal and monthly updates.
 3. Break down Civil site Work into roadways, individual drainage systems, individual flood control structures, site concrete, soil cement, paving, excavation cut and fill, clearing and grubbing and any other items determined to be necessary for the establishment of pay and activity items.
 4. Break down concrete structures into excavation, subgrade preparation, and appurtenant pre-foundation Work, concrete foundation construction, slabs on grade, walls, columns, suspended slabs, etc. (provide sufficient breakdown to accommodate necessary schedule detail.
 5. Break down mechanical Work within each structure to identify individual piping systems, equipment installation by equipment name and number, and equipment testing and checkout.
 6. Break down electrical and Instrumentation Work within each structure to identify individual systems, equipment installation by equipment name and number, and equipment testing and checkout.
 - a. Break down fiber optic conduit Work into conduit installation and pull boxes.

- b. Break down cathodic protection Work by ribbon anode and appurtenances, test station types, rectifiers, and insulating flanges.
 - 7. Break down protective coating Work by system. Where specific coating Work may be critical to performing the Work to meet milestone and schedule dates, such Work shall be included as individual pay and activity items.
 - 8. Break down utility relocation Work into individual pipelines running from and to termination points. Each pipeline shall be an individual pay item unless otherwise allowed by the Engineer.
 - 9. Break down pipeline Work into individual items including pipe materials, pipe installation, backfill, surface restoration, and hydrostatic testing; utility crossings; pipeline interconnections; and any other items determined necessary for the establishment and pay and schedule activities.
 - 10. Provide breakdown for disinfection, testing, and commissioning of pipelines and reservoirs.
 - 11. Operations and Maintenance (O & M) Manuals shall be broken down into one O & M Manual per piece of equipment or one O & M Manual per group of like-kind pieces of equipment for establishment of pay and schedule activity items.
 - 12. Break down all other Work not specifically included in the above items as necessary for establishment of pay and schedule activity items.
- C. After submittal of the Schedule of Values, as part of the Construction Progress Schedule submittal, meet with Engineer and jointly review the schedules. Review the value allocations and extent of detail to determine any necessary adjustments to the values and to determine if sufficient detail has been proposed. Make adjustments deemed necessary to the value allocation or level of detail and submit a revised detailed Schedule of Values within 5 workdays from receipt of comments from Engineer.

1.3 CHANGES TO SCHEDULE OF VALUES

- A. Assign values, approved by Engineer, for changes to the Construction Schedule which add activities not included in the original Construction Schedule but are included in the original Work (schedule omissions). Reduce other activity values to provide equal value adjustment increases for added activities as approved by Engineer.
- B. If Contractor and Engineer agree to adjust the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases, and equal decreases to values for activities may be made. Engineer may direct changes to the schedule when inequities are discovered and agreement on the reallocation cannot be achieved.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 30
SAFETY

PART 1 - GENERAL

1.1 SUMMARY

- A. Contractor's safety program shall conform to the requirements specified in the General Conditions and Supplementary Conditions.

1.2 DEFINITIONS

- A. For the purposes of this Section, an "active construction area" is any area where construction activities are occurring, or construction activities could be considered a potential hazard to people.
- B. A "Designated Safety Officer" or "Safety Representative" for the purposes of this Contract, means anyone who can identify the existing and predictable hazards in the areas surrounding a construction project or those working conditions at a construction project that are unsanitary or dangerous to employees. A "Designated Safety Officer" has the authority to make prompt corrective measures to eliminate those hazards.

1.3 SUBMITTALS

- A. Demonstrate compliance action with the stipulations of Utah Occupational Safety and Health Administration (OSHA), Mine Safety and Health Administration (MSHA), and other applicable local, state, and federal safety requirements by submitting to Engineer a copy of all safety plans, programs, and permits. Such plans and programs shall include, but are not limited to:
1. Hazard Analysis Prior to Major Activities (job safety analysis, JSA).
 2. Emergency Plan.
 3. Rigging and Hoisting Plans.
 4. Excavation and Trenching Plans.
 5. Respiratory Protection Program.
 6. Fire Protection Plan.
 7. Confined Space Entry Program.
 8. Explosives Handling and Storage.
 9. Confined Space Entry Program.
 10. Electrical Safety (drop cords, temporary power, GFCI's, etc.)
 11. Lock Out/Tag Out.
 12. Fall Protection.
 13. Heavy Equipment Operations.
 14. Burning and Welding Operations.
 15. Training Plan.
 16. Tunneling/Underground/Jacking/Boring Operations.
 17. Project Site Rules and Regulations (hazard protection plan).
 18. Material Handling (storage-disposal).
 19. Fuel Storage and Refueling.
 20. Hazard Communication/Right to Know.
 21. Subcontractor Requirements.
 22. Ventilation.

23. Personal Protective Equipment (hearing, eye, face).
 24. Power Transmission/Distribution (temporary and/or permanent).
 25. Traffic Control.
 26. Environmental Controls.
 27. Safety Meetings.
 28. Spill Control Plan.
 29. First Aid Facilities.
- B. Engineer's receipt of safety plans or programs will not relieve Contractor in any way from the full and complete responsibility for safety and training of its personnel, and the onsite personnel of Owner, Engineer, and other visitors to areas of active construction areas. Daily, inform Engineer of changes to the boundaries of the active construction areas.
- C. Be responsible for safety training all personnel who will have access to the active construction areas to meet state, federal, local and Contractor requirements. Maintain reasonable, regularly scheduled training sessions in mutually accessible facilities through entire Contract. Training costs for all personnel and visitors, except those costs associated with training personnel of Contractor, subcontractors, suppliers, and visitors will be considered incidental to other lump-sum portions of the Work and no additional compensation for such training will be provided.
- D. Safety Program Requirements:
1. Safety Representative Requirements:
 - a. Assign a full-time Safety Representative as defined in the General Conditions of the Contract.
 - b. The Safety Representative's duties and responsibilities will be hazard recognition, accidents prevention, new employee orientation (including subcontractors), and the maintaining and supervising of safety precautions and program. The Safety Representative or a qualified and approved deputy shall be onsite at all times while Work is ongoing.
 - c. Qualifications of the Safety Representative and assigned deputies shall be submitted to Engineer for review. Acceptance of their qualifications by Engineer is required prior to the start of any activity on the Project. The Safety Representative will, as a minimum, meet the requirements of regulations for the Utah Occupational Safety & Health Enforcement Program.
 2. Hazardous Substances:
 - a. Provide Engineer with a list of all hazardous substances anticipated to be brought on-site.
 - b. Maintain on site Material Safety Data Sheets (MSDS) prior to arrival of any hazardous substances on the Project.
 - c. Use storage area(s) as outlined in the spill control plan.
 3. Job Safety Analysis (JSA):
 - a. Outline the sequence of the Work, equipment to be used, identify hazards that may exist or may be created and what procedures and/or safety equipment will be used to eliminate or reduce these hazards. A Scope of Work JSA shall be prepared and provided to the Engineer prior to the start of unusual, hazardous, or have risk potential activities on the Project. The name of the competent person assigned to this activity will be included on the JSA.
 - b. Complete a JSA for any activity, which may be of an unusual nature or involves unique hazards.
 4. Reports

- a. Provide to Engineer copies of Contractor's and subcontractor's:
 - 1) First aid, recordable, lost time and near miss, monthly logs.
 - 2) OSHA 200 injury log (annually).
 - 3) Safety meeting reports and topics (weekly).
 - 4) List of competent persons as required by OSHA and the Project Health and Safety Manual for each required task and their qualification as such.
 - 5) Injury and accident reports will be submitted to Engineer within 24 hours of any incident. **Immediate** notification to Engineer of an accident is **required**. Full cooperation with Engineer in accident investigation is required.
- b. Conduct weekly safety inspections. Corrective actions shall be taken within 24 hours to address all deficiencies identified during inspections. Deficiency reports shall be prepared and submitted to Engineer within 48 hours indicating corrective actions taken. Failure to comply with required corrective measures identified in the safety inspection will result in the delayed signing of the monthly application for progress payment by Engineer.
- c. Provide Engineer with a report of any periodic audit of Contractor's safety performance and/or records.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 GENERAL

- A. Employ a bar chart schedule for the planning and scheduling of all Work required under the Contract Documents.
- B. In addition to the scheduling aspect, the same chart shall show an “S” curve for scheduled dollar expenditures versus time.
- C. In the process of preparing baseline schedule and monthly updates, consult with all key subcontractors and suppliers to assure concurrence with the feasibility and achievability of planned start dates, sequencing, durations, and completion dates.

1.2 RELATED SECTIONS

- A. Section 01 20 00 – Measurement and Payment

1.3 QUALIFICATIONS

- A. Demonstrate competence through the submission of a fully compliant Construction Progress Schedule with the initial schedule submission. Upon failure to so demonstrate competence in scheduling, Engineer may direct Contractor to employ the services of a scheduler that can demonstrate competence. Comply with such directives.

1.4 SUBMITTAL PROCEDURES

A. Submittal Requirements

- 1. Submit Construction Progress Schedule Digitally.
- 2. The time scale (horizontal) shall be in weeks. The activities shall be listed on the left-hand side (vertical).
- 3. Break down activities into sufficient detail to show all work activities. The listing from top to bottom shall be in a logical manner of which the Work will be accomplished. Provide space between activities or within bars to allow for marking of actual progress.
- 4. Provide a written narrative of the planning logic along with a description of Work and quantities included in each activity of the bar chart schedule.
- 5. Duration: The duration indicated for each activity shall be in units of whole working days and shall represent the single best time considering the scope of the Work and resources planned for the activity, including time for holidays and inclement weather. The calendar for the network shall be in calendar days. Except for certain non-labor activities, such as curing concrete or delivering materials, activity durations shall not exceed 14 days, be less than one day, nor exceed \$50,000 in value unless otherwise accepted by Engineer.

B. Time of Submittals

1. Submit the bar chart schedule with "S" curves and narrative within fifteen (15) working days after Notice to Proceed for review by Engineer. The schedule submitted shall indicate a project completion date the same as the contract completion date.
2. Submit a copy of the schedule, clearly showing progress made and actual "S" curves, on a two or four week basis depending on the duration of the project and reporting time agreed to in the preconstruction meeting.

C. Acceptance

1. The bar chart schedule and "S" curves, when accepted by Engineer, constitute the Construction Progress Schedule unless a revised schedule is required due to one or more of the following:
 - a. Substantial changes in the Work scope.
 - b. A change in Contract time.
 - c. Delinquency by Contractor that requires a recovery schedule.
2. Owner's review and acceptance of the Construction Progress Schedule is for conformance to the requirements of the Contract Documents only. Review and acceptance by Owner of Contractor's Construction Progress Schedule does not relieve Contractor of any of its responsibility whatsoever for the accuracy or feasibility of the Construction Progress Schedule, or of Contractor's ability to meet interim milestone dates and the Contract completion date, nor does such review and acceptance expressly or impliedly warrant, acknowledge, or admit the reasonableness of the logic and durations of the Construction Progress Schedule.

1.5 SCHEDULE UPDATES

- A. The Construction Progress Schedule shall be updated to reflect the as-built conditions of the Work and to accurately forecast the status of incomplete activities. Provide progress reports at each weekly progress meeting, stating actual percent earned versus percent planned. Submit Construction Progress Schedule updates to Engineer with each payment request, including approved changes in the Work and accurately depicting the current status and sequence of all activities.
- B. Submit the updated Construction Progress Schedule in the form, sequence, and number of copies requested for the initial schedule.
- C. Engineer will review each submitted Construction Progress Schedule update and provide comments within seven days of the submittal. Revise and resubmit the schedule within five days of receipt of comments from Engineer. Engineer will review the re-submittal within five days and provide comments if the schedule update is still unacceptable. Revise and resubmit the schedule within five days of receipt of comments from Engineer.

1.6 PROGRESS MEETINGS AND LOOK-AHEAD SCHEDULES

- A. For the weekly progress meetings, submit a look-ahead schedule. This schedule will cover four weeks: the immediate past week, the current week, and the forthcoming two weeks. List all activities from the accepted Construction Progress Schedule, which are complete, are scheduled for Work during the period, are currently planned to be worked, even if out of sequence, and Work which is unfinished but scheduled to be finished. Provide actual start and completion dates for the Work that has been completed the prior week. Forecast early start and early finish dates for the Work that is in process or upcoming.

- B. Identify each activity noted above by activity number corresponding to the accepted Construction Progress Schedule and detailed description of the activity.
- C. Deliver the look-ahead schedule to Engineer 24 hours prior to the weekly progress meeting in a format approved by Engineer.

1.7 CONSTRUCTION SCHEDULE REVISIONS

- A. Engineer may direct and, if so directed, Contractor shall propose, revisions to the Construction Progress Schedule upon occurrence of any of the following instances:
 - 1. The actual physical progress of the Work falls more than five percent (5%) behind the accepted Construction Progress Schedule, as demonstrated by comparison to the accepted monthly Construction Progress Schedule updates or as determined by Engineer if a current accepted Construction Progress Schedule does not exist.
 - 2. Engineer considers milestone or completion dates to be in jeopardy because of "activities behind schedule". "Activities behind schedule" are all activities that have not or cannot be started or completed by the dates shown in the Construction Progress Schedule.
 - 3. A Change Order has been issued that changes, adds, or deletes scheduled activities, or affects the time for completion of scheduled activities.
- B. When instances requiring revision to the Construction Progress Schedule occur, submit the proposed revised Construction Progress Schedule within ten (10) working days after receiving direction from Engineer to provide such schedule. No additional payment will be made for preparation and submittal of proposed revised Construction Progress Schedules. However, if Engineer accepts the proposed revised Construction Progress Schedule, it shall replace and supersede all previous Construction Progress Schedules and substitute for the next monthly Construction Progress Schedule update that would otherwise be required.
- C. Revisions to the Construction Progress Schedule shall comply with all the same requirements applicable to the original schedule.

1.8 SCHEDULE RECOVERY

- A. If a revised Construction Progress Schedule accepted by Engineer requires additional manpower, equipment, hours of work or work shifts, or to accelerate procurement of materials or equipment, or any combination thereof, as schedule recovery measures to meet Contract milestones, implement such schedule recovery measures without additional charge to Owner.

1.9 EARLY COMPLETION SCHEDULES

- A. Early completion schedules are generally not acceptable to Owner but may be accepted as a convenience to Contractor and under the following conditions.
 - 1. Submit a specific written request outlining the specific reasons for using the early completion schedule.
 - 2. Acknowledge and agree in writing that the proposed reduction in time represents Project time already paid for by Owner as part of the Bid Price, and available to both Contractor and Owner for the mitigation of impacts to the Project from any source. Contractor is not entitled to any increase in Contract price for failure to achieve the early completion and waives all claim to same.

3. Early completion schedules shall not be based upon or rely on expedited approvals by Owner or Engineer.
 4. Early completion schedules must meet all other requirements of the Contract.
- B. Revise early completion schedules, which have activities behind schedule, when and as requested by Engineer.

1.10 BASIS OF SCHEDULE NARRATIVES

- A. Furnish a basis of schedule narrative to Engineer with each Application for Payment. If the Work falls behind schedule, submit additional narrative at such intervals as Engineer may request.
- B. In each narrative, include a summary of progress for the month, description of any current and anticipated delaying factors, a variance analysis for varying activities, impacts on the construction schedule, and proposed corrective actions. Any Work reported complete, but which is not readily apparent to Engineer, must be substantiated with satisfactory evidence.
- C. In each narrative, include a list of the activities completed during the preceding month and a list of the activities started during the month but not yet completed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 33 20
SUBMITTAL PROCEDURES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for submittals required in performance of the Work, including shop drawings, schedules, surveys, reports, samples, plans, lists, drawings, documents, warranties, certifications, findings, programs, manuals, data sheets, or any other item of information required by the Contract Documents to be submitted in accomplishing the Work.

1.2 DEFINITIONS

- A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer's approval for inclusion in the Work.
- B. Deferred Submittal: Information in accordance with the applicable Building Code, submitted by Contractor for portions of the design that are to be submitted to permitting agency after the time of permit application and prior to installation of that portion of Work. Deferred Submittals must include Engineer's review documentation stating that submittal has been found to be in general conformance with overall Project design.
- C. Informational Submittal: Information submitted by Contractor to represent compliance with Contract Requirements included in the Work, but which are not part of the Work itself. Informational Submittals must be submitted to Engineer for information and for determination that submitted information is in accordance with Contract requirements.
- D. Shop Drawing: The term "Shop Drawing" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, and similar items.
- E. PDF: Abbreviation for "Portable Document Format", used for transmittal of electronic documents.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Whenever submittals are required hereunder, transmit all documents to Engineer in electronic format, via web-based construction management software. Contact information for the web-based project management software is as follows:

Brian Mecham, P.E.
Bowen Collins & Associates
154 E 14075 S
Draper, Ut 84020
Email: bmecham@bowencollins.com
Office 801-495-2224
Cell 801-828-7584

- B. Be responsible for the accuracy, completeness, and coordination of all submittals. Do not delegate this responsibility in whole or in part to any subcontractor. Submittals may be prepared by Contractor, subcontractor, or supplier, but Contractor shall ascertain that each submittal meets the requirements of the Contract and the Project. Ensure that there is no conflict with other submittals and notify Engineer in each case where a submittal may affect the work of another contractor or Owner.
- C. Coordination
1. Ensure coordination of submittals of related crafts and subcontractors.
 2. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently ahead of performance of related construction activities to avoid delay.
 3. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 4. Carefully review all submittals prior to submission. Sign and date each transmittal with a direct statement acknowledging that the equipment or material in the submittal meets all the requirements specified or shown in the Contract Documents without exception. No consideration or review of any submittals will be made for any items, which have not been so certified. All non-certified submittals will be returned without action taken, and any delays caused thereby shall be the total responsibility of Contractor. Submittals which cannot bear this certification because they contain an exception or deviation to the Contract Documents shall be so noted in the electronic transmittal and shall only be submitted in accordance with Section 01 25 10 – Products, Materials, Equipment and Substitutions.
- D. Processing: Allow sufficient review time so that installation will not be delayed because of the time required to process submittals, including time for resubmittals.
1. Except as may otherwise be indicated herein, Engineer will return each submittal, with comments noted thereon, within 21 calendar days following receipt by Engineer.
 2. For resubmittal, Engineer will be allowed the same review period as for the original submittal.
 3. It is considered reasonable that Contractor will make a complete and acceptable submittal to Engineer by the second submission of an item. Owner reserves the right to withhold monies due Contractor to cover additional costs of any review beyond the second submittal.
 4. Allow additional time if processing must be delayed for coordination with subsequent submittals. Engineer will promptly advise Contractor when a submittal being processed must be delayed for coordination.
 5. If an intermediate submittal is necessary, process the same as the initial submittal.
 6. No extension of Contract Time will be authorized resulting from non-compliant submittals or failure to transmit submittals to Engineer sufficiently in advance of the Work to permit processing.
 7. If an incomplete submittal is made, the submittal may be returned without review. A complete submittal will contain sufficient data to demonstrate that the items contained therein comply with the Contract Documents, meet the minimum requirements for submittals as described in the Contract Documents, and include all corrections as required from previous submittals.

E. Submittal Schedule

1. Within 30 days of the Notice to Proceed, submit a complete list of anticipated submittals, which includes Specification and Drawing references.
 - a. Coordinate submittal schedule with any subcontracts, schedule of values, the list of products, and Contractor's construction schedule.
 - b. Prepare schedule in chronological order.
 - c. Update the list with "early start" submittal dates within 15 days of submittal of the Construction Progress Schedule.
 - d. Update submittal dates whenever the schedule is updated and include any additional submittals identified after the initial submittal in the updates.
- F. Unsolicited Submittals: Unsolicited submittals may be returned without being reviewed.
- G. Changes in Work: Changes in the Work will not be authorized by submittal review actions. No review action, implicit or explicit, will be interpreted to authorize changes in the Work. Changes will only be authorized by separate written direction from Owner, in accordance with the General Conditions.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

A. Product Data:

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard published data is not suitable for use, submit as "Shop Drawings."
2. Mark each data sheet to show applicable choices and options pertinent to the Project. Where printed Product Data includes information on several products, some of which are not required for the Project, mark the data sheets to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
3. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

B. Samples

1. Whenever in the Specifications, samples are required, submit not less than 3 samples of each item or material to Engineer for acceptance at no additional cost to Owner.
2. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
3. Submit samples for acceptance, a minimum of 21 days prior to ordering such material for delivery to the jobsite. Submit in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the Work.
4. Transmit a submittal as a single PDF document with list of samples via the web-based project management software.

5. Individually and indelibly label and tag all samples to indicate all specified physical characteristics and Manufacturer's name for identification. Upon receiving acceptance by Engineer, one set of the samples will be stamped, dated, and returned. One set of samples will be retained by Engineer, and one set of samples will remain at the Project site until completion of the Work.
6. Unless indicated otherwise, all colors and textures of specified items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in Contract time or Price, clearly indicate this information in the submittal.

C. Shop Drawings

1. Wherever called for in the Contract Documents, or where required by Engineer, transmit an electronic Shop Drawing Submittal to Engineer for review, using the web-based project management software. Whenever required to submit design calculations as part of a Submittal, such calculations shall bear the signature and seal of a professional engineer registered in the appropriate discipline in the state of Utah unless otherwise directed.
2. Organization
 - a. Prepare a single shop drawing submittal for each item or class of material or equipment for which submittal is required. At a minimum, separate submittals are required for different Specification Sections except as follows. A single submittal covering multiple sections will not be accepted unless the primary specification references other sections for components. Example: If a pump section references other sections for the motor, protective coating, anchor bolts, local control panel, and variable frequency drive, a single submittal would be accepted; a single submittal covering vertical turbine pumps and horizontal split case pumps would not be acceptable.
 - b. Index the components for the submittal and reference the specification sections and paragraph numbers for all components in the description field of the electronic submittal. Relate the submittal components to drawing number, detail number, schedule title, or room number and building name, as applicable.
 - c. Unless indicated otherwise, terminology and equipment names and numbers used in submittals shall match the Contract Documents.
 - d. Engineer will assign a single review action to each submittal, which action shall pertain to every part of the submittal as a whole.
 - e. Disorganized submittals, which do not meet the requirements specified herein will be returned without review.
3. Format
 - a. Assemble submittals into a single PDF file for each transmittal. Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on PDF sheets at least 8-1/2" x 11" and no larger than 36" X 48"
 - b. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with all pertinent data, capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Present sufficient level of detail for assessment of compliance with the Contract Documents.
 - c. Assign each Submittal a unique number, including the specification section under which it is submitted. Number all submittals sequentially within the applicable specification section. Original submittals will be assigned a

numeric submittal number. Resubmittals shall be numbered with a revision number in addition to the original submittal number.

- D. Engineer's Action
1. If submittal is returned to Contractor marked "NO ACTION TAKEN", indicating that the submittal has been received and is being retained for record-keeping purposes. Formal revision and resubmission of said submittal will not be required.
 2. If submittal is returned to Contractor marked "NO EXCEPTIONS TAKEN", formal revision and resubmission of said Submittal will not be required and construction may proceed.
 3. If submittal is returned to the Contractor marked "MAKE CORRECTIONS NOTED", formal revision and resubmission of said submittal will not be required but construction must proceed according to the review comments included with the submittal.
 4. If submittal is returned marked "REVISE AND RESUBMIT", revise said submittal and resubmit. Construction may not proceed.
 5. If submittal is returned marked "REJECTED-RESUBMIT", revise said submittal and resubmit. Construction may not proceed.
 6. Resubmittal of portions of multi-page or multi-drawing submittals will not be allowed. For example, if a Shop Drawing Submittal that consists of ten drawings contains only one drawing that needs to be amended and resubmitted, the submittal as a whole is deemed as "REVISE AND RESUBMIT", and all ten drawings included in the submittal are required to be resubmitted.
 7. On resubmittals, flag any changes made, other than those made or requested by Owner or Engineer.
- E. Commence fabrication of an item only after Engineer has reviewed the pertinent submittals and Engineer has assigned action as either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED". Corrections indicated on submittals are considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the Contract requirements.
- F. Owner's and/or Engineer's review of shop drawing submittals does not relieve Contractor of the responsibility for correctness of details and dimensions and for compliance with the Contract Documents. Assume responsibility and risk for misfits due to errors in submittals. Be responsible for dimensions and design of adequate connections and details.
- G. Deferred Design Submittals: Items noted on the Contract Documents as "Deferred Submittals" must be submitted to Engineer, who will review them and forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance with the design of the Project. Do not install Deferred Submittal items until the deferred submittal documents have been approved by the permitting agency.
- H. Test and Evaluation Reports: Submit technical data, test reports, calculations, surveys, and certifications based on field tests and inspections by independent inspection and testing agency and by authorities having jurisdiction.
1. Reports of results of inspections and tests will not be considered Contract Documents.
 2. Refer to Section 01 45 00 - Quality Control for additional requirements.

1.5 PRECONSTRUCTION CONFERENCE SUBMITTALS

- A. At the preconstruction conference referred to in Section 01 11 00 - Summary of Work, submit the following items to Engineer for review:
 - 1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitute ("Or-Equal") submittals listed in the Bid.
 - 2. A list of all permits and licenses to be obtained, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.
 - 3. A preliminary Schedule of Values in accordance with Section 01 29 73 - Schedule of Values.
 - 4. A preliminary Construction Project Schedule in accordance with requirements of Section 01 32 16 - Construction Progress Schedule.
 - 5. The name and qualifications of the Designated Safety Representative in accordance with requirements of Section 01 31 30 - Safety.

1.6 SITE CONDITION SURVEYS

- A. Submit the site conditions survey data as required in Section 01 71 30 - Site Conditions Surveys.

1.7 CONSTRUCTION PROGRESS REPORTS

- A. Transmit a progress report to Engineer with each Application for Payment. If the Work falls behind schedule, submit additional progress reports at such intervals as Engineer may request.
- B. In each progress report, include sufficient narrative to describe any current and anticipated delaying factors, effect on the construction schedule, and proposed corrective actions. Any Work reported complete, but which is not readily apparent to Engineer, must be substantiated with satisfactory evidence.
- C. In each progress report, include a list of the activities completed with their actual start and completion dates, a list of the activities currently in progress, and the number of working days required to complete each.

1.8 SURVEY DATA

- A. Make available for examination throughout the construction period, all field books, notes, and other data developed while performing the surveys required by the Work and submit all such data to Engineer with documentation required for final acceptance of the Work.

1.9 UTILITY INVESTIGATION

- A. Transmit the findings of the utility investigation in accordance with Section 01 71 50 - Protection and Restoration of Existing Facilities.

1.10 QUALITY ASSURANCE/QUALITY CONTROL PLAN

- A. Prepare and submit a Quality Assurance/Quality Control Plan for the Work contained in the Contract in accordance with Section 01 45 00 - Quality Control.

1.11 CONTRACTOR DAILY REPORT

- A. Submit to Engineer, or designee, a daily report. Upload report not later than 9:00 A.M. of the workday following the report date and include the following:
1. Day of week, date, Contractor name and Report number.
 2. Summary of work in process (segregated by Contractor and Subcontractor).
 3. Details of work accomplished including quantities of Work installed.
 4. Summary of equipment working and where working.
 5. Summary of manpower by work element and Subcontractor.
 6. Receipt of major equipment or materials.
 7. All required testing performed and, if available, documented results.
 8. Notification of percent of Work delayed by abnormal weather conditions.
 9. Notification of percent of Work delayed by other utility conflicts or conditions.

1.12 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Manual
1. Submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the *Operations and Maintenance Manual*, written so that it can be used and understood by the Owner's operation and maintenance staff.
 2. Furnish initial submittal of the *Operations and Maintenance Manual* to Engineer upon delivery of the respective equipment.
 3. Subdivide the *Operations and Maintenance Manual* first by Specification Section number; second, by equipment item; and last, by "Part." Conform "Parts" to the following (as applicable):
 - a. Part 1 – Equipment Summary:
 - 1) Summary: In a summary table, indicate the equipment name, equipment number, and process area in which the equipment is installed.
 - 2) Form: Furnish an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the Work. Fill in the relevant information on the form and include it in Part 1.
 - b. Part 2 – Operational Procedures:
 - 1) Procedures: Include manufacturer-recommended procedures on the following in Part 2:
 - a) Installation
 - b) Adjustment
 - c) Startup
 - d) Location of controls, special tools, equipment required, or related instrumentation needed for operation
 - e) Operation procedures
 - f) Load changes
 - g) Calibration
 - h) Shutdown
 - i) Troubleshooting
 - j) Disassembly
 - k) Reassembly
 - l) Realignment
 - m) Testing to determine performance efficiency

- n) Tabulation of proper settings for all pressure relief valves, low and high- pressure switches, and other protection devices
 - o) List of all electrical relay settings including alarm and contact settings
 - p) Lubrication.
- c. Part 3 – Preventive Maintenance Procedures:
- 1) Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place.
 - 2) Schedules: Include recommended frequency of preventive maintenance procedures. Cover lubrication schedules, including lubricant SAE grade, type, and temperature ranges.
- d. Part 4 – Parts List:
- 1) Parts List: Furnish a complete parts list, including a generic description and manufacturer's identification number for each part. Include addresses and telephone numbers of the nearest supplier and parts warehouse.
 - 2) Drawings: Include cross-sectional or exploded view drawings with the parts list.
- e. Part 5 – Wiring Diagrams:
- 1) Diagrams: In this part, include complete internal and connection wiring diagrams for electrical equipment items.
- f. Part 6 – Shop Drawings:
- 1) Drawings: In this part, include approved shop or fabrication drawings, complete with dimensions.
- g. Part 7 – Safety:
- 1) Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.
- h. Part 8 – Documentation:
- 1) Place all equipment warranties, affidavits, and certifications required by the Technical Specifications in this part.
4. Transmit to Engineer, one copy of the *Operations and Maintenance Manual* in digital format. In addition to the digital copy, furnish Engineer with one hard copy of the *Operations and Maintenance Manual*. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. Prepare a table of contents indicating all equipment in the manuals. Display the title of each volume on the cover and spine.
5. Submit *Operations and Maintenance Manuals* in final form, not later than the 75 percent of construction completion date. Correct all discrepancies found by Owner or Engineer in the *Operations and Maintenance Manual* within 30 days from the date of written notification.
6. Incomplete or unacceptable *Operations and Maintenance Manuals* at the 75 percent construction completion point constitute sufficient justification to withhold the amount stipulated in paragraph "*Operations and Maintenance Manual Submittals*" of Section 01 77 00 - Project Closeout, from any monies due.

B. Certificates

- 1. When specified in individual specification sections, submit manufacturers' certificates to Engineer for review as specified.

2. Submit in form of letter or company standard forms, signed by officer of manufacturer.
 3. Include the following with each certification
 - a. Project name and location.
 - b. Contractor's name and address.
 - c. Quantity and date or dates of shipment or delivery to which certificate applies.
 - d. Manufacturer's name.
 - e. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - f. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.
- C. Record Documents
1. Prepare and maintain one set of record documents at the Project Site per the requirements of Section 01 78 39 - Project Record Documents. Submit to Engineer at close of Project.

1.13 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts: Submit a list of spare parts information for all mechanical, electrical, and instrumentation equipment. Include the current list price of each spare part. Limit the spare parts list to those spare parts which each manufacturer recommends be maintained by Owner in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate Owner in ordering. Cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 35 53
SECURITY

PART 1 - GENERAL

1.1 SUMMARY

- A. Protect the active construction areas of the Work, including all material, equipment, field office trailers, and their contents from theft, vandalism, and unauthorized entry.

1.2 DEFINITIONS

- A. For the purposes of this Section, an “active construction area” is any area where construction activities are occurring, or construction activities could be considered a potential hazard to people.

1.3 RELATED SECTIONS

- A. Section 01 57 19 – Temporary Environmental Controls

1.4 SUBMITTALS

- A. Prior to performance of any work at the Project Site, submit to Engineer for record only, a copy of the security plan commensurate with the needs of the Project, signed by officer of Contractor. Be solely responsible for adequacy of the security plan.
- B. Provide Engineer with drawing and data showing temporary fencing and gate locations, along with materials to be used.
- C. Provide Engineer with a list of 24-hour emergency phone numbers for Contractor personnel.
- D. Submit to Engineer an updated progressive inventory of materials and equipment received on-site.
- E. Submit log of workmen and visitors to Project Site.

1.5 SECURITY PROGRAM

- A. Protect Work and existing premises, including the field office trailers and their contents, from theft, vandalism, and unauthorized entry during working and non-working hours.
- B. Accept sole responsibility for Project Site security and protection of the Work.
- C. Initiate the security program at job mobilization and maintain the security program throughout construction period.
- D. Limit lighting to basic safety and security requirements, and shield when possible.
- E. Be responsible for the security of storage compound and lay down area, and for all plant material, equipment, and tools always.

F. Prohibit firearms for the Project Site.

G. Prohibit dogs from the Project Site.

1.6 ENTRY CONTROL

A. Entry control shall not unreasonably limit the personnel of Owner, Engineer, and their operations and maintenance groups from performing assigned duties. Temporary access limitations will be identified to Engineer and the operations and maintenance groups at least 24 hours prior to such limitation.

B. Restrict entry of unauthorized persons and vehicles into Project Site.

C. Allow entry only to authorized persons with proper identification.

D. Maintain a log of workmen and visitors and make log available to Owner on request. This log shall be submitted to Engineer monthly or as necessary.

E. Require all visitors to sign the visitor log acknowledgment of the project rules included in this Section. A copy of the project rules shall be given to each visitor. Submit copies of these forms to Engineer biweekly.

F. Contractor has the right to refuse access to the Project Site or require that a person or vehicle be removed from the Project Site if found violating any of the project rules.

G. Give jobsite security orientation training to all affected employees, including subcontractor employees. Employee participation in the security orientation shall be acknowledged by their respective individual signatures affixed to an orientation roster.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 41 26
PERMITS**

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

- A. Obtain permits required for the execution of Work in accordance with the Contract Documents. Provide copies of these permits to Owner.
- B. The intent of this Section is to furnish the known list of required permits for the Work under the Contract Documents. Owner does not guarantee that this list is complete. Be responsible for determining and verifying the extent of all permits required and for obtaining such permits.
- C. In the Bid Price, include costs for obtaining all necessary permits, including application fees and other costs, and the costs of complying with the conditions of all permits. Any fees listed in this section are estimates and are for information only. Verify and pay all actual fees.
- D. Within 30 Days of the Limited Notice to Proceed, submit a list of all permits and licenses to be obtained, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.

1.2 SUMMARY OF PERMITS TO BE OBTAINED BY CONTRACTOR

- A. Obtain the following permits. Submit copies of these permits to Engineer and maintain copies on-site. Comply with all conditions of the permits.
 - 1. Utah Department of Environmental Quality, Division of Air Quality:
 - a. Fugitive Dust Control Plan and Permit: Utah Admin. Code R307-309 requires a fugitive dust control plan. Plan should include procedures to minimize fugitive dust on-site and prevent fugitive dust capacities from exceeding allowable limits. Plan should be submitted prior to the start of clearing or construction.
 - 1) Agency: Utah Department of Environmental Quality, Division of Air Quality
 - 2) Contact: Division of Air Quality
 - 3) Telephone No.: (801) 536-4000
 - 2. Utah Department of Environmental Quality, Division of Water Quality:
 - a. UPDES General Permit for Construction Dewatering/Hydrostatic Testing of Pipelines: Covers discharge waters associated with dewatering operations and hydrostatic testing of pipelines.
 - 1) Agency: Utah Department of Environmental Quality, Division of Water Quality
 - 2) Contact: Jeanne Riley
 - 3) Telephone No.: (801) 536-4363
 - 4) Email: jriley@utah.gov
 - b. Notification of Chlorinated Water Discharge: This notification provides 30 days' notice prior to disinfection of pipeline and discharge of pipeline and discharge of chlorinated water.

- c. Ground Water Discharge Permit: Necessary for any activity which causes or has the potential to cause a discharge of pollutants to ground water.
 - 1) Agency: Utah Department of Environmental Quality, Division of Water Quality
 - 2) Contact: Eleanor Divver
 - 3) Telephone No.: (801) 536-0091
- 3. Herriman City
 - a. Traffic Control Permit: Required for any work done in public right-of-way that impedes traffic or pedestrian walkway.
 - 1) Agency: Herriman City
 - 2) Contact: Delinda Bodrero
 - 3) Address: 5355 W Herriman Main St
 - 4) Telephone No.: 801-446-5323
 - 5) Email: dbodrero@herriman.gov
 - b. Land Disturbance Permit: Required for any activity disturbing one or more acres of land, requiring placement or stockpiling of materials, requiring work within public right-of-way, or involving grading, excavation, and/or backfilling.
 - 1) Agency: Herriman City
 - 2) Contact: Delinda Bodrero
 - 3) Address: 5355 W Herriman Main St
 - 4) Telephone No.: 801-446-5323
 - 5) Email: dbodrero@herriman.gov
 - c. Tree Protection Plan: Required for any activity which may threaten existing trees or their root systems.
 - 1) Agency: Herriman City
 - 2) Contact: Trent Bristol
 - 3) Address: 5355 W Herriman Main St
 - 4) Telephone No.: 801-446-5323
 - 5) Email: tbristol@herriman.gov
 - d. SWPPP Review and Checklist:
 - 1) Agency: Herriman City
 - 2) Contact: Jonathan Bowers
 - 3) Address: 5355 W Herriman Main St
 - 4) Telephone No.: 801-446-5323
 - 5) Email: jbowers@herriman.gov
- 4. Salt Lake County
 - a. Existing Monument Preservation Permit is required to verify compliance with County policies and ordinances regarding existing public survey monuments. It is estimated that approximately 12 existing survey monuments have the potential to be disturbed by Project construction activity.
 - 1) Agency: Salt Lake County
 - 2) Contact: Salt Lake County Surveyor
 - 3) Address: 2001 South State Street, Suite N1-400, PO Box 144575, Salt Lake City, UT 84114-4575
 - 4) Telephone No.: (385) 468-8250

1.3 SUMMARY OF PERMITS OBTAINED BY OWNER

- A. The following permits have been or will be obtained by Owner for this Project. Verify and comply with conditions of said permits.

1. Salt Lake County
 - a. Flood Control Permit
2. USBR
 - a. SF-299
3. Herriman City
 - a. Floodplain Development Permit
4. State of Utah
 - a. Stream Alteration Permit

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 42 13
ABBREVIATIONS OF INSTITUTIONS

PART 1 - GENERAL

1.1 GENERAL

- A. Wherever in the Contract Documents, references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the reader, the following acronyms or abbreviations which may appear in the Contract Documents shall have the meanings indicated herein.

1.2 ABBREVIATIONS

AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers

ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturer's Association
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturer's Institute
CLSI	Clinical and Laboratory Standards Institute
CRSI	Concrete Reinforcing Steel Institute
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
EPA	Environmental Protection Agency
FM	Factory Mutual System
FPL	Forest Products Laboratory
HI	Hydronics Institute
IAPMO	International Association of Plumbing and Mechanical Officials
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Power Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society

IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
ISA	Instrument Society of America
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society
MTI	Marine Testing Institute
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NLGI	National Lubricating Grease Institute
NSF	National Sanitation Foundation International
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastics Pipe Institute
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association

SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPI	Society of the Plastics Industry, Inc.
SPR	Simplified Practice Recommendation
SSPC	Society for Protective Coatings
SSPWC	Standard Specifications for Public Works Construction
TIA	Telecommunications Industry Association
UL	Underwriters Laboratories, Inc.
WEF	Water Environment Federation
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association
WWPA	Western Wood Products Association (WWPA)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Titles of Sections and Paragraphs: Captions accompanying Specification Sections and Paragraphs are for convenience of reference only, and do not form a part of the Specifications.
- B. Applicable Publications: Whenever in these Specifications, references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies, which have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.
- C. Specialists, Assignments: In certain instances, Specification text requires (or implies) that specific Work is to be assigned to specialists or expert entities, who must be engaged for the performance of that Work. Such assignments shall be recognized as special requirements with no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, accept the final responsibility for fulfillment of the entire set of contract requirements.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall conform to or exceed the requirements of applicable codes and the applicable requirements of the following documents.
- B. References herein to "Building Code", "Plumbing Code", "Mechanical Code", "Fuel Gas Code", or "Fire Code" shall mean the latest adopted version of the International Building Code (IBC), the International Plumbing Code (IPC), the International Mechanical Code (IMC), the International Fuel Gas Code (IFGC), and the International Fire Code (IFC) as published by the International Code Council (ICC). Similarly, references to the "Uniform Mechanical Code" or the "Uniform Plumbing Code" shall mean the Uniform Mechanical Code or the Uniform Plumbing Code as published by the International Association of Plumbing and Mechanical Officials (IAPMO) References to the "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA). The latest edition of any "building" code as approved by the Municipal Code and adopted by the authority having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

- C. In case of conflict between codes, reference standards, Drawings and the other Contract Documents, the most stringent requirements shall govern. Bring all conflicts to the attention of Engineer for clarification and directions prior to ordering or providing any materials or furnishing labor. Bid the most stringent requirements.
- D. Construct the Work indicated herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein.
- E. Applicable Standard Specifications: References in the Contract Documents to the "Standard Specifications" shall mean the *Manual of Standard Specifications (APWA)*, latest version.
- F. References herein to "OSHA Regulations for Construction" shall mean *Title 29, Part 1926, Construction Safety and Health Regulations*, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- G. References herein to "OSHA Standards" shall mean *Title 29, Part 1910, Occupational Safety and Health Standards*, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
- H. References herein to "UDOT Standards" shall mean *Standard Specifications for Road and Bridge Construction*.
- I. References herein to "MSHA Standards" shall mean *Mine Safety and Health Administration Standards*, latest version.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

- A. Be responsible that all Work included in the Contract Documents, whether shown or not, complies with all EPA, OSHA, RCRA, NFPA, and any other Federal, State, and Local Regulations governing the storage and conveyance of hazardous materials, including petroleum products.
- B. Where no specific regulations exist, all chemical, hazardous, and petroleum product piping and storage in underground locations must be installed with double containment piping and tanks, or in separate concrete trenches and vaults, or with an approved lining which cannot be penetrated by the chemicals, unless waived in writing by Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 45 00
QUALITY CONTROL**

PART 1 - GENERAL

1.1 SUMMARY

- A. The requirements of this Section apply to, and are a component part of, each Section of the Specifications.

1.2 REFERENCES

- A. ASTM International (ASTM) standards, most recent editions:

ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
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ASTM D3740	Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
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ASTM D3666	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
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1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Submit Quality Control Plan.
- C. Submit credentials for field Quality Control Representative showing experience acceptable to Engineer.
- D. Submit credentials for testing laboratory showing compliance with Specifications and acceptable to Engineer.
- E. Submit results of testing as specified below.

1.4 SITE INVESTIGATION AND CONTROL

- A. Check and verify all dimensions and conditions in the field continuously during construction. Be solely responsible for any inaccuracies built into the Work due to Contractor's (including Subcontractor's) failure to comply with this requirement.
- B. Inspect related and appurtenant Work and report in writing to Engineer, any conditions which will prevent proper completion of the Work. Failure to report any such conditions constitutes acceptance of all Site conditions. Required removal, repair, or replacement caused by unsuitable conditions shall be performed at no additional cost to Owner.

1.5 INSPECTION OF THE WORK

- A. Inspect all Work performed by both Contractor and Subcontractors. Nonconforming Work and any safety hazards in the work area shall be noted and promptly corrected. Be responsible for the Work to be performed safely and in conformance with the Contract Documents.
- B. The Work shall be conducted under the general observation of Engineer and is subject to inspection by representatives of Owner acting on behalf of Owner to ensure strict compliance with the requirements of the Contract Documents. Such inspection may include mill, plant, shop, or field inspection, as required. Owner, Engineer, or any inspector(s) shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated.
- C. The presence of Engineer, or any inspector(s), shall not relieve Contractor of responsibility for the proper execution of the Work in accordance with all requirements of the Contract Documents. Compliance is the responsibility of Contractor. No act or omission on the part of Engineer, or any inspector(s) shall be construed as relieving Contractor of this responsibility. Inspection of Work later determined to be nonconforming shall not be cause or excuse for acceptance of the nonconforming Work. Owner may accept nonconforming Work when adequate compensation is offered, and it is in Owner's best interest as determined solely by Owner.
- D. All materials and articles furnished shall be subject to rigid documented inspection by qualified personnel. No materials or articles shall be used in the Work until they have been inspected and accepted by Contractor's Quality Control Representative and Engineer or other designated representative. No Work shall be backfilled, buried, cast in concrete, covered, or otherwise hidden until it has been inspected. Any Work covered in the absence of inspection shall be subject to uncovering. Where uninspected Work cannot be easily uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection.
- E. All Owner furnished materials and articles shall be subject to rigid inspection by Contractor's Quality Control Representative before being used or placed in the Work. Inform Engineer, in writing, of the results of said inspections within one working day after completion of inspection. If any material or articles provided by Owner are considered to be of insufficient quality for use in the Work, immediately notify Engineer.

1.6 TIME OF INSPECTION AND TESTS

- A. Furnish and prepare samples and test specimens required under these Specifications and for testing in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. Furnish and prepare all required test specimens without additional expense to Owner. As provided in the Contract Documents, performance of certain tests will be by Owner, and all costs therefore will be borne by Owner, except that the costs of any test, which shows unsatisfactory results shall be back charged to Contractor.
- B. Notify Engineer at least three Workdays before being ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under this Contract and request inspection before beginning any such Work of covering. Failure to notify Engineer at least three Workdays in advance of any such inspections shall be reasonable cause for Engineer to order a sufficient

delay in scheduled operations to allow time for such inspection. Be responsible for costs of any remedial or corrective work required, and all costs of such delays, including its impact on other portions of the Work.

1.7 SAMPLING AND TESTING

- A. Unless otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, Engineer reserves the right to use any generally-accepted system of inspection which, in the opinion of Engineer, will ensure Engineer that the quality of the workmanship is in full accord with the Contract Documents.
- B. Owner reserves the right to waive tests or quality control measures. However, waiver of any specific testing or other quality control measure, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality control requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the Contract Documents.
- C. Notwithstanding the existence of such waiver, Owner reserves the right to make independent investigations and tests as specified in the following paragraph and failure of any portion of the Work to meet qualitative requirements of the Contract Documents shall be reasonable cause for Owner to require the removal or correction and reconstruction of any such Work.
- D. In addition to any other inspection or quality control provisions that may be specified, Owner reserves the right to independently select, test, and analyze, at the expense of Owner, additional test specimens of any or all the materials to be used. Results of such additional tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the Work is discovered, as a result of such independent testing or investigation by Engineer, which fails to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such Work shall be borne by Contractor.

1.8 RIGHT OF REJECTION

- A. Engineer or designated representative, acting for Owner, always reserves the right to reject any articles or materials furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the Site. If Engineer or designated representative, through an oversight or otherwise, has accepted materials or Work which are defective or in any way contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected.
- B. Promptly remove or replace rejected articles or materials from the Site of the Work after notification of rejection.
- C. Bear all costs of removal and replacement of rejected articles or materials.

- D. Failure to promptly remove and replace rejected Work shall be considered a breach of this Contract and Owner may, after 7 days' notice, terminate Contractor's right to proceed with the affected Work and remove and replace the Work and issue a back charge to cover the cost of the Work.

1.9 QUALITY CONTROL REQUIREMENTS

- A. Establish and execute a Quality Control program for the services, which are being provided. The program shall provide adequate measures for verification and conformance to defined requirements of all personnel, including lower-tier subcontractors (including fabricators, suppliers, and sub-subcontractors). Prepare and submit a plan responsive to this Section for review by Engineer.
- B. Furnish Engineer with a project specific Quality Control Plan. The plan shall contain a comprehensive account of quality control procedures applicable to this Project. The detailed requirements for this Plan are delineated in the following paragraphs. No progress payments will be made until the Quality Control Plan is fully accepted by Engineer.
- C. Using the Quality Control Plan, describe and define the personnel requirements described herein. Provide personnel with assigned quality control functions reporting to a field Quality Control Representative. The field Quality Control Representative shall report to a senior manager of Contractor and shall not have supervisory or managerial responsibility over the work force. Persons performing quality control functions shall have sufficient qualifications, authority, and organizational freedom to identify quality problems and to initiate and recommend solutions. Contractor's Quality Control representative(s) shall be on-site as often as necessary (but not less than the daily hours specified in the Contract Documents) to remedy and demonstrate that Work is being performed properly and to make multiple observations of all Work in progress. The Quality Control Plan shall include a statement by the senior manager designating the Quality Control Representative and specifying authorities delegated to the Quality Control Representative to direct cessation or removal and replacement of defective Work.
- D. The Quality Control Plan shall ensure the achievement of adequate quality throughout all applicable areas of the contract. In the Quality Control Plan, describe the program and include procedures, work instructions and records. In addition, describe methods relating to areas that require special testing and procedures as noted in the Specifications.
- E. Identification and Control of Items and Materials: Describe procedures in the Quality Control Plan to ensure that items or materials that have been accepted at the site are properly used and installed. Provide procedures for proper identification and storage, and to prevent the use of incorrect or defective materials.
- F. Inspection and Tests: Provide written procedures defining a program for control of inspections performed. These procedures shall be described in the Quality Control Plan.
 - 1. Inspections and tests shall be performed and documented by qualified individuals. At a minimum, "qualified" shall mean having performed similar quality control functions on similar type projects. Records of personnel experience, training and qualifications shall be maintained and made available for review by Engineer upon request.
 - 2. Maintain and provide to Engineer, within two working days of completion of each inspection and test, adequate records of all such inspections and tests. Inspection and

- test results shall be documented and evaluated to ensure that requirements have been satisfied.
3. Procedures shall include:
 - a. Specific instructions defining procedures for observing all Work in process and comparing this Work with the Contract requirements (organized by specification section).
 - b. Maintaining and providing Daily Inspection Reports. Such reports shall, at a minimum, include the following:
 - 1) Item(s) inspected
 - 2) Quality characteristics in compliance
 - 3) Quality characteristics not in compliance
 - 4) Corrective/remedial actions taken
 - 5) Statement of certification
 - 6) QC Manager's signature
 - c. Specific instructions for recording all observations and requirements for demonstrating through the reports that the Work observed complied, or a deficiency was noted and action to be taken.
 - d. Procedures to preclude the covering of deficient or rejected Work.
 - e. Procedures for halting or rejecting Work.
 - f. Procedures for resolution of differences between the Quality Control Representative(s) and the production representative(s).
 4. The Quality Control Plan shall identify all contractual hold/inspection points as well as any Contractor imposed hold/inspections points.
 5. The Quality Control Plan shall include procedures to provide verification and control of all testing provided, including:
 - a. Maintaining and providing to Engineer Daily Testing Records. Such records shall, at a minimum, contain the following:
 - 1) Item(s) tested
 - 2) Quality characteristics in compliance
 - 3) Statement of correctness & certification
 - 4) Quality characteristics not in compliance
 - 5) Corrective/remedial actions taken
 - 6) QC Manager's signature
 - b. Individual test records will contain the following information:
 - 1) Item tested –item number and description
 - 2) Test results
 - 3) Test designation
 - 4) Test work sheet including location sample was obtained
 - 5) Acceptance or rejection
 - 6) Date sample was obtained
 - 7) Retest information, if applicable
 - 8) Control requirements
 - 9) Tester signature
 - 10) Testing QC staff initials
 - c. Providing for location maps for all tests performed or location of Work covered by the tests.
 - d. Maintaining copies of all test results.
 - e. Ensuring Engineer receives independent copy of all tests.
 - f. Ensuring testing lab(s) are functioning independently and in accordance with the specifications.

- g. Ensuring re-tests are properly taken and documented.
- G. Control of Measuring and Test Equipment: Measuring and/or testing instruments shall be adequately maintained, calibrated, and adjusted to maintain accuracy within prescribed limits. Perform calibration at specified periods against valid standards traceable to nationally recognized standards and documented.
- H. Supplier Quality Assurance: The Quality Control Plan shall include procedures to ensure that procured products and services conform to the requirements of the Contract Documents. Requirements of these procedures shall be applied, as appropriate, to lower-tier suppliers and/or Subcontractors.
- I. Deficient and Nonconforming Work and Corrective Action: The Quality Control Plan shall include procedures for handling of deficiencies and non-conformances. Deficiencies and non-conformances are defined as documentation, drawings, material, equipment, and Work not conforming to the specified requirements or procedures. The procedure shall prevent non-conformances by identification, documentation, evaluation, separation, disposition, and corrective action to prevent recurrence. Conditions having adverse effects on quality shall be promptly identified and reported to the senior level management. The cause of conditions adverse to quality shall be determined and documented and measures implemented to prevent recurrence. In addition, at a minimum, this procedure shall address:
 - 1. Personnel responsible for identifying deficient and non-complying items within the work.
 - 2. How and by whom deficient and non-compliant items are documented "in the field".
 - 3. The personnel and process utilized for logging deficient and non-compliant work at the end of each day onto a Deficiency Log.
 - 4. Tracking processes and tracking documentation for deficient and non-compliant items.
 - 5. Personnel responsible for achieving resolution of outstanding deficiencies.
 - 6. Once resolved, how are the resolutions documented and by whom.
- J. Special Processes and Personnel Qualifications
 - 1. The Quality Control Plan shall include detailed procedures for the performance and control of special process (e.g., welding, soldering, heat treating, cleaning, plating, nondestructive examination, etc.).
 - 2. Personnel performing special process tasks shall have the experience, training, and certifications commensurate with the scope, complexity, or nature of the activity. They shall be approved by Engineer before the start of Work on the Project.
- K. Audits: The Quality Control Plan shall provide for documented audits to verify that quality control procedures are being fully implemented by Contractor as well as its subcontractors. Audit records shall be made available to Engineer upon request.
- L. Documented Control/Quality Records
 - 1. Establish methods for control of Contract Documents, which describe how Drawings and Specifications are received and distributed to assure the correct issue of the document being used. The methods shall also describe how as-built data are documented and furnished to Engineer.
 - 2. Maintain evidence of activities affecting quality, including operating logs, records of inspections and tests, audit reports, material analyses, personnel qualification and certification records, procedures, and document review records.

3. Quality records shall be maintained in a manner that provides for timely retrieval, and traceability. Quality records shall be protected from deterioration, damage, and destruction.
 4. Provide a list with specific records as specified in the Contract Documents, which will be furnished to Engineer at the completion of activities.
- M. Acceptance of Quality Control Plan: Engineer's review and acceptance of the Quality Control Plan shall not relieve Contractor from any of its obligations for the performance of the Work. Contractor's quality control staffing is subject to Engineer's review and continued acceptance. Owner, at its sole option, without cause, may direct Contractor to remove and replace the Quality Control Representative. No Work covered by the Quality Control Plan shall start until Engineer's acceptance of the Quality Control Plan has been obtained.
- N. Engineer may perform independent quality assurance audits to verify that actions specified in the Quality Control Plan have been implemented. No Engineer audit finding or report shall in any way remove any requirements of this Contract.

1.10 TESTING SERVICES

- A. All tests which require the services of a laboratory to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to Engineer. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the tests in accordance with the specified standards.
- B. Independent testing laboratory shall be accredited by the American Association of State Highway and Transportation Officials (AASHTO) for the tests they will perform and as appropriate for the Work being performed. The laboratory shall also be accredited under ASTM C1077, ASTM D3740, and ASTM D3666.
- C. Engineer shall have the right to inspect work performed by the independent testing laboratory both at the project and at the laboratory. This shall include inspection of the independent testing laboratory's internal quality assurance records (quality assurance manual, equipment calibrations, proficiency sample performance, etc.).
- D. Obtain Engineer's acceptance of the testing firm before having services performed. Pay all costs for these testing services.
- E. Testing services provided by Owner, if any, are for the sole benefit of Owner. However, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.
- F. Testing Services furnished by Contractor: Unless otherwise specified, and in addition to all other specified testing requirements, provide all testing services in connection with the following materials as required for Engineer's review:
1. Concrete materials and mix designs.
 2. Embankment, fill, and backfill materials.
 3. Quality control testing of all precast concrete.
 4. All other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work.
 5. In addition, the following quality control tests shall be performed by Contractor:

- a. Holiday testing of pipeline coatings.
 - b. Air testing of field-welded joints for steel pipe or pipe cylinders and fabricated specials.
 - c. All testing and inspection of welding work including, but not limited to, welding procedure qualifications, welder operator qualifications, all work performed by the certified welding inspector, all appropriate nondestructive testing of welds and all repair and retest of weld defects.
- G. Transmittal of Test Reports: Written reports of tests and engineering data furnished for Engineer's review of materials and equipment proposed to be used in the Work shall be submitted per Section 01 33 20 - Submittal Procedures.
- H. The testing firm retained for material field testing shall furnish an electronic copy of each test report. Transmit to Engineer within three Workdays after test is completed. Consecutively number each report for each type of test.
- I. Testing firm shall furnish an electronic copy of each field and laboratory quality control test to Contractor, Owner and Engineer

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

bridges or steel plates in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case. Adopt designs furnished by said authority for such bridges or steel plates, or submit designs to said authority for approval, as may be required. New designs shall be stamped and signed by a professional engineer, licensed to practice in Utah.

- C. Street Use: Nothing herein shall be construed to entitle Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the Work hereunder. Conduct operations so as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No street shall be closed to the public without first obtaining permission of Engineer and proper governmental authority. Where excavation is being performed in primary streets or highways, always maintain one lane in each direction open to traffic unless otherwise indicated. Provide toe boards to retain excavated material if required by Engineer or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the Work shall always be kept accessible to fire-fighting equipment. Temporary provisions shall be made to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.
- D. Traffic Control: For the protection of traffic in public or private streets and ways, provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the MUTCD, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations."
- E. Take all necessary precautions for the protection of the Work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. Station such guards or flaggers and conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to OSHA Safety and Health Standards for Construction.
- F. Temporary Street Closure: If closure of any street is required during construction, apply in writing to the authority having jurisdiction at least 30 days in advance of the required closure for signage and detour requirements.
- G. Temporary Driveway Closure: Notify property owner or occupant (if not owner-occupied) of the closure of the driveways to be closed more than one eight-hour workday at least three working days prior to the closure. Minimize the inconvenience and minimize the time that the driveways will be closed. Fully explain to the owner/occupant how long the work will take and when closure is to start.

1.5 WORK AND STORAGE AREA

- A. Make independent arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the Work.
- B. Lands to be furnished by Owner for construction operation and other purposes are indicated. Should it be necessary to use any additional land for staging or for other purposes during the construction of the Work, independently arrange for the use of such lands and pay any

required rental or use fees. Unless otherwise shown, specified, or agreed, all sites shall be returned to their original condition or better upon completion of the Work.

- C. Nothing herein shall imply granting an exclusive use of roadways or public and/or private land employed to perform the Work.
- D. Temporary Storage Buildings and Enclosures
 - 1. Provide environmental control systems that meet recommendations of manufacturers of equipment and materials to be stored therein.
 - 2. Arrange and partition to provide security of contents and ready access for inspection and inventory.
- E. Construct and use a separate storage area with adequate spill containment for hazardous materials used in constructing the Work.
 - 1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.
 - 2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.
 - 3. Develop and submit to Engineer a plan for storing and disposing of the materials above.
 - 4. The separate storage area shall meet the requirements of authorities having jurisdiction over the storage of hazardous materials.
 - 5. Hazardous materials which are delivered in containers, shall be stored in the original containers until use. Hazardous materials which are delivered in bulk, shall be stored in containers which meet the requirements of authorities having jurisdiction.
 - 6. Obtain and submit to Engineer a single EPA number for wastes generated at the site.
 - 7. The separate storage area shall be inspected by the proper authorities prior to construction of the area, upon completion of construction of the area, and upon cleanup and removal of the area.
- F. In the event machinery and equipment need servicing on site, be responsible to clean environmentally hazardous materials from the site immediately.

1.6 PARKING

- A. Traffic and parking areas shall be maintained in a sound condition, free of excavated material, construction equipment, mud, and construction materials. Repair breaks, potholes, low areas, which collect standing water, and other deficiencies.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 EXPLOSIVES AND BLASTING

- A. The use of explosives on the Work will not be permitted.

1.2 DUST ABATEMENT

- A. Furnish all labor, equipment, and methods required to prevent, control, and mitigate fugitive dust from the construction activities. In complying with this requirement, conform to all local requirements in all circumstances. Be responsible for damage resulting from dust generated by its activities. Dust abatement measures shall be continued until Engineer directs otherwise.

1. Unpaved Roads: Apply liquid dust palliative as appropriate for traffic areas as approved by Engineer.
2. All other Non-Paved Work Areas: Apply a liquid dust palliative (soil stabilizer type) derived from natural organic plant sources and containing no growth – or germination – inhibiting materials as approved by Engineer. Application shall be effective for dust suppression according to applicable County Health District Air Pollution Control Division dust regulations. Do not allow movement of vehicles or storage of materials on treated areas.

1.3 RUBBISH CONTROL

- A. Prepare a trash abatement program and submit to Engineer for review. The program shall include placing all litter, trash, garbage, construction debris, and refuse in scavenger-proof, resealable containers. Trash includes, but is not limited to, cigarettes, cigars, gum wrappers, tissue, cans, paper, and bags. During the progress of the Work, keep the Project Site and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. Dispose of all rubbish and waste materials of any nature occurring at the Project Site, establish regular intervals of collection and disposal of such materials and waste. Keep haul roads free from dirt, rubbish, and unnecessary obstructions resulting from construction operations. Disposal of all rubbish and surplus materials shall be off the Site in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.
- B. Clean up and properly dispose of any oil, fuel, and other equipment leaks at the time of occurrence. Service and maintenance vehicles shall carry a bucket and pads to absorb leaks and spills. Notify Engineer of any spills or leaks at the time of occurrence.

1.4 SANITATION

- A. Toilet Facilities: Provide fixed or portable chemical toilets wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

- B. Sanitary and Other Organic Wastes: Establish a regular collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities or organic material wastes from any other source related to the construction operations shall be disposed of away from the Site in a manner satisfactory to Engineer and in accordance with all laws and regulations pertaining thereto.

1.5 CHEMICALS

- A. All chemicals used during project construction or furnished for project operation, whether soil sterilant, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.6 CULTURAL RESOURCES

- A. Direct attention to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800, which provide for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").
- B. Conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.
- C. In the event potential cultural resources are discovered during subsurface excavations at the Site of construction, institute the following procedures:
 - 1. Engineer will issue a Field Order directing the cessation all construction operations at the location of such potential cultural resources find. Mark the area in an appropriate manner to ensure that all construction equipment, activities, and personnel remain clear of the area until further notice.
 - 2. Field Order shall be effective until such time as a qualified archaeologist can be called to assess the value of these potential cultural resources and make recommendations to the State Historic Preservation Office.
- D. If the archaeologist determines that the potential find is a bona fide cultural resource, at the direction of the State Historic Preservation Office, suspend work at the location of the find under the provisions for changes contained in Articles 10, 11, and 12 of the General Conditions.

1.7 AIR QUALITY

- A. Maintain all vehicles and equipment in proper tune.
- B. Use Best Available Control Technology on construction equipment, including a timing retardation.
- C. Use natural-gas powered construction equipment where possible.
- D. Encourage employee car-pooling.

1.8 NOISE

- A. Comply with the hours of work as allowed by the local jurisdiction or land management agency.
- B. Noise limits on construction equipment will comply with the noise limits of the local jurisdiction or land management agency. All construction equipment shall be equipped with manufacturer's standard noise control devices (i.e., mufflers, acoustical lagging, and/or engineer enclosures). Take special care not to throttle the engine excessively and keep engine speed as low as possible. Do not leave the equipment running or idling needlessly, especially when near noise-sensitive land uses. Noise-sensitive land uses include, but are not limited to, residences, schools, hospitals, libraries, retirement and elderly care centers, religious and worship facilities, courts of law, certain noise-sensitive professional offices, and quiet recreational areas such as campgrounds and hiking trails.
- C. Use newer equipment whenever possible. Inspect all construction equipment at periodic intervals to ensure proper maintenance and the presence of noise control devices (i.e., mufflers and shrouding, etc.)
- D. Keep heavy, noisier equipment a minimum of 100 feet away from the property line of any noise-sensitive land use for any length of time. Avoid coming closer than 200 feet if multiple pieces of equipment are operating simultaneously. If such cases are unavoidable, avoid throttling the engine excessively or leaving the equipment running needlessly. Heavy equipment shall be operated in a manner to comply with the jurisdiction's noise ordinance and vibration performance standard. To comply with these requirements, it may be necessary to operate heavy equipment only 30 minutes out of each one-hour period at distances closer than 200 feet from an occupied property. During the remaining 30 minutes, the equipment should move further away or be shut down but may resume 30 minutes later.
- E. Locate stationary noisy equipment away from construction boundaries that are near noise-sensitive uses.
- F. Concrete trucks shall perform initial mixing and other activities that require high revving of the truck engine a minimum of 600 feet from noise-sensitive land uses. Keep engine revolutions per minute as low as possible at closer distances.
- G. Whenever possible, use electric hand tools rather than gas-powered tools.
- H. If operation of dewatering pumps and generators is required between the hours of 6 p.m. and 7 a.m. and within 600 feet of a noise-sensitive land use, they shall be treated with acoustical noise control measures (e.g., mufflers, shrouding, and/or enclosures) so as not to exceed 56 dba at 50 feet or other appropriate requirements of the local jurisdiction.
- I. If requested by the Engineer, install temporary noise barriers for construction activities, including staging areas that occur closer than 100 feet from noise-sensitive land uses. Noise barriers can be made of plywood, heavy vinyl curtain material, natural or temporary earth berms, or stockpiles of construction material.

1.9 CONTROL OF SURFACE WATER

- A. Be advised that portions of the Work site are located on hills and at elevations higher than other structures, this may lead to or be subject to flooding from surface waters. Work located outside major drainage ways may still be subject to minor channelized flows and overland sheet flow during some rainfall events. Work is not to impact properties or structures
- B. Be responsible for protecting the Work and temporary facilities from damage due to flooding, runoff, surface water flows, and related subsurface flows until final Project closeout. Provide protection for all aspects of the Work whether temporary or permanent. Provide all materials and equipment required to protect the Work. No additional payment will be made by Owner for providing protective measures or for any damage resulting from said flows. All damage from said flows shall be completely replaced in accordance with the Contract Documents at no additional cost to Owner.
- C. Be responsible for protecting the existing facilities from damage due to flooding, runoff, surface water flows and related subsurface flows that may leave the Work site due to construction activities and that would normally not leave the site prior to construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 71 00
MOBILIZATION**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Organization and mobilization of the forces.
- B. Transporting construction equipment to the jobsite and setting up.
- C. Transporting various tools, materials, and equipment to the jobsite.
- D. Erection of temporary buildings and facilities as required for field offices, staging, storage, and construction operations.

1.2 PAYMENT FOR MOBILIZATION

- A. Payment for mobilization shall be as described in Section 01 20 00 – Measurement and Payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Mobilization shall include the following principal items:
 - 1. Provide all required insurance certificates and bonds.
 - 2. Move onto the site, or portion of site as available, of all equipment required for first month's operations including office and storage trailers.
 - 3. Install temporary construction power, wiring, and lighting facilities.
 - 4. Develop construction water supply.
 - 5. Provide all on-site communication facilities, including telephones, cordless phone antenna, and radio pagers.
 - 6. Provide on-site sanitary facilities and potable water facilities.
 - 7. Arrange for and erection of work and storage yard.
 - 8. Construct and implement security features and requirements complying with Section 01 31 30 – Safety.
 - 9. Obtain all required permits.
 - 10. Post all OSHA required notices and establish safety programs.
 - 11. Provide Superintendent at the job site full time.

3.2 SUBMITTAL REQUIREMENTS

- A. The following submittals are due by the day indicated and must be approved by Owner as a condition precedent to completion of mobilization.

No.	Submittal	Specification Section
1.	Quality Assurance / Control Plan	01 45 00
2.	Mobilization Plan	01 71 00
3.	Safety Program	01 31 30
4.	Concrete Mix Designs	03 30 00
5.	List of Permits and Licenses	01 41 26
6.	Schedule of Submittals	01 33 20

3.3 MOBILIZATION PLAN

- A. Within 15 Days after receipt of the Notice to Proceed, submit a mobilization plan to Engineer for approval, which shall include a breakdown showing the estimated value of each component of mobilization as described in paragraphs 3.1 and 3.2 herein.
- B. Include a bar chart schedule showing each item of mobilization listed in paragraphs 3.1 and 3.2 herein and include scheduled start date, finish dates, and total duration. The plan shall also list each activity to be initiated in the first 90 Days following Notice to Proceed, complete, with scheduled start date, finish date, and total duration.

END OF SECTION

**SECTION 01 71 30
SITE CONDITIONS SURVEYS**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements to document conditions of the Project Site and adjacent properties before construction begins and after completion of the Work. Methods include still photographs, digital video recordings, and topographic surveys.

1.2 SUBMITTALS

- A. Submit all photographs, digital videos, and topographic survey data of the preconstruction conditions to Engineer for record purposes prior to, but not more than three weeks before, commencement of any construction activities.

1.3 CLOSEOUT SUBMITTALS

- A. Complete and submit all digital videos, still photographs, mapping, and survey data of the postconstruction conditions to Engineer prior to final inspection by Owner and Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Conduct thorough preconstruction and postconstruction Site conditions surveys of the entire Project. Site conditions surveys shall consist of photographs, digital video recordings, and topographic mapping. Provide and submit sufficient photographs, supplemented by digital video, to Engineer to resolve any damage claims, which may arise due to the construction of this Project. Develop topographic mapping using the Project coordinates and referenced to the Project base lines and benchmarks. Mapping shall be adequate to ascertain preconstruction and postconstruction conditions (including elevations) of all public and private property within and adjacent to the construction limits.
- B. Digital video or photographic surveys shall include, but not be limited to, all access roads used to transport material or equipment to and from the Site and elevation of roadways, drives, walks, and buildings. Use spot elevation surveys to document the elevation on abutting roadways, drives, and walks, taken at approximately 20-foot intervals and at the point of juncture with any structure to which they are attached or otherwise influenced by the Work.
- C. Digital video recordings required as part of this Section and by Section 31 10 00 – Site Preparation and Section 31 23 00 – Earthwork may be combined into a single set of media provided all the requirements for videos specified in all Sections are met.
- D. As a minimum, note preconstruction and postconstruction conditions and perform digital video surveys of the following:

1. Areas used to access the Site or haul materials and equipment to the Site.
2. The access road, both original and relocated locations and ultimately to the Site.
3. All Work areas, including, but not limited to, access corridors, disposal areas, and staging areas.
4. Temporary Construction Easement areas
5. Any work completed by other contractors at the Site that will be impacted or otherwise affected by Work of this Project.

END OF SECTION

SECTION 01 71 50
PROTECTION AND RESTORATION OF EXISTING FACILITIES

PART 1 - GENERAL

- A. Protect all existing utilities and improvements not designated for removal and restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, in accordance with the Contract Documents.
- B. Call Blue Stakes before commencing any digging for location of underground utility lines and cable locations.

1.2 RIGHTS-OF-WAY

- A. Do not perform any work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure. Do not enter upon the rights-of-way involved until notified by Engineer that Owner has secured authority therefore from the proper party.
- B. After authority has been obtained, give said party due notice of intention to begin work, if required by said party, and remove, shore, support or otherwise protect such pipeline, transmission line, ditch, fence, or structure or replace same.
- C. When two or more contracts are being executed at one time on the same or adjacent land in such manner that work on one contract may interfere with that on another, Owner will determine the sequence and order of the Work. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by Owner to Contractor so desiring, to the extent, amount, in the manner, and at the times permitted and in full conformance with the conditions of the Contract Documents.
- D. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage, except as provided for temporary suspension of the Work in the General Conditions of the Contract.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

- A. Do not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization from governing agency. Do not begin pavement breaking or excavation until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. Accurately replace survey markers or points disturbed after all street or roadway resurfacing has been completed.
- B. Obtain all monument permits required, see Section 01 41 26 – Permits.

1.4 RESTORATION OF PAVEMENT

- A. General: Replace all paved areas cut or damaged during construction with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing a permit. The pavement restoration requirement to match existing sections applies to all components of existing sections, including sub-base, base and pavement. Conform temporary and permanent pavement to the requirements of the affected jurisdictional agency. Neatly saw cut pavements, which are subject to partial removal, in straight lines.
- B. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, place temporary surfacing promptly after backfilling and maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.
- C. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, saw cut back and trim the edge to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement. Refer to plans for minimum dimension of T-patch replacement width over disturbed pipeline trenches in paved areas.
- D. Pavement Crown: In areas where pipeline trenching impacts an existing crown of asphalt, survey, and submit to Engineer documentation showing the pre-construction location of the crown prior to trenching. Replace the crown of asphalt to its pre-construction location to the satisfaction of the governing agency and Engineer.
- E. Restoration of Sidewalks or Private Driveways: Wherever sidewalks or private roads have been removed for purposes of construction, place suitable temporary sidewalks or roadways promptly after backfilling and maintain them in satisfactory condition for the period fixed by the authorities having jurisdiction over the affected portions before proceeding with the final restoration. If no such period of time is so fixed, maintain said temporary sidewalks or roadways until the final restoration thereof has been made.
- F. Restoration of Curb and Gutter: Wherever curb and gutter, including driveway and sidewalk approaches, have been removed for purposes of construction, replace these improvements following construction to the specific dimension and requirements of the authority having jurisdiction. Replace improvements, including required ADA access details to the latest version of the authoritative standard regardless of their preconstruction condition.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

- A. General. Protect underground utilities and other improvements, which may be impaired during construction operations, regardless of whether the utilities are indicated on the Drawings. Take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.
- B. Except for utilities specifically located on the Drawings, be responsible for exploratory excavations (potholing) as deemed necessary to determine the exact locations and depths of

utilities, which may interfere with the Work. Perform all such exploratory excavations as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the Work's progress. When such exploratory excavations show the utility locations as shown on the Drawings to be in error, so notify Engineer. Refer to plans for minimum advance distance that potholing must be performed prior to pipeline trenching work.

- C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.
- D. Utilities to be Moved: In case it becomes necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of Contractor, be notified by Owner to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, notify Engineer a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.
- E. Utilities to be Removed: Where the proper completion of the Work requires temporary or permanent removal and/or relocation of an existing utility or other improvement which is indicated, remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to Engineer and the owner of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition as found prior to removal.
- F. Owner's Right of Access: Owner and owners of public utilities and franchises reserve right to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work of this Contract.
- G. Underground Utilities Indicated: Existing utility lines that are indicated or the locations of which are made known prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced unless otherwise repaired by the owner of the damaged utility. If the owner of the damaged facility performs its own repairs, reimburse said owner for the costs of repair.
- H. Underground Utilities Not Indicated: In the event of damage to existing utility lines that are not indicated or the locations of which are not made known prior to excavation, make a verbal report of such damage immediately to Engineer and a written report thereof promptly thereafter. Notify the utility owner of the damage. If directed by Engineer, repairs shall be made under the provisions for changes and extra work contained in the General Conditions.
- I. Damages. Costs of locating and/or repairing damage not due to failure to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the Work which was interrupted or idled by removal or relocation of such utility facilities, and which was necessarily idled during such Work will be paid for as extra Work in accordance with the provisions of the General Conditions.

- J. Approval of Repairs: All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other work.
- K. Fire Hydrants: Keep all fire hydrants and water control valves free from obstruction and available for use at all times.
- L. Maintaining in Service: Unless indicated otherwise, all oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Engineer are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. Be responsible for and repair all damage due to construction operations. The provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.
- M. Utility Service Laterals: Not all utility service laterals are shown on the plans. Anticipate that there are no less service laterals than there are homes where project trenches are located in the vicinity of a street between a home and the utility main. Protect in place or remove and replace to the satisfaction of the utility owner, all utility service laterals encountered during construction. Duration of utility service outages and public notification procedures shall conform to the standards of the controlling agency and these Contract documents.

1.6 TREES OR SHRUBS WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

- A. General: Except where trees or shrubs are indicated to be removed, exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits. Do not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or Owner. Trim or replace existing trees and shrubs which are damaged during construction using the services of a certified tree company under permit from the jurisdictional agency and/or Owner.
- B. Trimming: symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Do not use spikes for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosene, coal tar, creosote, or other material injurious to the life of the tree.
- C. Replacement: Immediately notify the jurisdictional agency and/or Owner if any tree or shrub is damaged by construction operations. If, in the opinion of said agency or Owner, the damage is such that replacement is necessary, replace the tree or shrub at no additional expense to Owner. The tree or shrub shall be of a like size and variety as the one damaged, or, if of a small size, the pay to the owner of said tree a compensatory payment acceptable to the tree or shrub owner, subject to the approval of the jurisdictional agency or Owner. The size of the tree or shrub shall not be less than 1-inch diameter nor less than 6 feet in height. Planting of replacement trees and shrubs shall be in accordance with the recommendations of the nursery furnishing the plants. Unless otherwise indicated, water and maintain the replacement trees and shrubs for 6 months after planting.

1.7 LAWN AREAS

- A. Repair lawn or landscaped areas damaged during construction to match the pre-construction condition to the satisfaction of the landowner and Owner. Use high quality sod to restore all lawn areas. Location and quality of irrigation system equipment shall be confirmed prior to construction. Where lawn irrigation systems have been removed or damaged during construction, be responsible for replacement of systems in kind to the satisfaction of the landowner. Anticipate that pressurized irrigation systems are present in all maintained lawn areas that will be impacted by construction. Verify proper operation of the irrigation system with landowner as required for maintenance of newly installed sod prior to transferring of watering responsibilities.

1.8 UNIMPROVED AREAS

- A. Remove and stockpile topsoil prior to construction in accordance with the specifications. Replace topsoil prior to restoration of unimproved areas.
- B. Unimproved areas, including unclassified open spaces, fields, and unimproved rights-of-way, damaged during construction shall be repaired to match pre-construction conditions to the satisfaction of the landowner and Owner. At a minimum, unimproved areas shall be smoothed and finished graded with topsoil to match preconstruction topography, and reseeded using a native seed mix acceptable to the landowner and Owner.
- C. All slopes greater than 2H : 1V shall be protected with erosion control matting prior to reseeded.

1.9 OTHER SURFACE IMPROVEMENTS

- A. Conduct a pre-construction survey of all properties that will be impacted by construction operations. All improvements that have the potential to be impacted by construction, including but not limited to fencing, landscaping, boulders, retaining walls, irrigation systems, concrete improvements, and other public and/or private improvements, shall be protected in place, or if necessary, removed and replaced with like kind or better quality following construction.

1.10 NOTIFICATION BY CONTRACTOR

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, notify the owners or agencies responsible for such facilities not less than three days nor more than seven days prior to excavation so that a representative of said owner or agencies can be present during such Work if they so desire.
- B. When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.

- C. Contact, cooperate with, and provide written notice (including Contractor's phone number) at least seven days prior to beginning Work on each street. The written notice shall include the approximate schedule and explanation of Work and shall be given to each homeowner, business, all emergency agencies, schools, and residents, which will be affected by the project; particularly in reference to temporary interruptions to vehicular access. At least twenty-four hours prior to initiation of Work, provide a second notice to confirm the scope of scheduled Work. Submit a copy of the notifications to Engineer, for approval, prior to the start of construction. Make verbal door-to-door communication prior to construction to remind all affected parties of the construction to take place. In addition, be responsible to answer and resolve any conflicts that may arise between a homeowner or business owner and the construction personnel.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 71 51
AQUEDUCT PROTECTION AND MONITORING

PART 1 - GENERAL

1.1 THE REQUIREMENTS

- A. The work in this section includes specific measures required to protect the Jordan and Southwest Aqueducts from potential damages during construction of the Wood Hollow Drainage Improvements.
- B. The Jordan Aqueduct is owned by the United States Bureau of Reclamation (BOR, USBOR, Reclamation) and operated and maintained by the Jordan Valley Water Conservancy District (JVWCD, District). Both entities may be referred to as Aqueduct Owner in these specifications.
- C. The Southwest Aqueduct (SWA) is owned and maintained by the JVWCD.
- D. The Jordan Aqueduct is located in the BOR easement and runs parallel to the JVWCD easement for the Southwest Aqueduct. Existing Jordan Aqueduct horizontal and vertical alignment, based upon original BOR design drawings, are shown on the plans. Limits of the BOR right-of-way are shown on the plans.
- E. The Southwest Aqueduct is located in the JVWCD easement and runs parallel to the Jordan Aqueduct. Existing Southwest Aqueduct horizontal and vertical alignment, based upon original design drawings, are shown on the plans. The limits of the JVWCD easement are not included on the plans, as the project area is entirely within JVWCD property.
- F. The existing Jordan Aqueduct was constructed in the 1970's and 80s using gasketed bell and spigot style pipe. The Jordan Aqueduct consists of 78-inch diameter reinforced concrete pipe (RCP) crossing Wood Hollow Creek.
- G. The SWA was constructed 2019-2020 and consists of 66" welded steel pipe with welded joints: mortar-lined and mortar-coated.
- H. The size and age of the Jordan Aqueduct and lack of joint restraint requires that extreme caution be exercised when operating equipment and constructing facilities along or adjacent to the BOR right-of-way. Excessive vibration, loading, or settlement of the aqueduct may cause joints to leak and the pipeline to fail. The Jordan Aqueduct and SWA must continuously convey water for a significant portion of the population of the Salt Lake Valley. The aqueducts cannot be taken out of service for maintenance and repair without significant advance planning and expense, and then only during limited (low wintertime demand) periods of the year for short and long-planned schedule durations.
- I. Requirements of this Section are based upon the Encroachment Guidelines for Jordan Aqueduct and the U.S. Department of the Interior Bureau of Reclamation Engineering and O&M Guidelines for Crossings. Copies of these documents are included in the Reference Document Attachments, Appendix C.

- J. Note that this Section is intended to provide a summary of the key requirements of the above documents as they relate to Aqueduct Protection. It is not intended to be a comprehensive list of BOR requirements. All requirements of these documents shall be adhered to when operating along or adjacent to the Jordan and Southwest Aqueducts and United States right-of-way.

1.2 REFERENCES

- A. Engineering and O&M Guidelines for Crossings – Bureau of Reclamation Water Conveyance Facilities, April 2008
- B. Standard Form 299 – Application for Transportation and Utility Systems and Facilities on Federal Lands
- C. 29 CFR 1926: OSHA Safety and Health Regulations for Construction

1.3 DEFINITIONS NOT USED

1.4 SUBMITTALS

- A. Submit a detailed protection and monitoring plan, including working drawings which identifies the specific equipment, equipment specifications, drum weights, axle weights, calculations of live and dead loads, and construction procedures including excavation and haul off, placement of materials, and compaction methods that will be used for all phases of the construction that occur within the BOR right-of-way. Provide documentation that equipment does not exceed HL-93 loading within the JA BOR easement.
- B. Provide training to drivers, equipment operators, subcontractors, and employees regarding the requirements of the approved protection and monitoring plan. Provide all individuals with a hard hat sticker to indicate successful completion of training for protection of the Jordan Aqueduct prior to beginning work in the JA BOR easement. Ensure JWCD/USBOR and UDOT program management are invited to this training prior to beginning work. Continuously provide training to additional staff as required throughout the project to maintain awareness of the requirements of the BOR right of way.
- C. Upon completion of construction, provide both the District and BOR with one hard copy and one electronic copy of as-built drawings showing actual improvements in, on, or along the rights-of-way. Drawing format shall meet BOR record drawing requirements. Contact the BOR Provo Area Office for detailed requirements.

1.5 QUALITY CONTROL

- A. Assign full time personnel responsible to monitor and verify that the approved protection plan is being followed at all times while operating within the BOR rights-of-way. Submit 24 hr contact information.
- B. As a first item of work, “pothole excavations” should be made to field locate and identify the alignment of the Jordan Aqueduct and Southwest Aqueduct within the construction zone. Provide 48-hours advance notification and conduct all pothole excavation work in the presence of BOR and/or JWCD staff. All pothole work within 24 inches of either aqueduct

should be done using hand-held tools or vac truck only. Obtain all permitting for Pothole work in the BOR ROW.

- C. Where operating equipment in the BOR ROW, maintain clear visual marking along the aqueduct centerline and limits of the Load Restricted Area (defined as 12-feet each side of centerline of the aqueduct) within the BOR right-of-way at all times during construction.
- D. All individuals operating equipment within the BOR right-of-way must display a hard hat sticker to indicate that they have successfully completed necessary training per Section 1.5.B prior to beginning work. Stickers should be clearly visible to on-site field representatives.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 BOR ENCROACHMENT APPLICATION PROCESS

- A. Requirements for obtaining an authorization to cross Reclamation project land are in the Code of Federal Regulations (CFR) at 43 CFR 429 and Reclamation Manual LND 08-01. Applicants must complete the Standard Form (SF) 299, "Application for Transportation and Utility Systems and Facilities on Federal Lands." The form is included in the Reference Document Attachments and can be obtained electronically at: <https://www.gsa.gov/forms-library/application-transportation-utility-systems-telecommunications-and-facilities-federal>
- B. The Owner has performed the work required for BOR SF 299 permitting of the pipeline as part of this project and the regulations are provided for Contractor knowledge and understanding of to comply with the requirements of the BOR, Contractor shall follow all provision of SF 299 permits obtained by JWCD. One permit is being obtained for mainline SWA-02 pipeline installation, and the second SF 299 permit is being obtained for the Jordan Aqueduct valve vault work at 11400 South. Copies of the current SF299 applications are provided in Appendix C. Final obtained permits will be provided to the awarded contractor.

3.2 CONSTRUCTION WITHIN THE BOR JORDAN AQUEDUCT RIGHTS-OF-WAY

- A. All new construction shall meet requirements of the Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, and 4, included in the Reference Document Attachment, Appendix C for reference.
- B. All new construction and utility crossings shall meet requirements of the Engineering and O&M Guidelines for Crossings by the U.S. Department of the Interior Bureau of Reclamation, included at the end of this Section for reference.
- C. All requests for encroachments on U.S Bureau of Reclamation land, facility, or water body must obtain a written land use authorization from JWCD and BOR.

- D. Storage of hazardous materials is not permitted within the BOR rights-of-way.
- E. All temporary and permanent changes in ground surfaces within the BOR rights-of-way are considered to be encroaching structures and must be handled as such.
- F. All finished grades shall provide a 4-foot minimum cover above the existing aqueducts.
- G. Surface structures that will generally be allowed to be constructed within the BOR rights-of-way include standard concrete pavement section, asphalt pavement, non-reinforced parking areas, curbs, gutters, sidewalks, walkways and driveways, and removable barriers. **However, it is understood that all surface structures shall be analyzed and considered on an individual basis.**
- H. Structures that may not be constructed in, on, or along the BOR rights-of-way include but are not limited to permanent structures such as retaining walls, street light standards, supports for large signs, power or communication poles, drainage structures, buildings, permanent foundations, permanent traffic barriers, cement or rock walls, sound walls, and longitudinal fences.
 - 1. During the SF299 permitting process, the Owner will obtain an exception from the BOR for any structures required for this project.
- I. Parallel utilities are not permitted within the BOR rights-of-way.
- J. Trees or vines are not permitted within the BOR rights-of-way.
- K. If existing drainage features are to be modified during construction, detailed drawings showing the proposed drainage replacement/restoration should be submitted with the application for review and approval.
- L. Notify the BOR Provo Area Office Field Engineering Division Manager at (801) 379-1000 and the Jordan Valley Water Conservancy District (District) at (801) 565-4300 at least forty-eight (48) hours in advance of commencing construction to permit inspection by the BOR and/or District.
- M. Notify JWCD immediately upon any evidence of suspected damage to the Jordan or Southwest Aqueducts so that emergency inspection or response efforts can be initiated as determined necessary. The JWCD 24-hour contact is 801-256-4401. Always maintain this 24-hour emergency contact information available to on-site crews and provide contractor's 24-hour contact information to JWCD's on-call staff.

3.3 UTILITY CROSSINGS

- A. Any non-metallic encroaching structure below ground level shall be accompanied with a metallic strip within the BOR rights-of-way.
- B. The points where proposed crossing utilities enter and exit the BOR rights-of-way should be plainly and permanently marked by signposts. Signposts should contain the name of the owner/operator, contents of the pipeline, utility identification, and emergency contact phone number.

- C. Utilities including electrical and communication lines, and pipelines containing sewage, oil, gasoline, natural gas, contaminated waters, non-potable waters, or hazardous materials should only **cross perpendicular (between 70 and 90 degrees)** to the Jordan Aqueduct.
- D. Utilities crossing above or under the Jordan or Southwest Aqueduct should maintain a vertical clearance between the utility and aqueduct of **at least of 12 inches**.
- E. Sanitary sewer crossings shall be contained within steel pipe casings within the BOR right-of-way.
- F. No vertical or horizontal bends will be permitted on utilities within the BOR right-of-way.
- G. Overhead wires across BOR rights-of-way should be at least 32 feet above all ground levels. For electrical power lines of 69 kilovolts (kV) or higher voltage, the minimum clearance should be 40 feet plus 0.25 inch per kV of line-to-line voltage above 450 kV. Poles or towers are not allowed within the BOR rights-of-way.
- H. High voltage, direct current powerlines are generally not permitted to encroach on the BOR rights-of-way for the Jordan Aqueduct, except in unusual circumstances and with proper cathodic protection considerations.
- I. Refer to the Engineering and O&M Guidelines for Crossings for specific cathodic protection requirements within the BOR rights-of-way.

3.4 LOAD RESTRICTIONS WITHIN BOR JORDAN AQUEDUCT RIGHTS-OF-WAY

- A. Load restrictions must be carefully observed to protect the Jordan Aqueduct from damages that could be caused by excessive live or dead loading or vibrations during construction. The Load Restricted Area surrounding the Jordan Aqueduct is defined as a zone within 12-feet of both sides of the centerline of the pipeline (24-feet total width).
- B. Limit equipment, operation, procedures, and methods of construction within the Load Restricted Area to ensure that any combination of either live loads or dead loads does not exceed the design capabilities of the aqueduct. Comply with the following constraints, procedures, and load restrictions which apply to all construction activities and operations located within this zone.
- C. The largest equipment loading (live load) which shall be permitted within the Load Restricted Area is HL-93 and there must be a temporary minimum soil cover of 3-feet or greater.
- D. Prevent heavy equipment (exceeding an HL-93 loading) from encroaching within the Load Restricted Area. Dynamic loading of equipment, including soil compaction equipment, shall not exceed HL-93 loading. In all cases there shall be a temporary minimum of 3 feet of cover within the Load Restricted Area.
- E. Operation of backhoes, augers, excavation or lifting equipment which may impose point loads from outriggers, wheels, or jacks is not permitted within the Load Restricted Area.

- F. All backfill material within the BOR rights-of-way shall be compacted to a minimum of 95-percent maximum density specified by ASTM Part 19, D-698, method A; unless otherwise shown.
- G. Backfilling of any excavation or around any structure within the BOR rights-of-way shall be compacted in layers not exceeding 6-inches thick if hand compacted or 8-inches thick if power compacted to the following requirements:
 - 1. cohesive soils to 95 percent maximum density specified by ASTM Part 19, D-698, method A; or
 - 2. noncohesive soils to 95 percent relative compaction specified by ASTM D 7382-08.
- H. Maintain existing ground cover over the aqueduct unless special exceptions are approved which allow for modifications during construction.
- I. Do not place fill or temporarily stockpile construction materials in the Load Restricted Area - within 12-feet either side of the centerline of the aqueduct.

3.5 SPECIAL PROTECTIONS FOR TEMPORARY LOW COVER CONDITIONS WITHIN THE BOR EASEMENT FOR THE JORDAN AQUEDUCT – (BELOW 3 FEET OF COVER)

- A. Special protections are required for the aqueduct during interim conditions when there is a temporary low cover over the Jordan Aqueduct, such as when replacement of the existing roadway requires the pavement section and subgrade to be removed and replaced for development of the new roadway section over the aqueduct.
- B. Temporary low cover conditions are present any time there is less than the allowable minimum 3 feet depth of soil over the aqueduct that is required for any equipment loading. Note that permanent finish grade cover over the existing aqueduct requires 4 feet of minimum cover.
- C. Coordinate planned subgrade elevations with Jordan Aqueduct pothole depths. Submit cross sections in low cover areas illustrating the identified depth of cover and proposed subgrade elevation at 25-foot intervals.
- D. Excavation over the aqueduct shall take place from the adjacent existing pavement to allow removal of excavated material while maintaining the minimum cover or sufficient offset distance between the top of aqueduct and construction equipment and not directly loading construction equipment on the aqueduct during low cover conditions.
- E. For placement of granular borrow materials, utilize the adjacent existing pavement for material delivery and place import material using one of the following methods:
 - 1. Side dump trucks, placing material directly on grade.
 - 2. Belly dump trucks, placing material on the existing pavement and blading off of pavement onto grade.
- F. Backfill within 18-inches of the aqueduct shall be compacted using light, hand operated compactors and rollers. Mechanical compaction shall not be allowed within 6-inches of the aqueduct.

- G. Once a working platform has been established, a low ground pressure Dozer/Grader (less than 7 psi ground pressure) shall be used to spread material across the sub grade while maintaining a minimum of 18-inches of cover over the aqueduct.
- H. Utilize static rolling compaction methods with light weight equipment (less than 8,000 lbs.) within the low cover zone between 18-inches and 36-inches cover. Vibratory compaction shall not be used within the Load Restricted Area when cover over the existing Jordan Aqueduct is less than 36-inches.

3.6 SPECIAL PROTECTIONS FOR POTENTIAL GROUND SETTLEMENT

- A. Definitions:
 - 1. Differential Settlement: Difference in ground settlement that is observed between points located along the centerline of the aqueduct over a specified length at any given location within the construction zone.
 - 2. Total Settlement: Total measured ground settlement that is observed along the centerline of the aqueduct within the limits of the construction zone.
- B. All necessary precautions should be taken to prevent ground settlement from occurring which could be damaging to the existing Jordan Aqueduct. No settlement or excessive vibration will be allowed along the existing aqueduct. Contractor shall be responsible for all damages to the Jordan Aqueduct as a result of Southwest Aqueduct construction, including damages to joints and the interior mortar lining of the aqueduct.

3.7 SPECIAL PROTECTIONS FOR VIBRATION CONTROL DURING CONSTRUCTION

- A. Vibration monitoring will be completed by JWCD and the Engineer during construction activities in the BOR easement that may cause vibration to the JA-2. Provide 7 days' notice to Engineer of schedule of activities that may vibrate the JA-2 to allow for monitoring equipment to be set up prior.
- B. Do not exceed the following special vibration limits for the Jordan Aqueduct:
 - 1. 0.1 in/sec for both steady state and impact vibrations along the centerline of the existing aqueduct.
- C. For purposes of these special aqueduct vibration limits, steady state vibrations will be considered as all continuous and frequent intermittent sources including pogo stick compactors, vibratory pile drivers, and vibration compaction equipment.
- D. For purposes of these special aqueduct vibration limits, impact vibrations will be considered as all transient sources which create a single isolated event such as impact pile driving, blasting, jack and boring, or other non-recurring heavy drop impact.

END OF SECTION

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**SECTION 01 77 00
PROJECT CLOSEOUT**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Contract closeout, including final cleaning, preparation, and submittal of closeout documents, warranties and bonds, and final completion certification.
- B. Closeout submittals and submittal forms in both hard copy and electronic format.

1.2 SUBMITTALS

- A. Closeout Documents: Submit the following closeout documents prior to making a written request for Final Completion.
 - 1. Project record drawings and documents per Section 01 78 39 – Project Record Documents.
 - 2. Shop drawings.
 - 3. Keys and keying schedule.
 - 4. Post construction survey record documents, where required.
 - 5. Quality Control reports per Section 01 45 00 – Quality Control.
 - 6. Final Operation and Maintenance Manuals.
 - 7. Maintenance stock items; spare parts and special tools.
 - 8. Written warranties and bonds where required.
 - 9. Bonds for roofing or maintenance, if indicated.
 - 10. Access Badges and Parking Permits.
 - 11. Release of liens or release of claims forms submitted by all subcontractors and suppliers, if requested by Owner
- B. Evidence of Compliance With Inspections and Other Requirements of Governing Authorities: Submit the following:
 - 1. Special Inspection Reports.
 - 2. Release from each affected property owner or agency indicating final acceptance.
- C. Operation and Maintenance Manuals
 - 1. One percent of the contract price will be withheld from any monies due as progress payments, if at the 75 percent construction completion point, the approved *Operations and Maintenance Manual* complying with Section 01 33 20 - Submittal Procedures has not been submitted. The aforementioned amount will be withheld by Owner as the agreed, estimated value of the approved *Operations and Maintenance Manuals*. Any such retention of money for failure to submit the approved *Operations and Maintenance Manuals* on or before the 75 percent construction completion point shall be in addition to the retention of any payments due under General Conditions of the Contract.
- D. Final Change Order: A final Change Order shall be submitted and processed if required. Final payment and close-out procedures shall comply with requirements of the Contract Documents.

1.3 CLOSEOUT TIMETABLE

- A. Establish dates for equipment testing, acceptance periods, and on-site instructional periods as required under the Contract Documents. Such dates shall be established not less than one week prior to beginning any of the required activities, to allow Owner, Engineer, and their authorized representatives sufficient time to schedule attendance at such activities.

1.4 COMPLETION PROCEDURES

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Prior to making such request, the following must be complete:
1. Work necessary for the safe, proper, and complete use or operation of the facility as intended.
 2. Punch list of items remaining to be completed, for submission with the request for issuance of a Certificate of Substantial Completion.
 3. Submit and receive acceptance of accurate record drawings for all work completed to date.
 4. Submit and receive acceptance of all specified warranties, bonds, guarantees and operation and *Operations and Maintenance Manuals*.
 5. Complete all required vendor training, testing, and where required, start-up.
 6. Deliver all required spare parts, maintenance stock items, and special tools.
 7. Complete equipment and communications system testing successfully.
- B. Upon receipt of the request, Engineer and designated representatives will review the request, the Work, and the above requirements to determine whether Substantial Completion has been achieved. If this review fails to support Substantial Completion, Engineer will notify Contractor in writing citing the reasons for rejection. If Engineer determines that Substantial Completion has been achieved, the following procedures will be followed:
1. Engineer, his/her representative, and user representatives will review the Work and the punch list to assure all deficiencies are noted on a final punch list.
 2. Engineer will schedule and conduct a pre-final walk-through of the facility with representatives of Owner, Engineer, Contractor, and others, for the purpose of formally reviewing the Work, the final punch list, and the readiness of the Work for use. A copy of the final punch list will be furnished to all participants and any additional items noted during the walk-through will be added to the list.
 3. Upon completion of the pre-final walk-through, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion as the date of the walk-through, provided the walk-through has verified that the Work is in fact ready for use and occupancy by Owner for its intended purpose. Engineer will attach to the certificate a punch list of items to be completed or corrected before final payment. In accordance with the General Conditions of the Contract, upon approval of this request by Owner, the facility will be considered Substantially Complete.
- C. When Contractor deems that the entire Work or an agreed portion thereof is complete, Contractor shall notify Engineer and Owner in writing that the entire Work is complete. Final Completion will be deemed to have occurred when Work is completed including the following:

1. All final punch list items have been corrected, signed off by Contractor and Engineer, and demonstrated to Owner during a final walk-through.
2. All updates to record drawings, and *Operations and Maintenance Manuals* have been made.
3. Demobilization and site cleanup are complete.
4. Facilities and/or equipment have been properly demonstrated to be functioning as required.
5. Owner has received releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.
6. New permanent cylinders and key blanks for all locks have been provided to Owner.

D. Final Inspection and Payment

1. When all items have been completed or corrected, Engineer, Contractor, and Owner will promptly make a final inspection to verify completion. Final payment and Engineer's *Notice of Acceptability* will then be processed in accordance with the General Conditions of the Contract.

E. Partial Utilization may be desired at Owner's option, as described in the General Conditions. If Partial Utilization is requested, the same procedure for completion of that portion of the Work as indicated in paragraphs A and B above, will be used.

1.5 CLOSE-OUT PROCEDURE

- A. Engineer and Contractor shall meet and resolve all outstanding issues including, but not limited to:
1. Claims and adjustments for time or costs
 2. Outstanding, unused allowances
 3. Procedures for handling warranty issues.
- B. A Final Change Order shall be processed if required. Final payment and close out procedures shall comply with all requirements of the Contract Documents.

1.6 MAINTENANCE AND GUARANTEE

- A. Comply with the maintenance and guarantee requirements contained in General Conditions of the Contract.
- B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless Contractor has obtained a statement in writing from the affected private authority or public agency releasing Owner from further responsibility in connection with such repair or resurfacing. Submit such release(s) to Engineer.
- C. Make all repairs and replacements promptly upon receipt of written order from Owner. If Contractor fails to make such repairs or replacements promptly, Owner reserves the right to do the Work and Contractor, and his surety shall be liable to Owner for the cost thereof.

1.7 BOND

- A. Furnish a Performance Bond as required by General Conditions of the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. Certificate of Final Completion of the Work by Owner will be withheld until requirements for final cleanup of the Project Site are complete as follows:
1. Perform final cleaning prior to inspections for final acceptance.
 2. Employ skilled workers who are experienced in cleaning operations.
 3. Use cleaning materials that are recommended by manufacturers of surfaces to be cleaned.
 4. Avoid scratching, discoloring, and otherwise damaging surfaces being cleaned.
 5. Broom clean and power wash exterior paved surfaces and rake clean other surfaces of sitework. Police yards and grounds to keep clean.
 6. Remove dust, cobwebs, and traces of insects and dirt.
 7. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, fixtures, and Equipment.
 8. Remove nonpermanent protection and labels.
 9. Polish finish hardware.
 10. Polish glossy surfaces to clear shine.
 11. Clean light fixtures and replace burned-out or dim lamps.

3.2 WASTE DISPOSAL

- A. Remove temporary structures and facilities and arrange for and dispose of surplus materials, waste products, and debris as follows:
1. Prior to making disposal on private property, obtain written permission from owner of such private property.
 2. Do not fill ditches, washes, or drainage ways which may create drainage problems.
 3. Do not create unsightly or unsanitary nuisances during disposal operations.
 4. Maintain disposal site in safe condition and good appearance.
 5. Complete leveling and clean-up prior to final acceptance of the Work.

3.3 TOUCH-UP AND REPAIR

- A. Touch up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for final acceptance.
- B. Refinish or replace entire surfaces that cannot be touched-up or repaired satisfactorily.

3.4 DEMOBILIZATION

- A. Demobilization shall include moving equipment, field trailers, construction materials, debris, and so forth from the Site as well as performing final cleanup.
1. Disturbed areas shall be restored to their original state or better.
 2. Permanent improvements damaged during construction operations shall be repaired or replaced at no additional cost to Owner.

3. Remove all equipment, materials, waste, and debris from the site and restore site to original condition upon completion of construction.
4. The work area shall be restored to its original or better condition and shall be inspected and approved by Engineer.

END OF SECTION

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SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Maintain at the Site for Owner, one record copy of the Drawings, Specifications, Operation and Maintenance manuals, coordination drawings, and Shop Drawings that are clearly marked with a red pen to indicate all changes and or revisions resulting from, but not limited to, the following:
 - 1. Actual Project as constructed.
 - 2. Addenda.
 - 3. Change Orders and other modifications.
 - 4. Engineer's instructions.
 - 5. Field revisions.
 - 6. Requests for Information (RFI).
 - 7. All other changes.
- B. Give special attention to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings.
- C. Record drawings shall be supplemented by any detailed sketches as necessary or directed to fully indicate the Work, as actually constructed.
- D. Section Includes:
 - 1. Maintenance of Documents and Samples
 - 2. Marking Devices.
 - 3. Recording.
 - 4. Close-out Submittal Delivery.

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

- B. Store documents and samples in field office apart from documents used for construction.
- C. Maintain documents in clean, dry, legible condition and in good order. Keep record documents separate from those used for construction.
- D. Always make documents and samples available for reference by Engineer and Owner.
- E. In the case of those drawings which depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the record drawings shall be updated by indicating those portions which are superseded by change order drawings or final shop drawings, and by including appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.
- F. During progress meetings, record documents may be reviewed to ascertain that changes have been recorded.

- G. Updated Drawings, when provided by Engineer, will be substituted for the hand markups provided Contractor prints the applicable Drawings and inserts them into the record set each month.
- H. Copies of the record drawings will be audited regularly by Engineer after the month in which the Notice to Proceed is given as well as on completion of the Work. Failure to properly maintain record drawings in an up-to-date condition may result in the withholding of payments due at the sole discretion of Owner.

1.3 MARKING DEVICES

- A. Use a red color pen for recording all information to all documents defined herein.

1.4 RECORDING

- A. Label each document "CONFORMING TO CONSTRUCTION RECORD" in neat large red printed letters.
- B. Record information concurrently with construction progress, at the time the material or equipment is installed. Do not conceal any work until required information is recorded.
- C. Drawings shall be legibly marked to record actual construction per the following:
 - 1. Record actual depths of various elements of foundations in relation to finish first floor datum.
 - 2. Record actual as-built depths, horizontal and vertical location, (at every direction change and a maximum of 100 feet intervals on straight runs), of underground pipes, duct banks, and other buried utilities. Reference horizontal location to Project coordinate system and vertical elevations to Project datum.
 - 3. Identify and record specific details of pipe connections, location of existing buried features and utilities located during excavation, and the final locations of piping, equipment electrical conduits, manholes, and pull boxes (horizontal coordinates and vertical elevation).
 - 4. Identify and record location of spare conduits including beginning, ending, and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.
 - 5. Record actual schedules, lists, layout drawings, and wiring diagrams.
 - 6. Record field changes of dimension and detail.
 - 7. Record changes made by instruction from Engineer or by Change Order.
 - 8. Record details not on original Contract Drawings.
- D. Specifications and Addenda shall be legibly marked to record:
 - 1. Manufacturer, trade name, catalog number, and supplier for each product and item of equipment installed.
 - 2. Changes made by instruction from Engineer or by Change Order.
- E. Record potholing data and installation of marker balls.
- F. All surveying for record documents shall be performed by a licensed surveyor.

1.5 CLOSEOUT SUBMITTALS

- A. At Contract closeout, deliver complete record documents to Engineer as required in Section 01 77 00 - Project Closeout. Final payment will not be acted upon until the record drawings have been prepared and delivered to Engineer.
- B. The information submitted will be incorporated by Engineer into final drawings to be provided to Owner. Be responsible for the accuracy of submitted construction information. Engineer will assume that the information provided by Contractor is correct and faithfully represents actual construction.
- C. This submittal shall include the record paper set along with the electronic version. Electronic version shall include .pdf files and .dwg files of each drawing.
- D. Prepare submittal with transmittal letter containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Title and number of each record as-built document.
 - 5. Signature of Contractor's authorized representative and a statement that certifies that the record documents are accurate and reflect what was installed during construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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DIVISION 02
EXISTING CONDITIONS

**SECTION 02 41 00
DEMOLITION**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes demolition, salvage, and reconstruction of existing civil, landscaping, structural, architectural, mechanical, HVAC, electrical, and instrumentation facilities as indicated in accordance with the Contract Documents.

1.2 RELATED SECTIONS

- A. Section 31 23 00 – Earthwork

1.3 REFERENCES

- A. Air-Conditioning, Heating, and Refrigeration Institute (AHRI) standards, most recent editions:

- Guideline K Containers for Recovered Non-flammable Fluorocarbon Refrigerants.

- B. American National Standards Institute (ANSI) standards, most recent editions:

- A10.6 Safety and Health Program Requirements For Demolition Operations.

- C. Environmental Protection Agency (EPA), standards and laws, most recent editions:

- 40 CFR 61 National Emission Standards for Hazardous Air Pollutants.

- 40 CFR 82 Protection of Stratospheric Ozone.

- 40 CFR 273 Standards for Universal Waste Management.

- D. Occupational Safety and Health Administration (OSHA) standards and laws, most recent editions:

- 29 CFR 1926 Safety and Health Regulations for Construction.

1.4 DEFINITIONS

- A. Demolition: Dismantling, razing, destroying, or wrecking of any fixed building or structure or any part thereof. Demolition also includes removal of pipes, manholes, tanks, conduit, and other underground facilities, whether as a separate activity or in conjunction with construction of new facilities.

- B. Modify: Provide all necessary material and labor to modify an existing item to the condition indicated or specified in Contract Documents.

- C. Relocate: Remove, protect, clean, and reinstall equipment, including electrical, instrumentation, and all ancillary components required to make the equipment fully functional, to the new location identified herein and on Contract Drawings.
- D. Renovation: Altering a facility or one or more facility components in any way.
- E. Salvage/Salvageable: Remove and deliver to the specified location(s), the equipment, building materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of Owner. Unless otherwise specified, title to items identified for demolition reverts to Contractor.
- F. Universal Waste Lamp: In accordance with 40 CFR 273, the bulb or tube portion of an electric lighting device, examples of which include, but are not limited to, fluorescent, high-intensity discharge, neon, mercury vapor, high-pressure sodium, and metal halide lamps.
- G. Universal Waste Thermostat: A temperature control device that contains metallic mercury in an ampule attached to a bimetal sensing element, and mercury-containing ampules that have been removed from these temperature control devices in compliance with the requirements of 40 CFR 273.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Coordinate the Work in areas where existing facilities are interconnected with new facilities and where existing facilities remain operational. The Work as indicated is not all inclusive. Be responsible for performing the reconstruction indicated plus that which can be reasonably inferred from the Contract Documents as necessary to complete the Project. The Specifications and Drawings identify the major facilities to be demolished and reconstructed, but auxiliary utilities such as water, air, chemicals, drainage, lubrication, fluid power, electrical wiring, controls, and instrumentation are not necessarily shown.
2. Drawings used to indicate demolition and reconstruction are based on drawings conforming to construction records for the existing facilities. These drawings have been reproduced to show existing conditions and to clarify the scope of Work as much as possible. Prior to bidding, conduct a comprehensive survey at the Site to verify the correctness and exactness of the Drawings, the scope of Work, and the extent of auxiliary utilities. A complete set of available drawings conforming to construction records may be provided upon request.
3. While demolition and reconstruction are being performed, provide adequate access for the continued operation and maintenance of equipment and treatment processes. Erect and maintain fences, warning signs, barricades, and other devices around the reconstruction as required for the protection of the Contractor employees and the Owner's personnel at the Site. Remove such protection when reconstruction activities are complete, or as work progresses, or when directed by Engineer.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Informational Submittals

1. Submit proposed Demolition/Renovation Plan, in accordance with requirements specified herein, for approval before such Work is started.
2. Submit copies of any notifications, authorizations and permits required to perform the Work.
3. Submit a shipping receipt or bill of lading for all universal waste shipped.

1.7 REGULATORY AND SAFETY REQUIREMENTS

- A. When applicable, accomplish demolition Work in strict accordance with 29 CFR 1926 Subpart T.
- B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the General Conditions, conform to ANSI A10.6.
- C. Furnish timely notification of this demolition/renovation project to applicable federal, state, regional, and local authorities in accordance with 40 CFR 61 Subpart M.

1.8 DEMOLITION/RENOVATION PLAN

- A. Prepare Demolition/Renovation Plan to provide for safe conduct of the Work, including the following:
 1. Detailed description of methods and equipment to be used for each operation.
 2. Planned sequence of operations, including coordination with other work in progress.
 3. Procedures for removal and disposition of materials specified to be salvaged.
 4. Disconnection schedule of utility services.
- B. Include statements affirming Contractor inspection of the existing roof deck, floors, walls, and framing members, and their suitability to perform as a safe working platform or, if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the Work if applicable for Project Work.

1.9 SEQUENCING AND SCHEDULING

- A. Do not commence demolition work until the Demolition/Renovation Plan has been accepted by Engineer.
- B. Include the Work of this Section in the progress schedule, as specified in Section 01 32 16 – Construction Progress Schedule.
- C. Comply with sequencing requirements in Section 01 14 40 - Construction and Schedule Constraints.

1.10 USE OF EXPLOSIVES

- A. Use of explosives is not permitted.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate demolition and reconstruction Work with Engineer. Unless otherwise indicated, be responsible for the sequence of activities and perform Work in accordance with applicable safety rules and regulations.
- B. Verify that any utilities connected to structures, equipment, and facilities to be removed, relocated, salvaged, replaced, or abandoned are rendered inoperable, replaced with new utilities, or adequately bypassed with temporary utilities before proceeding with demolition and reconstruction.
- C. Avoid damage to adjacent facilities and limit Work activities to the extent indicated. If reconstruction beyond the scope indicated is required, obtain approval from Engineer prior to commencing.

3.2 PROTECTION OF EXISTING FACILITIES

- A. Before beginning any reconstruction, survey the existing facilities and examine the Contract Documents to determine the extent of demolition and/or reconstruction and coordination with the Work. Protect existing facilities not subject to the Work of this Section and maintain in accordance with Section 01 71 50 – Protection and Restoration of Existing Facilities. Repair or replace damaged existing facilities to the previous condition.
- B. Provide safe passage for pedestrians and drivers around areas of demolition. Where pedestrian and driver safety is endangered in the area of Work, use traffic barricades with flashing lights.
- C. Do not overload structural elements. Be responsible for shoring, bracing, or adding new supports as may be required for adequate structural support as a result of Work performed under this Section. Remove temporary protection when the Work is complete or when so authorized by Engineer.
- D. Dust and Debris Control
 - 1. Prevent the spread of dust and debris to occupied portions of existing facilities and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.
 - 2. Vacuum and sweep the Work area daily.
 - 3. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicular traffic.
- E. Weather Protection:
 - 1. For portions of the facility scheduled to remain, protect interior materials and equipment from weather at all times. Where removal of existing roofing is necessary to accomplish the Work, have materials and workers ready to provide adequate and temporary covering of exposed areas to ensure effectiveness and to prevent loss.

- F. Facilities:
1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.
 2. Floors, roofs, walls, columns, pilasters, and other structural elements that are designed and constructed to stand without lateral support or shoring and are determined by Contractor to be in stable condition, may remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by Engineer.
 3. Protect all facility elements not scheduled for demolition.
 4. Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities.
- G. Protection of Personnel:
1. During demolition, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.
 2. Provide temporary barricades and other forms of protection to protect Owner's personnel and the general public from injury due to demolition Work.
 3. Provide protective measures as required to provide free and safe passage of Owner's personnel and the general public to occupied portions of the structure.

3.3 EXISTING FACILITIES TO BE DEMOLISHED AND ABANDONED

- A. Facilities:
1. Buildings, vaults and adjacent designated areas scheduled for complete demolition are as shown on the Contract Drawings.
 2. Portions of buildings and other areas scheduled for selective demolition, partial demolition, and renovation Work are as shown on the Contract Drawings.
- B. Structures:
1. Remove existing above grade structures indicated to 3 feet minimum below grade unless otherwise indicated.
 2. Remove interior walls, other than retaining walls and partitions, as shown on Contract Drawings.
 3. Remove partition walls as shown on Contract Drawings.
 4. Core drill concrete slabs and other concrete improvements scheduled to remain in place below ground, or break holes at the structure's lowest point to allow water to freely migrate through.
 5. Remove sidewalks, curbs, gutters, and street light bases as indicated on Contract Drawings.
 6. Where existing railing is removed, remove post embedments and anchors and fill post holes with non-shrink grout flush to the floor surface. At the point of continuation of existing handrailing, install a new post with rail connections matching the existing railing system. Install new posts in existing concrete floors in core-drilled socket holes and the annular space between the post and hole filled with non-shrink grout
- C. Substructure: Where applicable, extract conflicting existing pilings prior to driving new piles.
- D. Utilities and Related Equipment:

1. Notify Owner or appropriate utilities to turn off affected services at least 48 hours before starting demolition or renovation activities.
2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by Engineer.
3. When utility lines are encountered that are not indicated on Contract Drawings, notify Owner prior to further work in that area.
4. Remove meters and related equipment and deliver to a location as determined by Owner.
5. Excavate and remove utility lines serving buildings to be demolished to 5 feet beyond the outside perimeter of the demolition.
6. Provide a permanent leak-proof closure for water and gas lines.
7. Plug other utility lines with concrete to a minimum plug length of 2 feet to prevent groundwater infiltration.
8. When existing pipe is removed, plug the resulting open ends whether or not so indicated. When removed piping is exposed, blind flange the remaining piping or fit with a removable cap or plug.
9. When existing piping is removed from existing structures, fill resulting openings in the structures and repair any damage such that the finished rehabilitated structure appears as a new homogeneous unit with little or no indication of where the new and old materials join. Fill openings in water-bearing structures with non-shrink grout to be watertight and reinforced as required or indicated. In locations where the surface of the grout will be exposed to view, recess the grout approximately 1/2-inch and fill the recessed area with cement mortar grout.

E. Paving and Slabs:

1. Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated.
2. Provide neat sawcuts at limits of pavement removal as indicated.

F. Concrete:

1. Core drill corners of new opening to avoid overcutting adjacent reinforcing in existing concrete to remain. Saw concrete along straight lines to a depth of not less than 2 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished Work, and the remaining concrete is sound.
2. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.
3. Where new concrete adjoins existing concrete, thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 1/4 inch. Rebar and small embeds at existing concrete may be required to be left to engage new concrete. Saturate surface with water for 24 hours prior to placing new concrete. Tie new Work into the existing construction as shown on Contract Drawings.
4. At locations not to receive new concrete, paint exposed rebar or metal embed ends.

G. Patching:

1. Where removals leave holes and damaged surfaces exposed in the finished Work, patch and repair to match adjacent finished surfaces as to texture and finish.
2. Where new Work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new Work.
3. Patching as specified and indicated, includes:

- a. Fill holes and depressions caused by previous physical damage or left because of removals in existing exposed elements like walls with an approved patching material, applied in accordance with the manufacturer's printed instructions.
- H. Cylinders and Canisters: Remove all fire suppression system cylinders and canisters and dispose as specified in 40 CFR 82.
- I. Door Locksets: Remove all locksets from doors indicated to be removed and disposed of. Turn locksets over to Owner immediately after removal.
- J. Electrical:
 - 1. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 3/4 inch below final finished surface.
 - 2. When removing designated equipment, conduit and wiring may require rework to maintain service to other equipment.
 - 3. Rework existing circuits or provide temporary circuits as necessary during renovation to maintain service to existing lighting and equipment not scheduled to be renovated. Existing equipment and circuiting shown are based on limited field surveys and drawings conforming to construction records. Verify existing conditions and make necessary adjustments. Record the Work on the Project's construction record drawings. This includes, but is not limited to, swapping and other adjustments to branch circuits and relocation of branch circuit breakers within panelboards as required to accomplish the finished work.
 - 4. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated.
 - 5. Remove raceways and cabling not scheduled for reuse.
 - 6. For inaccessibly concealed items, cut off and abandon in place.
 - 7. Remove items exposed or concealed above accessible ceilings.
 - 8. Cap/seal or tab raceways and cabling scheduled for future use.
 - 9. When relocating existing equipment, extend existing wiring or run new wiring from the source.
 - 10. Where the existing raceway is concealed, clean the outlet box and install a blank cover plate.
 - 11. Where the concealed raceway is uncovered, remove raceway (or extend to new location if appropriate).
 - 12. Provide new typewritten panelboard circuit directory cards.
- K. Universal Waste Lamps and Thermostats: Manage, contain, package, and label in strict accordance with 40 CFR 273.

3.4 BURNING

- A. The use of burning as the Site for disposal of refuse and debris will not be permitted.

3.5 BACKFILL

- A. Do not use demolition debris as backfill material.
- B. Fill excavation, open basements, and other hazardous openings to existing ground level or foundation level of new construction in accordance with Section 31 23 00 – Earthwork.

3.6 TITLE TO MATERIALS

- A. Except for items listed herein to be salvaged, all items designated to be removed become the property of Contractor.

3.7 DISPOSITION OF MATERIAL

- A. Do not remove equipment and materials until acceptance of Contractor's Demolition/Renovation Plan by Engineer.
- B. Salvage equipment and material to the maximum extent possible.
- C. Remove salvaged items designated as the property of Owner in a manner to prevent damage and pack or crate to protect the items from damage while in storage or during shipment. Properly identify containers as to contents.
- D. Repair or replace, at the discretion of Engineer, items designated as the property of the Owner damaged during removal or storage.
- E. Deliver salvaged items that are designated as the property of Owner to a storage site as directed by Owner.
- F. Owner will not be responsible for the condition or loss of, or damage to, property scheduled to become Contractor's property after Engineer's authorization to begin demolition or renovation. Materials and equipment may not be viewed by prospective purchasers or sold on the Site.
- G. Store Contractor owned salvaged items where approved by Owner and remove them from Owner's property before completion of the Contract.

3.8 REUSE OF MATERIALS AND EQUIPMENT

- A. Store equipment and material designated to be reused in a location designated by Engineer.
- B. Equipment and material designated to be reused must be cleaned, serviced, and checked for proper operability before being put back into service.
- C. Engineer will determine condition of equipment and materials prior to removal. Properly store and maintain equipment and materials in same condition as when removed.

3.9 UNSALVAGEABLE MATERIAL

- A. Dispose of concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, off Site unless indicated otherwise.
- B. Dispose of combustible material in a sanitary fill.
- C. Dispose of universal waste lamps and thermostats in strict accordance with 40 CFR 273.

3.10 CLEANUP

- A. Remove and transport debris and rubbish in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal apply.

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**DIVISION 03
CONCRETE**

**SECTION 03 11 00
CONCRETE FORMING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish, fabricate, and install concrete formwork, bracing, shoring, supports, and falsework in accordance with Contract Documents.
- B. Work includes installation of form ties, clips, supports and other appurtenances necessary to meet Specifications and produce finished concrete structures.

1.2 RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete

1.3 REFERENCES

- A. American Concrete Institute (ACI) standards, most recent editions:

ACI 117	Specification for Tolerances for Concrete Construction and Materials
ACI 317	Standard Tolerances for Concrete Construction and Materials
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 347	Formwork for Concrete

- B. National Sanitation Foundation (NSF), most recent edition:

NSF 61	Drinking Water System Components, Health Effects
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- C. U.S. Department of Commerce, National Institute of Standards and Technology, (NIST) standards, latest editions:

PS 1	Structural Plywood
PS 20	American Softwood Lumber Standard (ASLS)

1.4 SYSTEM DESCRIPTION

- A. Be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements specified herein.
- B. Design and construct falsework to provide the necessary rigidity and to support the loads imposed. Design falsework for the support of a superstructure to support the loads that would be imposed if the entire superstructure were placed at one time.

- C. Falsework Calculations and Drawings: All falsework or vertical shoring installations where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure, exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or provision for vehicular or railroad traffic through falsework or vertical shoring is made, shall be approved and signed by a civil or structural engineer, registered in the State of Utah. Always maintain a current copy of the falsework plan or shoring layout on the job site.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Shop Drawings: Submit detailed drawings of the falsework proposed to be used. Include drawings with sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the falsework, means of protecting existing construction which supports falsework, and typical soil conditions. Submittals shall include the following:
 - 1. Form ties and all related accessories, including taper tie plugs, if taper ties are used.
 - 2. Form gaskets.
 - 3. Form releasing agent, including NSF certification when applicable.
 - 4. List of form materials and locations for use.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Except as otherwise expressly accepted by Engineer, utilize new material for all lumber brought on the job site for use as forms, shoring, or bracing. Unless otherwise indicated, form surfaces are to be smooth and fabricated from the following materials:
 - 1. Walls: Steel or plywood panel.
 - 2. Columns: Steel, plywood or fiberglass.
 - 3. Roof and Floor: Plywood.
 - 4. All Other Work: Steel panels, plywood or tongue and groove lumber

2.2 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 - 1. Form ties (general):
 - 1) Burke Penta-Tie, Burke Company.
 - 2) Richmond Snap-Tys, Richmond Screw Anchor Company.
 - 3) Gates Ties, Gates and Sons, Inc.
 - 4) Engineer approved equal.

2.3 FORM AND FALSEWORK MATERIALS

- A. Provide materials for concrete forms, formwork, and falsework that conform to the following requirements:
 - 1. Lumber: Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with U.S. Product Standard PS 20.

2. Plywood: New, waterproof, synthetic resin-bonded, exterior type Douglas Fir or Southern Yellow Pine plywood manufactured especially for concrete formwork, conforming to the requirements of PS 1 for Concrete Forms, Class I, edge sealed.
 3. Form materials: Metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.
- B. Unless otherwise indicated, provide exterior corners in concrete members with 3/4-inch chamfers. Re-entrant corners in concrete members do not require fillets unless otherwise indicated.
- C. Design forms and falsework to support the roof and floor slabs for the total dead load, plus a live load of 50 psf (minimum). The minimum design load for combined dead and live loads is 100 psf.

2.4 FORM TIES

- A. Provide form ties with integral waterstops with a plastic cone on both sides of walls, or other suitable means for forming a conical hole to ensure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, may not exceed 1-1/2 inches; and all such fasteners must leave holes of regular shape for reaming.

2.5 FABRICATION

- A. Form tolerances: Provide forms in accordance with ACI 347, ACI 318, or 350 and the following tolerances.
1. Wall tolerances:
 - a. Straight wall surface:
 - 1) Exposed wall surface: Flat planes within tolerance specified.
 - 2) Plumb within 1/4 inch in 10 feet or within 1 inch from top to bottom for walls over 40 feet tall.
 - 3) Depressions in wall surface: Maximum 5/16 inch when 10-foot straightedge is placed on high points in all directions.
 - 4) Thickness: Maximum +1/4 inch or -1/2 inch from dimensions shown.
 2. Slab tolerances:
 - a. Exposed slab surfaces: Comprise of flat planes as required within tolerances specified.
 - b. Slab finish tolerances and slope tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on end blocks, no low spots that allow a block of twice the tolerance in thickness to pass under the supported 10-ft straightedge:
 - 1) Steel gage block: 5/16 inch thick.
 - c. Finish slab elevation: Slope slabs to floor sumps, drains, and gutter, to drain regardless of tolerances.
 - d. Thickness: -1/4 inch or +1/2 inch from thickness shown, except when thickness tolerance will affect slope, drainage, or slab elevation.
 3. For all other tolerances, refer to ACI 117.
 4. Make transitions from plus to minus tolerances gradual, even, and smooth.

PART 3 - EXECUTION

3.1 GENERAL

- A. Use forms to confine the concrete and shape it to the required lines wherever necessary. Assume full responsibility for the adequate design of all forms. Promptly remove any forms which are unsafe or inadequate in any respect from the Work and replaced at no increased cost to Owner. Provide worker protection from protruding reinforcement bars in accordance with applicable safety codes. Provide a sufficient number of forms of each kind to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state, and federal regulations.
- B. Install plumb and string lines before concrete placement and maintain during placement. These lines will be used by both Contractor and Engineer for control and verification of the form lines. Provide sufficient number, properly installed for that purpose. During concrete placement, continually monitor plumb and string line form positions and immediately correct deficiencies.
- C. Conform to the shape, lines, and dimensions of members as called for on the Drawings, substantial and free from surface defects, and sufficiently tight to prevent leakage. Brace forms or tie them together to maintain their position and shape under a load of freshly placed concrete. If adequate foundation for shores cannot be secured, provide trussed supports.

3.2 FORM CONSTRUCTION

- A. Construct forms in conformance with ACI 347.
- B. Set forms true to the required shape and size and conform to the established alignment and grade. Provide sufficient strength and rigidity to maintain form position and shape under the loads and operations incident to placing and vibrating the concrete. Provide suitable and effective means on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. Assemble the forms tight to prevent the loss of water, cement, and fines during placing and vibrating of the concrete. Specifically, provide the bottom of wall forms that rest on concrete footings or slabs with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form. Provide adequate clean-out holes at the bottom of each lift of forms. The size, number, and location of such clean-outs must be as acceptable to Engineer. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, provide pour windows of the size and spacing needed to allow placement of concrete to the requirements of Section 03 30 00 - Cast-in-Place Concrete. Provide size, number, and location of such form windows acceptable to Engineer.
- C. Vertical surfaces: Form all vertical surfaces of concrete members except where placement of the concrete against the ground is shown. Add no less than 1 inch of concrete to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the

required lines and will stand securely without caving or sloughing until the concrete has been placed and has set.

- D. Construction joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to Engineer. When a second lift is placed on hardened concrete, take special precautions to include the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory affect on the concrete. Set pipe stubs and anchor bolts in the forms where required.
- E. Form ties
1. Embedded Ties: Ream holes left by the removal of form tie cones with suitable toothed reamers to leave the surface of the holes clean and rough before being filled with mortar as specified for finish of concrete surfaces in Section 03 30 00 - Cast-in-Place Concrete. Wire ties for holding forms will not be permitted. Leave no form-tying device or part thereof, other than metal, embedded in the concrete. Do not remove ties in such manner to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, provide rubber grommets where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods must remain embedded and must terminate not less than 2 inches back from the formed face or faces of the concrete.
 2. Removable Ties: Where taper ties are approved for use, place the larger end of the taper tie on the wet side of walls in water retaining structures. After the taper tie is removed, thoroughly clean the remaining hole and roughen for bond. Place a precast neoprene or polyurethane tapered plug at the wall centerline. Fill the hole completely with nonshrink grout for water bearing and below-grade walls. For above-grade walls which are dry on both sides, fill the remaining hole with nonshrink or regular cement grout. On exposed faces of walls fill the outer 2 inches of the exposed face a cement grout matching the color and texture of the surrounding wall surface.

3.3 REMOVAL OF FORMS

- A. Employ careful procedures for the removal of forms to avoid injury to the concrete. No heavy loading on green concrete will be permitted. In the case of roof slabs and above-ground floor slabs, maintain forms in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength specified in Section 03 30 00 - Cast-in-Place Concrete; provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 7 days. The time required to establish said strength will be determined by Engineer who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time will be used as the minimum length of time. Forms for all vertical walls must remain in place at least 2 days after the concrete has been placed. Forms for all parts of the Work not specifically mentioned herein must remain in place for periods of time as determined by Engineer and ACI 347.

3.4 REUSE OF FORMS

- A. Forms may be reused only if in good condition and only if acceptable to Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to Engineer.

3.5 MAINTENANCE OF FORMS

- A. Maintain forms at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, must conform to the established alignment and grades. Before concrete is placed, thoroughly clean the forms to remove dirt and debris. Treat form surfaces with a non-staining mineral oil or other lubricant acceptable to Engineer. Remove excess lubricant before placing the concrete. Where field oiling of forms is required, perform the oiling at least 2 weeks in advance of their use. Take care to keep oil off the surfaces of steel reinforcement and other metal items embedded in concrete.

3.6 FALSEWORK

- A. Place falsework on a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, limit the maximum calculated pile loading to 20 tons. When falsework is supported on any portion of the structure which is already constructed, the load imposed by the falsework shall be spread, distributed, and braced to avoid any possibility of damage to the structure.

END OF SECTION

**SECTION 03 20 00
CONCRETE REINFORCING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish, fabricate, and install reinforcing steel as shown on Contract Documents.
- B. Work includes installation of tie wires, clips, supports, and other appurtenances necessary to meet Specifications and produce finished concrete structures.

1.2 RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete
- B. Section 03 60 00 - Grout

1.3 REFERENCES

- A. American Concrete Institute (ACI) standards, most recent editions:

ACI 315	Details of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures

- B. American Welding Society (AWS):

D1.4	Structural Welding Code – Reinforcing Steel
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- C. ASTM International (ASTM) standards, most recent editions:

ASTM A615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A706	Standard Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM A775	Standard Specification for Epoxy-Coated Reinforcing Steel Bars
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

- D. Concrete Reinforcing Steel Institute (CRSI) standards, most recent editions:

Placing Reinforcing Bars

Manual of Standard Practice

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Submit details of the concrete reinforcement steel and concrete inserts at the earliest possible date after receipt of the Notice to Proceed.
- C. Include, but not limit to, the following:
 - 1. Complete bar schedule, bar details and erection drawings to conform to ACI 315.
 - 2. Each type of bar marked with identification corresponding to identification tag on bar.
 - 3. Length, type, and location of all splices.
 - 4. Erection drawings shall be clear, easily legible and to a minimum scale of:
 - a. 1/4 inch = 1 foot.
 - b. 1/8 inch = 1 foot if bars in each face are shown in separate views.
 - 5. Size and location of openings.
- D. Furnish a certified Affidavit of Compliance issued by steel manufacturer that reinforcing steel furnished for project meets requirements of ASTM standards referenced herein, as applicable.
- E. Do not use Contract Documents as erection drawings.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Welding operators, processes, and procedures to be qualified in accordance with AWS D1.4.
 - 2. Welding operators to have been qualified during the previous 12 months prior to commencement of welding.
- B. Certifications
 - 1. Submit manufacturer's certification that products submitted meet requirements of standards referenced.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Store reinforcing steel on wood supports in a manner that prevents it from coming in contact with the ground.
- C. Store only bars with same identifying label in same stack.
- D. Cover epoxy coated reinforcement for protection against both moisture and ultraviolet light and so that condensation does not form on the bars.
- E. When handling coated bars, use systems with padded contact areas.

- F. Thoroughly inspect coated steel after delivery to the job site and again after installation to ensure that it is not damaged.
 - 1. Repair damage with patching material meeting manufacturer's requirements.
 - 2. Promptly patch sheared ends and other cuts or exposed areas before detrimental oxidation occurs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 - 1. Mechanical Couplers:
 - a. Lenton Form Saver by Erico Products.
 - b. Dowel Bar Splicer System by Richmond Screw Anchor Company.
 - c. Engineer-approved equal.

2.2 REINFORCEMENT STEEL

- A. Materials:
 - 1. Reinforcing bars: ASTM A615, Grade 60.
 - 2. Reinforcing bars to be welded: ASTM A706.
 - 3. Smooth dowels: ASTM A615, Grade 60 plain billet steel bars epoxy coated in accordance with ASTM A775. Provide slip dowel sleeves to allow longitudinal movement equal to joint width plus 1/4 inch.
 - 4. Slip Dowel Sleeve: One or two component Speed Dowel System as manufactured by Greenstreak, Inc., to accept #5 rebar x 12-inch-long slip dowels, including epoxy coating when specified herein or shown on Drawings.
 - 5. Welded wire fabric: ASTM A1064 and the details indicated; provided, that welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either provided in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W4 size shall be provided in flat sheets only.
 - 6. Spiral reinforcement: Cold drawn steel wire conforming to the requirements of ASTM A1064.
 - 7. Welding Electrodes: E90 meeting requirements of AWS D1.4.
- B. Fabrication of Bars:
 - 1. Fabricate with cold bends conforming to recommended dimensions shown in ACI 318.
 - 2. Field fabrication will be allowed only if Contractor has equipment to properly fabricate steel to same tolerances as for shop fabrications.
 - 3. Attach identification tags with identifying mark.
 - 4. Contractor may at his option continue steel reinforcement through openings in walls and slabs, then field cut opening.

2.3 BOLSTERS, CHAIRS AND ACCESSORIES

- A. Conform to ACI 315 and CRSI Manual of Standard Practice.

- B. Provide spacers, bolsters, chairs, ties and other devices necessary to properly space, place, support, and fasten steel reinforcement in place during concrete placement.
- C. Metal accessories shall be stainless steel with plastic coated tips where legs will be exposed in finished concrete surfaces. Color of plastic shall be grey to match concrete color.
- D. Do not use rocks, broken bricks, wood blocks, or concrete fragments for support of steel reinforcement.
- E. Support between Reinforcing Steel and Formed Exposed Surfaces: Metal bar chairs.

2.4 PRECAST CONCRETE BLOCK BAR SUPPORTS (DOBIES)

- A. Supports between Reinforcing Steel for Roof Slabs: Concrete block prohibited.
- B. Minimum Compressive Strength of Blocks: 5,000 psi in seven days.
- C. Minimum Bearing Area: 9 square inches. Place as required to maintain specified clearances.
- D. Wire ties shall be embedded in concrete block bar supports.

2.5 MECHANICAL COUPLERS

- A. Provide mechanical couplers where shown and where approved by Engineer and in accordance with ACI building code standards. The couplers shall develop the full tensile strength of the bars being spliced at each splice (Type 2).
- B. Where the type of coupler used is composed of more than one component, supply all components required for a complete splice. This shall apply to all mechanical splices, including those splices intended for future connections.

2.6 EPOXY GROUT

- A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements found in Section 03 60 00 - Grouting.

2.7 FABRICATION

- A. Tolerances:
 - 1. Sheared lengths: plus or minus 1 inch.
 - 2. Overall dimensions of stirrups, ties, and spirals: plus or minus 1/2 inch.
 - 3. All other bends: +0 inch, -1/2 inch.
- B. Minimum diameter of bends measured on the inside of the rebar to be as indicated in ACI 318.
- C. Ship all reinforcement to job site with attached plastic or metal tags.
 - 1. Place on each tag the mark number of the reinforcement corresponding to the mark number indicated on the shop drawings.
 - 2. Mark numbers on tags to be so placed that the numbers cannot be removed.

2.8 TESTING

- A. Perform at mill for each heat.
- B. If requested by Engineer, furnish samples of each type of welded splice used in the Work in a quantity and of dimensions adequate for testing.
- C. At the discretion of Engineer, radiographic testing of direct butt-welded splices will be performed. Provide assistance necessary to facilitate testing. Repair any weld which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by Owner; except, the costs of all tests which fail to meet specified requirements shall be paid by Contractor at no increase in cost to Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Tolerances:
 - 1. Rebar Placement:
 - a. Clear distance to formed surfaces: plus or minus $\frac{1}{4}$ inch.
 - b. Minimum spacing between bars: $\frac{1}{4}$ inch.
 - c. Top bars in slabs and beams:
 - 1) Members 8 inches deep or less: plus or minus $\frac{1}{4}$ inch.
 - 2) Members between 8 inches and 2 feet deep: plus or minus $\frac{1}{4}$ inch.
 - 3) Members more than 2 feet deep: plus or minus $\frac{3}{4}$ inch.
 - d. Crosswise of members: Spaced evenly within plus or minus 1 inch.
 - e. Lengthwise of members: plus or minus 2 inches.
 - 2. Minimum clear distance between rebars:
 - a. Beams, walls, and slabs: Distance equal to rebar diameter or 1 inch, whichever is greater.
- B. Minimum concrete protective covering for reinforcement, unless indicated otherwise on Contract Documents:
 - 1. Concrete deposited against earth: 3 inches.
 - 2. Formed surfaces exposed to weather or in contact with earth:
 - a. 2 inches for reinforcing bars #6 or larger.
 - b. $1\frac{1}{2}$ inch for reinforcing bars less than #6.
 - 3. Formed surfaces exposed to any liquid: 2 inches for all rebar sizes.
 - 4. Interior surfaces:
 - a. $1\frac{1}{2}$ inch for beams, and girders..
 - b. $\frac{3}{4}$ inch for slabs, walls, and joists.
- C. Splice steel to conform to Chapter 12 of ACI 318 or ACI 350 as applicable. Unless indicated otherwise on Contract Documents, provide splices for reinforcing as follows:
 - 1. Rebar:
 - a. Lapped splices shall be not less than a Class B splice for reinforcement unless otherwise indicated.
 - b. Mechanical splices shall be used whenever shown on the Contract Documents and may be used at other locations at Contractor's option. Such locations shall be shown specifically on the rebar shop drawings.

- c. Welding:
 - 1) Perform welding of rebars in accordance with requirements of AWS D1.4.
 - 2) Have each welder place an approved identifying mark near each completed weld.
 - 2. Welded wire fabric: Splice lap length measured between outermost cross wires of each fabric sheet shall not be less than 1 spacing of cross wires plus 2 inches, or less than 1.5 times the development length, nor less than 6 inches. Development length shall be as required for the basic development length for the specified fabric yield strength in accordance with Section 12 of ACI 318 or ACI 350.
 - 3. Provide splices of reinforcing not specifically indicated or specified subject to approval of Engineer.
- D. Placing Rebars
- 1. Assure that reinforcement at time concrete is placed is free of mud, oil, or other materials that may affect or reduce bond.
 - 2. Reinforcement with rust, mill scale, or a combination of both will be accepted as being satisfactory without cleaning or brushing provided dimensions and weights including heights of deformations on a cleaned sample are not less than required by applicable ASTM specifications that govern the rebar supplied.
 - 3. Rebar support:
 - a. Support rebars and fasten together to prevent displacement by construction loads or placing of concrete.
 - b. On ground, provide supporting concrete blocks.
 - c. Over formwork, provide plastic-coated metal chairs, runners, boosters, spacers, hangers, and other rebar support. Only tips in contact with the forms need to be plastic coated.
 - d. Bars additional to those shown on the Contract Documents, which may be found necessary or desirable by Contractor for the purpose of securing reinforcement in position, shall be provided by Contractor at his own expense.
 - e. Tie securely at minimum of 33% of intersections with 16-gage or larger annealed iron wire.
 - f. Accommodate placement of formed openings.
 - g. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, rebars in the upper layers shall be placed directly above rebars in the bottom layer with clear distance between layers to be 1 inch. Place spacer rebars at 3 feet maximum centers to maintain the required 1-inch clear distance between layers.
 - h. Extend reinforcement to within 2 inches of concrete perimeter edges. If perimeter edge is earth formed, extend reinforcement to within 3 inches of the edge.
 - i. To insure proper placement, furnish templates for all column vertical bars and dowels.
 - j. Provide splices of reinforcement not specifically indicated or specified subject to Engineer's approval.
 - k. Do not bend reinforcement after embedding in hardened concrete unless approved by Engineer. Do not bend reinforcing by means of heat.
 - l. Tie wires shall be bent away from form surfaces.
 - m. Do not tack-weld reinforcement.

- E. Ensure that steel reinforcement and embedments do not exceed 160 Degrees F at time of concrete placement.

3.2 FIELD QUALITY CONTROL

- A. Reinforcement Congestion and Interfaces:
 - 1. Notify Engineer whenever the specified clearances between rebars cannot be met.
 - 2. Do not place any concrete until Engineer submits a solution to rebar congestion problem.
 - 3. Rebars may be moved slightly to avoid interference with other reinforcement steel, conduits, or embedded items.
 - 4. If rebars are moved more than 1 bar diameter, or enough to exceed above tolerances, obtain Engineer's approval of resulting arrangement of rebars.
 - 5. No cutting of rebars shall be done without written approval of Engineer.
- B. Employ a testing laboratory to perform and report following:
 - 1. Review and approve Contractor proposed welding procedures and processes for conformance with AWS D1.4.
 - 2. Qualify welders in accord with AWS D1.4.
 - 3. Test three samples of each bar size and each type of weld in accord with AWS D1.4. The tensile strength of each test shall be not less than 125 percent of the required yield strength of the rebar tested.
 - 4. Conduct nondestructive field tests (radiographic or magnetic particle) on not less than one random sample for each 10 welds. In addition, if any welds are found defective, test five previous welds performed by the same welder.
 - 5. Visually inspect each weld for presence of cracks, undercuts, inadequate size, and other visible defects.

3.3 COORDINATION

- A. Coordination with placement of formwork, formed openings, embedded items, and other Work.

END OF SECTION

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**SECTION 03 30 00
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide cast-in-place concrete work as shown on Contract Drawings and as specified herein.
- B. Section includes:
 - 1. Concrete Materials.
 - 2. Proportioning and Mixing.
 - 3. Ready Mixed Concrete.
 - 4. Curing Materials.
 - 5. Expansion Joint Filler.
 - 6. Elastomeric Bearings.
 - 7. Waterstops.
 - 8. Liquid Floor Hardener.
 - 9. Preparing for Concreting.
 - 10. Placing of Concrete.
 - 11. Finishing.
 - 12. Curing.
 - 13. Field Quality Control.

1.2 RELATED SECTIONS

- A. Section 03 11 00 – Concrete Forming.
- B. Section 03 20 00 – Concrete Reinforcing.
- C. Section 03 60 00 – Grouting.

1.3 REFERENCES

- A. American Concrete Institute (ACI) standards, most recent editions:
 - ACI 117 Standard Tolerances for Concrete Construction and Materials
 - ACI 211 Standard Practice for Selecting Proportions for Concrete
 - ACI 212 Chemical Admixtures
 - ACI 301 Specifications for Structural Concrete for Buildings
 - ACI 305R Guide to Hot Weather Concreting
 - ACI 306R Guide to Cold Weather Concreting
 - ACI 318 Building Code Requirements for Structural Concrete

ACI 350 Code Requirements for Environmental Engineering Concrete Structures

B. ASTM International (ASTM) standards, most recent editions:

ASTM C31 Standard Specification Making and Curing Concrete Test Specimens in the Field

ASTM C33 Standard Specifications for Concrete Aggregates

ASTM C39 Test for Compressive Strength of Cylindrical Concrete Specimens

ASTM C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C94 Standard Specifications for Ready-Mixed Concrete

ASTM C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

ASTM C143 Standard Test Method for Slump of Hydraulic Cement Concrete

ASTM C172 Standard Practice for Sampling Freshly Mixed Concrete

ASTM C260 Specification for Air-Entraining Admixtures for Concrete

ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C494 Standard Specification for Chemical Admixtures for Concrete

ASTM C586 Standard Test Method for Potential Alkali Reactivity of Carbonate Rocks as Concrete Aggregates (Rock-Cylinder Method)

ASTM C595 Standard Specification for Blended Hydraulic Cements

ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM C827 Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures

ASTM C1077 Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

ASTM C1260 Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

- | | |
|------------|---|
| ASTM C1293 | Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction |
| ASTM C1567 | Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method) |
| ASTM D412 | Test Methods for Rubber Properties in Tension |
| ASTM D624 | Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers |
| ASTM D746 | Test Method for Brittleness Temperature of Plastics and Elastomers by Impact |
| ASTM D747 | Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam |
| ASTM D1751 | Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM D1752 | Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction |
| ASTM D2240 | Test Method for Rubber Property - Durometer Hardness |
| ASTM D2419 | Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate |
- C. International Concrete Repair Institute (ICRI) standards, latest editions:
- | | |
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| Guideline No 310.1R | Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion |
| Guideline No 320.2R | Guide for selecting and specifying Materials for repair of Concrete Surfaces |
- D. NSF International (NSF), most recent edition:
- | | |
|--------|--|
| NSF 61 | Drinking Water System Components, Health Effects |
|--------|--|
- E. U. S. Army Corps of Engineers standards, most recent editions:
- | | |
|-----------|----------------|
| CRD-C 572 | PVC Waterstops |
|-----------|----------------|

1.4 DEFINITIONS

- A. Construction Joints: Fresh concrete placed against a hardened concrete surface; joint between two pours is called a construction joint. Unless otherwise indicated, provide construction joints with a waterstop and sealant groove of the shape indicated.

- B. Expansion Joints: To allow concrete to expand freely, space provided between two pours, formed as indicated. Space is made by placing filler joint material against the first pour; acts as a form for the second pour.
- C. Control Joints: Provide weakened plane in concrete, where shrinkage cracks will likely occur. A groove, shape and dimensions indicated in Drawings, formed or saw-cut in concrete. Groove is filled with joint sealant material.
- D. Laitance: In placement of concrete, accumulation of small inert particles of cement and aggregate on surface, caused by excess of water that, when it evaporates, leaves a thin layer, causing weakened plane for subsequent pour.
- E. Alkalis: Term "alkalis" referred to herein is defined as sum of percentage of sodium oxide and 0.658 times percentage of potassium oxide ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$). These oxides shall be oxide content determined in accordance with ASTM C114.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Product data:
 - 1. Concrete mix design(s) proposed for use. Proposed concrete mix design submittal to include the following information:
 - a. Sieve analysis and source identification of fine and coarse aggregates. Include sand equivalency.
 - b. Source test results for aggregate organic impurities.
 - c. Source test results for deleterious aggregate per ASTM standards.
 - d. Proportioning of all materials.
 - e. Type of cement with mill certificate for cement.
 - f. Slump.
 - g. Air Content.
 - h. Brand, type, ASTM designation, and quantity of each admixture proposed for use.
 - i. 28-day cylinder compressive test results of trial mixes per ACI 350 and as indicated herein.
 - j. Shrinkage test results.
 - k. Standard deviation value for concrete production facility.
 - 2. Manufacturer and type of joint filler, joint sealant, curing agent, finishing aid, and chemical floor hardener.
 - 3. Waterstops:
 - a. Provide manufacturer's current test reports with written material certification.
 - b. Provide samples of extruded or molded sections of each size or shape to be used in the Work. Samples shall represent in all aspects, the material to be furnished under this Contract.
 - c. Provide sample of fabricated cross-construction of each size or shape of waterstop to be used. Fabricate samples so that material and workmanship represent the materials to be furnished in the Work.
 - d. Provide manufacturer's written certification as an integral part of the shipping form, to show that the material shipped to Work meets or exceeds the physical property requirements specified.

4. Manufacturer and type of bonding and patching mortar and bonding adhesive used at construction joints.
5. Pour plan for concrete pour sequence.

1.6 CONCRETE CONFERENCE

- A. A meeting to review the detailed requirements of the Contractor's proposed concrete design mixes and to determine the procedures for producing proper concrete construction shall be held no later than 30 days after the notice to proceed.
- B. All parties involved in the concrete work shall attend the conference, including the following:
 1. Contractor's representative.
 2. Testing laboratory representative.
 3. Concrete subcontractor.
 4. Reinforcing steel subcontractor and detailer.
 5. Concrete supplier.
 6. Admixture manufacturer's representative.
- C. The conference will be held at a mutually agreed upon time and place. Notify Engineer no less than 5 days prior to the date of the conference.

1.7 QUALITY ASSURANCE

- A. Preconstruction Testing: Perform all preliminary and trial batch laboratory tests on cement, aggregates, and concrete.
- B. Testing Agencies: The testing laboratory shall meet or exceed the requirements of ASTM C1077.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Mixing, transporting, handling, placing, curing, and testing concrete in accordance with applicable ACI and ASTM specifications and as specified.
- C. Storage of material:
 1. Cement:
 - a. Protect cement from exposure to moisture until used.
 - b. Do not use if caked or lumpy.
 - c. Store sacked cement to permit access for inspection and sampling.
 2. Aggregate:
 - a. Store to prevent segregation and contamination with other sizes or foreign materials.
 - b. Obtain samples for testing from aggregates at point of batching.
 - c. Do not use frozen or partially frozen aggregates.
 - d. Do not use the bottom 6 inches of stockpiles in contact with ground.
 - e. Allow sand to drain until moisture content is uniform prior to use.
 3. Admixtures:
 - a. Protect from contamination, evaporation, freezing, or damage.
 - b. Maintain within temperature range recommended by manufacturer.

c. Completely mix solutions and suspensions prior to use.

D. Delivery:

1. Prepare a delivery ticket for each load of ready-mix concrete delivered to the project. Truck operator shall hand ticket to Engineer at time of delivery, which shows the following information for each load:
 - a. Mix identification mark.
 - b. Quantity delivered (by volume).
 - c. Amount of each material in batch.
 - d. Outdoor temperature in the shade.
 - e. Time at which cement was added.
 - f. Amount of water added at jobsite by Contractor.
 - g. Amount of superplasticizer added where applicable.

1.9 SITE ENVIRONMENTAL REQUIREMENTS

- A. When temperature is below 40°F or is likely to fall below 40°F during 24-hour period after placing concrete, heat materials, (not in excess of 140°F) including both water and aggregates and protect concrete so that temperature of the concrete is between 50°F and 90°F for 24-hour period after placing concrete.
- B. During hot weather, shade materials from sun and use cool water so temperature of concrete does not exceed 90°F at time of placing concrete.
- C. Placing of concrete is not permitted where, in opinion of Engineer, wind, rain or inadequate facilities furnished by Contractor prevents proper finishing or curing of concrete.

1.10 COORDINATION

- A. Coordination with placement of reinforcing steel, embedded items, and other Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 1. Expansion joint fillers:
 - a. WR Meadows, Inc.
 - b. NMW, Incorporated
 - c. Rubberite Cypress Sponge Corporation
 - d. Engineer approved equal.
 2. Membrane Curing Compound.
 - a. 1100-Clear, WR Meadows, Inc.
 - b. Clear Resin Cure (J11w), Dayton Superior.
 - c. L&M Cure R, L&M Construction Chemicals, Inc
 - d. Engineer approved equal.
 3. Evaporation Retardant:
 - a. AquaFilm (J74), Dayton Superior.
 - b. Eucobar, Euclid Chemical Company.

- c. MasterKure ER 50, Master Builders.
- d. Engineer approved equal.
- 4. Waterstops, Plastic Serrated Type:
 - a. BoMetals, Inc.
 - b. Durajoint, DCA Construction Products
 - c. Greenstreak, Sika, Inc.
 - d. Vinylex, Sika, Inc
 - e. Engineer approved equal.
- 5. Waterstops, Plastic Adhesive Type:
 - a. Lockstop, Sika, Inc.
 - b. Synko-Flex, Henry Company
 - c. Engineer approved equal.
- 6. Waterstops, Hydrophilic Type
 - a. Ultraseal, Adeka, Inc.
 - b. Adcor ES, WR Grace,
 - c. Hydro-Flex, Henry Company.
 - d. Hydrotite, Sika, Inc.
 - e. Engineer approved equal.
- 7. Bonding agent:
 - a. Armatek 110 EpoCem, Sika, Inc.
 - b. Engineer approved equal.
- 8. Set Controlling Admixtures
 - a. For air temperature at the time of placement over 80°F; set-retarding and hydration control:
 - 1) MasterSet Delvo, Master Builders.
 - 2) Recover, GCP Applied Technologies.
 - 3) SikaTard 440, Sika Corporation.
 - 4) Engineer approved equal.
 - b. For air temperature at the time of placement under 40°F: Non-corrosive set accelerating:
 - 1) Daraset 400, GCP Applied Technologies.
 - 2) MasterSet FP 20, Master Builders.
 - 3) Plastocrete 161FL by Sika Corporation.
 - 4) Engineer approved equal.
- 9. Air-entraining Agent:
 - a. MasterAir AE 200, Master Builders.
 - b. Daravair 1000, GCP Applied Technologies.
 - c. Sika AEA-15, Sika Corporation.
 - d. Engineer approved equal.
- 10. Finishing Aids:
 - a. Day1 Finishing Aid, Solomon Colors.
 - b. Slab Assist, TK Products.
 - c. Engineer approved equal.
- 11. Crystalline Waterproofing Repair Grout:
 - a. Mortar IC, AquaFin, Inc.
 - b. Penecrete Mortar, Penetron International, LTD.
 - c. Concentrate Dry Pac, Xypex Chemical Corporation.
 - d. Engineer approved equal.
- 12. Pigments for Underground Conduit Banks:
 - a. Arizona Oxides, #1835.

- b. Bayer, Bayferrox #130.
 - c. Davis, #117.
 - d. As currently approved by Rocky Mountain Power Company.
13. Liquid Chemical Floor Hardener:
- a. Surfhard, Euclid Chemical Company, Cleveland, Ohio.
 - b. Burke-O-Lith, EDOCO.
 - c. Solidus Hardener, Lambert Corporation.
 - d. Engineer-approved equal.

2.2 MATERIALS

- A. Blended Hydraulic Cement: Comply with ASTM C595, Type IL (10) (MS), grey color.
 - 1. Cement shall not contain more than 0.60 percent equivalent alkalis.
 - 2. Limestone content is limited to 10 percent.
 - 3. Single brand of cement used throughout Work; brand approved by Engineer.

- B. Fly Ash: ASTM C618, Class F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
 - 1. Maximum of 25 percent replacement at 1.0 pounds of fly ash per pound of cement replaced.

- C. Coarse Aggregate: Conforming to ASTM C33 and as noted below.
 - 1. Clean, hard, durable gravel, crushed gravel, crushed rock or combination thereof.
 - 2. Reactivity: Non-reactive or below innocuous behavior level.
 - 3. Prepare and handle coarse aggregates in two or more size groups for combined aggregates with maximum size greater than 3/4 inch.
 - 4. When aggregates are proportioned for each batch of concrete, combine the size groups.
 - 5. Obtain coarse aggregates from sources approved by Engineer.

- D. Combined Aggregates: Well graded from course to fine sizes; uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradation will be established during the trial batch process.

- E. Fine Aggregates: Natural or combination of natural and manufactured sand that is hard and durable.
 - 1. Lightweight Sand for Fine Aggregate: Not permitted.
 - 2. Sand Equivalency: Tested in accordance with ASTM D2419; not less than 80 percent for an average of 3 samples; not less than 80 percent for an individual test.
 - 3. Gradation: In accordance with ASTM C33; 15 to 30 percent passing number 50 screen; 5 to 10 percent passing number 100 screen.
 - 4. Fineness Modulus: Not over 3.00.
 - 5. Reactivity: Non-reactive or below innocuous behavior level.
 - 6. Obtain fine aggregates from sources approved by Engineer.

- F. Water: Clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities, as determined by Engineer.

- G. Admixtures:

1. Maximum total water-soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials, and admixtures by weight percent of cement:
 - a. 0.06 For prestressed concrete.
 - b. 0.10 For all other concrete.
2. Do not use calcium chloride.
3. Provide admixtures of same type, manufacturer, and quantity as used in establishing required concrete proportions in the mix design.
4. Air entraining admixtures: ASTM C260.
5. Water reducing admixtures:
 - a. Comply with ASTM C494, Type A.
 - b. Conform to applicable provisions of ACI 212.3R.
 - c. Follow manufacturer's instructions.
 - d. Use chloride free admixtures only.
6. Set controlling admixtures with or without water-reducing properties.
 - a. ASTM C494, Types B through E.
 - b. Conform to applicable provisions of ACI 212.3R.
 - c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no additional cost to Owner.
 - d. Follow manufacturer's instructions.
 - e. Use chloride free admixtures only.
7. High Range Water Reducers:
 - a. In accordance with ASTM C494, Type F.
 - b. Conform to applicable provisions of ACI 212.3R.
 - c. Locations for use of high range admixtures shall be as shown on the Contract Drawings. Do not use high range admixtures in other locations unless specifically approved by Engineer and at no additional cost to Owner.
 - d. Added at the plant unless written permission is given by Engineer to add the product at the Site.
 - e. Mixing: Minimum 70 revolutions or 5 minutes after addition of high-range water reducer.
 - f. Slump before Addition: Maximum 2 inches.
 - g. Slump after Addition: Minimum of 6 inches and maximum of 10 inches.
8. Pigments for Underground Conduit Banks: Add pigment to concrete encasing electrical duct banks as required by governing agency.

H. Curing Materials

1. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C156 shall not exceed 0.055 grams per square centimeter of surface.
2. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU B 790A (1) (2). The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.
3. Polyethylene-coated burlap for use as concrete curing blanket shall be 4 mils thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when

determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

4. Membrane Curing Compound: ASTM C309, Type 1, Class B. Sodium silicate compounds will not be allowed.

I. Expansion Joint Filler

1. Provide expansion joints in concrete construction where shown on Contract Drawings.
2. Expansion Joint Filler: Preformed, non-extruding, resilient type, constructed of cellular sponge rubber, extending full thickness of slab, in accordance with ASTM D1752, Type I.

J. Grout: As specified in Section 03 60 00 – Grouting.

K. Waterstop, Plastic Serrated Type:

1. Extruded elastomeric polyvinyl chloride compound: containing plasticizers, resins, stabilizers, and other materials necessary to meet requirements of Specifications.
 - a. Store waterstops to permit free circulation of air around waterstop material.
 - b. Provide manufacturer’s factory fabrications for intersections, transitions, and changes of direction.
 - c. In accordance with Specification CRD-C572.

	<u>VALUE</u>	<u>ASTM STD.</u>
<u>PHYSICAL PROPERTY, SHEET MATERIAL</u>		
Tensile Strength-minimum (psi)	1750	D412, Die C
Ultimate Elongation-minimum (%)	350	D412, Die C
Low Temp. Brittle-maximum (°F)	-35	D746
Stiffness in Flexure-minimum (psi)	400	D747
<u>ACCELERATED EXTRACTION (CRD-C572)</u>		
Tensile Strength-minimum (psi)	1500	D412, Die C
Ultimate Elongation-minimum (%)	300	D412, Die C
<u>EFFECT OF ALKALIES (CRD-C572)</u>		
Change in Weight (%)	+.25/- .10	-----
Change in Durometer, Shore A	+5	D2240
<u>FINISHED WATERSTOP</u>		
Tensile Strength minimum (psi)	1400	D412, Die C
Ultimate Elongation minimum (%)	280	D412, Die C

d. Style:

- 1) Centerbulb, 7/8 inch OD, 6 inches long.
- 2) Flat Strip, 6 inches long unless noted otherwise.
- 3) Labyrinth, 4 3/8 inch long minimum

L. Waterstop, Plastic Adhesive Type: Non expansive plastic adhesive strip type conformable, manufactured solely for the purpose of preventing water from passing through construction joints.

1. Primer as recommended by waterstop manufacturer.

M. Waterstop, Hydrophilic Type: Expansive, conformable blended rubber-based material.

1. Primer as recommended by waterstop manufacturer.

- N. Liquid Chemical Floor Hardener:
1. Colorless, aqueous solution containing magnesium fluosilicate combined with a wetting agent.
 - a. Premeasured, premixed, and packaged at the factory.
 - b. Not less than 2 pounds fluosilicate per gallon.
 - c. Provide material which does not react with, inhibit, or otherwise interfere with adhesives and bonding of future floor finishes.
- O. Elastomeric Bearing Materials:
1. Rubber bearing pads shall be furnished with the dimensions, material properties, and elastomer grade as required by the Drawings and in accordance with ASTM D2240, Type A, Shore 30 or 40 Durometer.
 2. Prepare concrete support surfaces and adhere pads to concrete per manufacturer's recommendations.
- P. Finishing Aids:
1. Topically applied colloidal silica compound.
 2. Do not use as a curing compound.
 3. Only to be used to assist in finishing by working into the surface immediately after application.

2.3 EQUIPMENT

- A. On-Site Batch Plants:
1. Direct weighing equipment approved by Engineer for measuring cement and aggregate. Scales certified by Bureau of Weights and Measures. Certification current within 6 months.
 2. Equip mixer with suitable water meter or another measuring device approved by Engineer.
 - a. Meter capable of measuring water in variable amounts within a tolerance of 1 percent.
 - b. Water feed control mechanism capable of being locked in position to deliver constant supply of specified amount of water to each batch of concrete.
 - c. Meter equipped with setback register with a readily visible vertical face and double hands indicating in cubic feet and decimals.
 - d. Provide positive, quick-acting cut-off valve in the water line to the mixer. Operating mechanism must not leak when valves are closed.
 3. Batch mixer of an approved type and size, designed to ensure uniform distribution of all component materials throughout the mass during the mixing operation. Install and use a batch timer and counter, including lock release and audible indicator on each concrete mixer.
- B. Concrete Pumps:
1. Provide pumping equipment with two cylinders, designed to operate with only one cylinder in case one is not functioning. In lieu of this requirement, provide a standby pump on the site during pumping.
 - a. Minimum Diameter of Hose (conduit): 4 inches.
 - b. Aluminum conduits for conveying the concrete will not be permitted.
- C. Vibrators:

1. Internally vibrated, high speed power vibrators of an approved immersion type. In sufficient numbers with standby units as required.

D. Truck Mixers:

1. At the Contractor's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C94, including the following supplementary requirements.
2. Ready-mixed concrete shall be delivered to the site of the Work, and discharge shall be completed within 90 minutes after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.
3. Truck mixers shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.
4. Mix each batch of concrete in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
5. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the Work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.
6. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

2.4 REINFORCEMENT STEEL

- A. Provide in accordance with Section 03 20 00 – Concrete Reinforcing.

2.5 CONCRETE MIXES

- A. General: Concrete shall be composed of cement, admixtures, aggregates, and water. These materials shall be of the qualities specified and in accordance with ACI 301 specifications. The exact proportions in which these materials are to be used for different parts of the Work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide

fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. All changes shall be subject to review by the Engineer.

B. Fine Aggregate Composition:

1. In mix designs for structural concrete, the percentage of fine aggregate in total aggregate by weight shall be as indicated in the following table:

Fineness Modulus	Maximum Percent
2.7 or less	41
2.7 to 2.8	42
2.8 to 2.9	43
2.9 to 3.1	44

2. In all other concrete, the maximum percentage of fine aggregate of total aggregate, by weight, shall not exceed 50.

C. Concrete compressive strength, aggregate size, and slump in accordance with the following:

Type of Construction	Compressive Strength (psi)	Aggregate Gradation (ASTM C33)	Slump in Inches (Max.)	Max W/C Ratio (by Weight)
Structure walls and top slabs.	4,500	#57 (1")	4	0.45
Structure footings; foundations and bottom slabs.	4,500	#467 (1-1/2")	4	0.45
Reinforced concrete encasements; thrust blocks	4,000	#467 (1-1/2")	4	0.50
Site Slabs; Curb and gutter	4,000	#57 (1")	4	0.50
Lean Concrete	3,000	#467 (1-1/2")	5	0.60
Site underground conduit banks: Min. 3 lbs red pigment/sack cement	3,000	#8 (3/8")	5	0.60

1. Compressive Strength: minimum at 28 days of age.
2. Slump as shown above, plus or minus 1 inch.
 - a. When plasticizing agents are added at the Site, measure slump before addition of any plasticizing agents.
 - b. Measure at point of discharge of the concrete from delivery truck per ASTM C143.
 - c. Concrete of lower than maximum slump may be used provided it can be properly placed and consolidated.
3. Minimum cement content:
 - a. Reinforced Concrete: Six sacks (564 lbs) Portland Cement per cubic yard.
 - b. Unreinforced Concrete: Five sacks (470 lbs) Portland Cement per cubic yard.
4. Air content: Provide air entrainment resulting in a total air content of 4 to 7 percent for all types of construction.

- a. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.
 - b. Air may be omitted from interior slabs to be trowel finished.
- D. Selection of Proportions:
- 1. General: Proportion ingredients to produce proper workability, durability, strength, and other required properties. Prevent segregation and collection of excessive free water on the surface.
 - 2. Pan stair fill:
 - a. Coarse aggregate: 100 percent passing a 1/2-inch sieve.
 - b. Proportions:
 - 1) One sack (94 lbs) cement.
 - 2) 150 pounds coarse aggregate.
 - 3) 150 pounds fine aggregate (sand).
 - 4) Adjust mix to obtain satisfactory finishing.
 - 3. Submit mix design data for approval as required by this specification Section.
 - 4. Proportion mixture to provide desired characteristics using one of the methods described below:
 - a. Method 1 (Trial Mix): Per ACI 350, Chapter 5, except as modified herein.
 - 1) Air content within range specified above.
 - 2) Record and report the temperature of trial mixes.
 - 3) Proportion trial mixes per ACI 211.1.
 - b. Method 2 (Field Experience): Per ACI 350, Chapter 5, except as modified herein.
 - 1) Field test records must be acceptable to Engineer to use this method.
 - 2) Test records shall represent materials, proportions, and conditions similar to those specified herein.
 - c. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of ACI 350, using the standard deviation of the proposed concrete production facility.
 - 5. Shrinkage Limitation
 - a. Shrinkage limitations apply only to structural concrete.
 - b. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036 percent or 0.042 percent, respectively per ASTM C157, as modified herein.
 - c. Use a mix design for construction that has first met the trial batch shrinkage requirements.

2.6 SOURCE QUALITY CONTROL

- A. Trial Batch: Based on submitted concrete mixes for each class of concrete.
- B. Aggregates:
 - 1. Fine and coarse aggregates shall be tested in accordance with ASTM C1260 or ASTM C1293 to show compliance with ASTM C33 for alkali-silica reactivity and the aggregates shall be non-reactive.
 - 2. The fine aggregate shall be tested in accordance with ASTM C40 to show compliance ASTM C33 for organic impurities.

3. The fine and coarse aggregate shall be tested in accordance with ASTM C88 to show compliance with ASTM C33.
4. The fine and coarse aggregate shall be tested in accordance with ASTM C142 to show compliance with ASTM C33.
5. The fine and coarse aggregate shall be tested in accordance with ASTM C123 to show compliance with ASTM C33.
6. The fine and coarse aggregate shall be tested in accordance with ASTM C117 to show compliance with ASTM C33.
7. The coarse aggregate shall be tested in accordance with ASTM C131 to show compliance with ASTM C33.
8. In addition to initial aggregate testing, each type of aggregate shall be tested at no increased cost to the Owner for conformance to ASTM C33 under any of the following conditions:
 - a. Concrete placement extending longer than six months.
 - b. There is a noticeable change in aggregate appearance, consistency, or ease of excavation.
 - c. The aggregate supplier changes pits, or locations in the original pit.
9. If the test results fail to meet the requirements of ASTM C33 and this Section, the Engineer may stop the placement of concrete, and may require additional testing of aggregates or field and trial batch testing of concrete to verify conformance to ASTM C33 and the strength and shrinkage requirements of this Section.
10. The Engineer may conduct any additional testing of aggregates at any time during the concrete placement period. Depending on the test results, testing cost will be paid by Contractor or Owner, according to the General Conditions. If test data fails to conform to ASTM C33, the Engineer may stop the placement of concrete or take corrective actions as indicated above.

C. Concrete Testing:

1. Concrete testing to be performed by certified laboratory under direction of professional engineer licensed to practice in the State of Utah. Submit test results to Engineer and obtain approval prior to placement of concrete.
2. When concrete mix design is done per ACI 350, Method 1, (Trial Mix) incorporate shrinkage testing as specified herein into the mix design for all structural concrete mixes.
3. When concrete mix design is done per ACI 350, Method 2, (Field Experience), provide three drying shrinkage with seven compressive strength test specimens for approval of structural concrete mixes, using the actual materials and proportions proposed for the mixes. Provide additional trial batch testing when required by Engineer because of unsatisfactory test results.
4. Test four compression test cylinders at 7 days and three at 28 days:
 - a. Determination of compressive strength in units of psi will be made in accordance with ASTM C31.
 - b. Modulus of elasticity will be determined by following formula:
 - 1) $E_c = 33 * W * 1.5\sqrt{f'c}$
 - a) E_c = Modulus of Elasticity
 - b) W = Weight of Concrete, lb/ft³.
 - c) $f'c$ = Required 28 day strength, psi.
5. Drying Shrinkage Tests:
 - a. Perform drying shrinkage tests for the trial batch.
 - b. Provide one set of three specimens from each class of structural concrete.

- c. Specimen Prisms: 4 inches by 4 inches by 11 inches with effective 10-inch gauge length, fabricated, cured, dried, and measured in accordance with ASTM C157, modified as follows:
 - 1) Remove specimens from molds at an age of 23 plus/minus 1/2 hour after trial batching; place immediately in water at 73 plus/minus 1 degree F for 30 minutes; and measure within 30 minutes thereafter to determine original length.
 - 2) Submerge in saturated lime water at 73 plus/minus 3 degrees F for 7 days.
 - 3) Remove specimens from lime water and measure length at 7 days of age. This is the base length for drying shrinkage calculations ("0" days drying age).
 - 4) After determining base length for drying shrinkage, store specimens immediately in a humidity control room maintained at 73 plus/minus 3 degrees F and 50 plus/minus 4 percent relative humidity for remainder of test.
 - 5) Make measurements to determine shrinkage expressed as percentage of base length: Report separately for 0, 7, 14, 21, and 28 days of drying age, after 7 days of moist curing.
- d. Drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age.
 - 1) If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, the results obtained from that specimen shall be disregarded.
 - 2) Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens.

PART 3 - EXECUTION

3.1 PREPARING FOR CONCRETING

- A. Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. Surface shall be free from standing water, mud, and debris at the time of placing concrete.
- B. Construct forms to the shape, lines and dimensions of members shown on Drawings and sufficiently tight to prevent leakage of mortar. Take special care when forming concrete containing high range water reducing agents. Brace and tie forms to maintain position and shape.
 - 1. Before placing concrete containing superplasticizing agents, Contractor shall submit a Pour Plan to Engineer for approval. Engineer may require additional manpower or equipment for these pours as required to limit defects in the concrete. The Pour Plan shall include the following:
 - a. Number of crew members and assignment of each.
 - b. Number of vibrators to be used.
 - c. Number of vibrators in reserve.
 - d. Time of day and anticipated duration of pour.
 - e. Type and capacity of pumping equipment if used.

- C. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
1. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
 2. Do not place floor drains through beams.
- D. Unless otherwise indicated, provide exterior corners in concrete members with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.
- E. Complete all formwork, installation of parts to be embedded, reinforcement and surface preparation prior to placing concrete.
1. Use setting diagrams, templates, and instructions for locating and setting embedments and attachments.
 2. Prior to placing concrete, position and support pipe, conduit, dowels, and other ferrous items required to be embedded, to ensure clearance between items and any part of concrete reinforcement as specified below.
 3. Securing such items in position by welding to reinforcement is prohibited.
 4. Embedded electrical conduits and piping:
 - a. Install pipe, conduits and their sleeves passing through slabs or walls so as not to impair the strength of the concrete member.
 - b. Pipes and conduits larger than 3 inches in diameter may be embedded in structural concrete only after submittal and review of location and reinforcement details.
 - c. Pipes and conduits may be installed without the specific permission noted in paragraph b. above as follows:
 - 1) They are 3 inches or less in diameter, are spaced not less than 3 diameters on center (horizontally and vertically) and conform to paragraph 2) and 3) below.
 - 2) Pipes, conduits, and their sleeves embedded within a wall or slab are not larger (outside dimension) than 1/3 the overall thickness of the wall or slab in which they are embedded.
 - 3) There is a minimum of 2 inches between the pipe or conduit and surface of the slab or wall.
 - d. In walls and slabs with 2 layers of reinforcement, install pipes and conduits between layers of reinforcement as close to the middle of the concrete as practical without disturbing the reinforcement. Outside diameter of the pipe or conduit shall not exceed 1/3 the slab or wall thickness. Do not space parallel and crossing runs of pipe or conduit closer than 3 diameters on center, except at cabinet and outlet box locations.
 - e. In slabs with a single layer of reinforcement, install under reinforcement steel with a minimum of 2 inches clear to the concrete surface.
- F. Provide openings in formwork to accommodate other trades. Accurately place and securely support all items built into forms.
- G. Waterstops:
1. Preparation
 - a. Uncoil waterstop minimum of 24 hours prior to installation for ease of handling and fabrication.

- b. Position waterstop to ensure proper distance from steel reinforcing bars and to prevent rock pockets and honeycomb.
 - c. Clean concrete joint and waterstop after first pour to remove debris and dirt.
 - 2. Installation
 - a. Position waterstop across joints as specified herein and as indicated on Drawings.
 - b. Center waterstops on joint unless shown otherwise.
 - c. When centerbulb is present at moving joints, ensure that it is not embedded.
 - d. All waterstops fully continuous for the extent of the joint.
 - e. Secure plastic serrated waterstop in correct position before concrete placement with hog rings and wire to adjacent reinforcing steel at 12-inch maximum spacing. Center-to-center spacing may be increased upon written request and approval of Engineer.
 - f. Take suitable precautions and means to support and protect waterstops during the progress of the work.
 - g. Carefully place concrete without displacing waterstop from proper position.
 - h. For waterstops in slabs, limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, then place remaining concrete to full height of slab.
 - 3. Field Splices
 - a. Only butt splices are permitted in the field. Butt splices shall be made by the method of continuous heat welding using a manufacturer-approved waterstop welding iron.
 - b. Splice PVC waterstops neatly and in accordance with manufacturer's written instructions.
 - c. Excessive PVC weld spatter is not acceptable.
 - d. A maximum of one splice is permitted in any straight 20 feet of waterstop.
- H. Construction, Expansion, and Contraction Joints:
 - 1. Provide at locations indicated or as approved by Engineer.
 - 2. Install construction joints in beams, slabs, and girders perpendicular to the planes of their surfaces.
 - 3. At least 48 hours shall elapse between placing of adjoining concrete construction.
 - 4. Before new concrete is placed against existing concrete, coat all construction joints with an approved bonding adhesive used and applied in accordance with manufacturer's instructions.
- I. Thoroughly clean surfaces of metalwork to be in contact with concrete immediately before concrete is placed.
- J. Remove ponded water from the excavation and moisten fill.
- K. Remove laitance, tighten forms, roughen, clean, wet and slush hardened concrete with cement grout prior to placing fresh concrete at construction joints. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.
- L. Cylinder Storage Device
 - 1. Provide and maintain a cylinder storage device at a protected location on the Site, acceptable to Engineer and as follows:

- a. Maintain concrete test cylinders at a temperature range of 60 degrees F to 80 degrees F for the initial 24-hour curing period.
 - b. Once placed in the storage device, do not move the cylinders during this period.
 - c. Equip the storage device with an automatic 24-hour temperature recorder that continuously records on a time/temperature chart with an accuracy of ± 1 degree F.
 - d. Have the storage device available at the point of use at least 24 hours before concrete placement.
 - e. A 24-hour test run may be required before placement of concrete.
2. Engineer may stop placement of concrete if the storage device is not functional or cannot accommodate the required number of test cylinders.
 3. Use water containing hydrated lime if water is to be in contact with cylinders.

3.2 PLACING CONCRETE

- A. Notify Engineer not less than 24 hours in advance of the times and places at which Contractor intends to place concrete.
- B. Place concrete in compliance with ACI Specifications and requirements of this Section.
- C. Place concrete only in presence of duly authorized representative of Engineer.
- D. Remove and replace concrete not placed as specified or of inferior quality, as determined by Engineer, and assume associated expense.
- E. Ready Mix Equipment:
 1. Do not exceed manufacturer's rated capacity of the mixer.
 2. Ensure sufficient mixing time for uniform distribution of materials.
 3. Discharge all concrete from mixer prior to mixing new batch.
 4. In accordance with ASTM C94.
- F. Transporting:
 1. Transport concrete from mixer to place of deposit by methods, which prevent segregation or loss of material.
 2. Provide runways when wheelbarrows are used to transport concrete.
 3. Do not wheel conveying equipment over reinforcement or support runways on reinforcement.
- G. Placing:
 1. Deposit concrete in a continuous manner and as rapidly as possible within planned joints or sections.
 2. Do not use concrete that has attained initial set or contained mixing water for more than 90 minutes.
 3. Uniformly distribute concrete during process of depositing and in no case move deposited concrete in forms more than 6 feet in horizontal direction.
 4. Do not drop freely more than 5 feet in unexposed work or more than 3 feet in exposed work; where greater drops are required, use duct or other approved method.
 5. Do not place concrete against icy or frost covered earth surfaces.
- H. Compacting:

1. Compact by internal type vibrators supplemented by rodding and tamping as necessary, to maximum practicable density, free from pockets of coarse aggregate in such a manner that surfaces are smooth and free from voids.
2. Avoid excessive vibration of concrete; avoid segregation of aggregates.
3. Avoid disturbance of previous lifts where initial set has taken place.
4. Use of form vibrators or tapping of forms is prohibited.

I. Finishing/Trowel Aid:

1. Use finishing/trowel aid on horizontal surfaces where identified on Contract Drawings. The product may also be used on other horizontal surfaces at Contractor's option.
2. Apply finishing/trowel aid directly in front of float or trowel operations and immediately finish into the concrete surface.

J. Temperature of Delivered Concrete:

1. Maximum 90 degrees F.
2. Minimum concrete temperature in accordance with following table:

Outdoor Temperature at Placement (In shade)	Concrete Temperature (At delivery to Site)
Below 30 Degrees F	65 Degrees F
Between 30 and 45 Degrees F	60 Degrees F
Above 45 Degrees F	50 Degrees F

3. Heating concrete ingredients: Heat ingredients to temperature no higher than necessary to maintain specified placement temperature of concrete; maximum of 80 Degrees F.
4. Methods of heating concrete ingredients subject to approval of Engineer.
5. Pre-cooling of ingredients: Cool ingredients as required to maintain specified placement temperature of concrete.
6. No additional compensation due to the foregoing requirements.

K. Concrete Protection:

1. Protect all concrete against physical injury until final acceptance by Owner.
2. Protect concrete from reduced strength due to weather extremes.
3. Protect concrete that is still plastic and whenever precipitation is imminent or occurring, as determined by Engineer.
4. When the temperature is below 40 Degrees F or is likely to fall below 40 Degrees F during the 24-hour period after placing the concrete, follow the recommendations of ACI 306R, except as modified herein.
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice, or snow.
 - b. After the mean daily temperature in the vicinity of the Project site falls below 40 degrees F for more than 1 day, maintain concrete at a temperature above 50 degrees F for at least 72 hours after it is placed, with additional requirements listed under Article 3.3 - Curing below.
 - c. When removing protection, do not allow concrete to cool suddenly.
 - d. Calcium chloride will not be permitted as a concrete accelerator or to thaw frozen subgrade prior to concrete placement.

5. When the temperature is 90 Degrees F or above, or is likely to rise above 90 Degrees F within the 24-hour period after concrete placement; or when there is any combination of high air temperature, low relative humidity, and wind velocity which would impair concrete strength or quality, follow the recommendations of ACI 305R and the following:
 - a. Keep concrete as cool as possible during placement and curing.
 - b. Do not allow concrete temperature to exceed 90 Degrees F at placement.
 - c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
 - d. Dampen subgrade and forms with cool water immediately prior to placement of concrete.
 - e. Apply an evaporation retardant per manufacturer's instructions between placement and finishing operations.
 - f. Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
 - g. Take appropriate precautions per ACI 305R when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R.

3.3 CURING

- A. Cure concrete for not less than 14 days after placing as follows:
 1. Leave forms in place at least 14 days.
 2. Strictly follow careful procedures for the removal of forms and perform with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted.
 3. Keep encasement concrete, concrete cradles and anchor blocks moist until covered. The surface shall be covered with moist earth not less than 4 hours, or more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.
 4. Concrete slabs may be cured by either of the following two methods:
 - a. Method 1:
 - 1) After finishing slab, wet surface with a fine spray of water and cover with polyethylene-bonded waterproof paper sheeting.
 - 2) Lap sheets 4 inches at sides and ends and seal with adhesive tape to form a continuous watertight joint.
 - 3) Weigh sheeting down with wood planks to keep sheeting in contact with concrete.
 - 4) Repair or replace sheets immediately if damage occurs.
 - b. Method 2:
 - 1) Cover concrete with water-saturated polyethylene-coated burlap curing mats and keep continuously wet for curing period.
 - 2) Lap sheets 4 inches at sides and ends and seal with adhesive tape to form a continuous watertight joint.
 - 3) Weigh sheeting down with wood planks to keep sheeting in contact with concrete.
 - 4) Repair or replace sheets immediately if damage occurs.
- B. As an alternative to above referenced curing methods for formed and slab concrete, spray surface with liquid curing compound that does not affect bond of paint to concrete surface.
 1. Apply curing compound in accordance with manufacturer's instructions as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and

within 2 hours after completion of finish or stripping of forms, if stripped in less than 14 days.

- a. Maximum coverage rate of 200 square feet per gallon, applied in such a manner as to cover surface with a uniform film to seal thoroughly.
 2. Curing vertical surfaces with a curing compound:
 - a. Cover vertical surfaces with a minimum of two coats of the curing compound.
 - b. Apply the first coat of curing compound immediately after form removal. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - c. Allow the preceding coat to completely dry prior to applying the next coat.
 - d. Vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.
 3. Curing Compound: As specified herein.
 4. Take care to avoid damage to seal during curing period.
 5. Repair broken or damaged seals occurring before expiration of curing period by application of additional curing compound over damaged portion.
 6. Do not use curing film method where construction joints are to be made
- C. In hot weather, follow curing procedures outlined in ACI 305R and the following:
1. Begin curing unformed surfaces immediately after finishing and continue for 24 hours. Curing shall consist of application and maintenance of water saturated material to all exposed surfaces; horizontal, vertical, and otherwise. After 24-hour interval, continue curing, using one of the following methods:
 - a. Moist cure for six more days.
 - b. Application of curing compound as specified above.
 2. Begin curing formed concrete immediately after placing. Curing shall consist of keeping forms continuously wet for 24 hours. Thereafter, continue curing, using one of the following methods:
 - a. Loosen forms and position soaker hose so that water runs down along concrete surfaces. Continue for six more days.
 - b. Strip forms and apply curing compound as specified for vertical surfaces above. Do not allow concrete surfaces to dry prior to application of curing compound.
- D. In Cold Weather, following curing procedures outlined in ACI 306R and the following:
1. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.
 2. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 Degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise, the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 Degrees F. Concrete cured by water curing shall be protected against freezing temperatures for 72 hours immediately following the 72 hours of protection at 50 Degrees F.
 3. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 Degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 Degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean

- daily temperature remains above 40 Degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.
4. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications

3.4 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined, and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer. In no case will extensively patching honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Remove and replace concrete containing extensive voids, holes, honeycombing, or similar depression defects. Promptly execute all repairs and replacements herein specified at no additional expense to Owner.
- B. Perform all repairs in accordance with the manufacturer's recommendations and with ICRI Guideline No 310.1R and Guideline No 320.2R. Follow these guidelines for removal geometry, exposing and undercutting reinforcing steel, cleaning and repair of reinforcing steel, and edge and surface condition of concrete, regardless of the amount of corrosion present or not present in the reinforcing steel.
 1. Remove unsound deteriorated concrete from Work by high pressure water blasting machines capable of scoring concrete surfaces to minimum amplitude roughness of 3/16-inch. Remove to provide for minimum thickness specified for mortar. If reinforcing is exposed in this process, remove additional concrete until the surface is a minimum of 1-inch or 1 bar diameter behind the exposed reinforcing.
 2. Clean exposed reinforcing bars of rust and other deleterious materials which may prevent bonding of the repair product.
 3. Keep surface at saturated surface dry (SSD) condition for a minimum of 24-hours prior to placement of repair material.
 4. Place and cure repair grout as specified in Section 03 60 00 - Grouting and in accordance with manufacturer's written recommendations.
 5. For exposed walls, include a portion of white Portland cement as required to make the color of the patch match the color of the surrounding concrete.
- C. Ream holes left by tie-rod cones with suitable toothed reamers to leave the surfaces of the holes clean and rough. Repair these holes in an approved manner with dry-packed cement grout specified in Section 03 60 00 - Grouting. Do not ream holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension but repair them in an approved manner with dry-packed cement grout specified in Section 03 60 00 - Grouting.
- D. Build up and shape repairs in such a manner that the completed Work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Cure surfaces of said repairs as required for the concrete in the repaired section.

- E. Prior to filling any structure with water, repair all cracks that may have developed by grooving and filling as shown on the Contract Drawings. Perform this repair method on the water bearing face of members. Prior to backfilling, repair cracks on faces of members in contact with fill, which are not covered with a waterproofing membrane, as specified herein.

3.5 PATCHING HOLES IN CONCRETE

A. Patching Small Holes

1. Fill holes which are less than 12 inches in their least dimension and extend completely through concrete members, as specified herein.
2. Fill small holes in members which are water-bearing or in contact with soil or other fill material, with nonshrink grout specified in Section 03 60 00 - Grouting. Where a face of the member is exposed to view, hold the nonshrink grout back 2 inches from the finished surface. Patch the remaining 2 inches according to the paragraph in Part 3 entitled "Treatment of Surface Defects."
3. Fill small holes through all other concrete members with nonshrink grout, with exposed faces treated as above.

B. Patching Large Holes

1. For holes which are larger than 12 inches in their least dimension, provide a keyway chipped into the edge of the opening all around, unless a formed keyway exists. Fill holes with concrete as specified herein.
2. For holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, set reinforcing steel in drilled holes and epoxy grout as specified in Section 03 60 00 - Grouting. Match the reinforcing added to the reinforcing in the existing wall unless otherwise shown.
3. For large holes in members which are water bearing or in contact with soil or other fill, place either a hydrophilic type or a plastic adhesive type waterstop material around the perimeter of the hole as specified herein, unless there is an existing waterstop in place.

3.6 CONCRETE FINISH

- A. General: Provide surfaces free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, with finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are specified herein. These tolerances are to be distinguished from irregularities in finish as described herein.
- B. Do not use aluminum finishing tools.
- C. Formed Surfaces:
 1. Exterior buried surfaces require no treatment after form removal except for curing, repair of defective concrete, and treatment of surface defects.
 2. Finish surfaces exposed to view as specified under "Architectural Concrete Finish" below.
- D. Surface holes larger than 1/2 inch in diameter or deeper than 1/4-inch are defined as surface defects in basins and exposed walls.

- E. Unformed Surfaces: After proper and adequate vibration and tamping, bring all unformed top surfaces of slabs, floors, walls, and curbs to a uniform surface with suitable tools. Immediately after the concrete has been screeded, treated with a liquid evaporation retardant. Use the retardant again after each operation as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:
1. Finish U1 – Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8 inch. No further special finish is required.
 2. Finish U2 After sufficient stiffening of the screeded concrete, float finish surfaces with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Minimize floating as necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities are limited to 1/4-inch. Tool joints and edges where shown or as determined by the Engineer.
 3. Finish U3 After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel trowel with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. Provide finish that is smooth and free of all irregularities.
 4. Finish U4 Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, lightly broom the surface with broom lines perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.
- F. Floor Hardener:
1. Apply to all exposed concrete floor surfaces.
 2. Apply after concrete has cured minimum 7 days.
 3. Apply in accordance with manufacturer's recommendations.
 4. Keep floors covered and free of traffic and loads for a minimum of 10 days after completion.

3.7 ARCHITECTURAL CONCRETE FINISH

- A. General: Architectural finish is required for permanently exposed concrete surfaces and in other locations where specifically called out on the Contract Drawings.
1. Immediately after the forms have been stripped, inspect the concrete surface, and repair any poor joints, voids, rock pockets, or other defective areas. Fill all form-tie holes as indicated herein.
 2. Do not apply architectural finishes until the concrete surface has been repaired as required and the concrete has cured at least 14 days.
 3. Conform all architecturally treated concrete surfaces to the accepted sample required herein in texture, color, and quality. Maintain and protect the concrete finish.
- B. Smooth Concrete Finish
1. Wet the concrete surface and apply grout with a brush. Use grout made by mixing one part Portland cement and one part fine sand that will pass a No. 16 sieve with sufficient water to give it the consistency of thick paint. Use 1/2 gray and 1/2 white Portland Cement as determined by Engineer. Vigorously rub the freshly applied grout into the concrete surface with a wood float filling all small air holes. After all the surface grout has been removed with a steel trowel, allow the surface to dry and,

when dry, vigorously rub with burlap to remove completely all surface grout so that there is no visible paint-like film of grout on the concrete. Complete the entire cleaning operation for any area the day it is started and leave no grout on the surface overnight.

2. Terminate cleaning operations for any given day at panel joints. It is essential that the various operations be carefully timed to secure the desired effect which is a light-colored concrete surface of uniform color and texture without any appearance of a paint or grout film.
3. If improper manipulation results in an inferior finish, rub such inferior areas with carborundum bricks.
4. Before beginning any of the final treatment on exposed surfaces, treat in a satisfactory manner, a trial area of at least 200 square feet in some inconspicuous place selected by the Engineer and preserve said trial area undisturbed until the completion of the job.

3.8 TOLERANCES:

A. Construction Tolerances: Set and maintain concrete forms and perform finishing operations so as to ensure that the completed Work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the Specifications, permissible deviations will be in accordance with ACI 117.

1. The following non-cumulative construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4 inch In 20 feet or more: 1/2 inch
Variation from the level or from the grades shown.	In 10 feet: 1/4 inch In 20 feet or more: 1/2 inch
Variation from plumb.	In 10 feet: 1/4 inch In 20 feet or more: 1/2 inch
Variation in the thickness of slabs and walls.	Minus 1/4 inch Plus 1/2 inch
Variation in the locations and sizes of slabs and wall openings.	Plus or minus 1/4 inch

3.9 FIELD QUALITY CONTROL

A. General

1. Tests on component materials and for slump, temperature, air content, unit weight, compressive strength and shrinkage of concrete will be performed as specified herein.
2. The cost of all laboratory tests for qualification of mix designs on cement, aggregates, and concrete, including strength and shrinkage testing will be borne by Contractor. The cost of all field-testing during construction, including slump, temperature, air, strength, and shrinkage will also be borne by Owner. However, Contractor will be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications.

3. Provide access for Engineer to aggregate stockpiles for concurrent sampling during construction.
 4. Provide access for Engineer to batch plant for monitoring batching procedures during construction.
 5. Supply concrete for testing at no additional cost to Owner. Assist Engineer in obtaining samples, and disposal and cleanup of excess material.
 6. Take composite samples of concrete placed in the Work in accordance with ASTM C172 from the first placement of each class of concrete and at the following minimum frequency for each class:
 - a. Not less than one sample per day on which concrete is placed.
 - b. Not less than one sample for each 50 cubic yards of concrete placed.
 - c. Not less than one sample for each 5,000 square feet of surface area for slabs or walls.
 - d. Not less than 5 samples from randomly selected batches for the Work.
- B. Slump Tests
1. Perform in accordance with requirements of ASTM C143 at frequency indicated for sampling above.
- C. Temperature Tests
1. Test concrete temperature per ASTM C1064 at frequency indicated for sampling above.
- D. Air Content Tests
1. Test air content per ASTM C231 at frequency indicated for sampling above.
- E. Unit Weight
1. Test unit weight per ASTM C138 at frequency indicated for sampling above.
- F. Shrinkage Tests
1. Drying shrinkage tests will be made for the first placement of each class of structural concrete, and during construction every 3 months to ensure continued compliance with these Specifications. Make A minimum of 1 test per structure shall be made regardless of the timing.
 2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried, and measured in accordance with ASTM C157 as modified in this Section.
 3. The maximum concrete shrinkage for specimens cast in the field may not exceed the trial batch maximum shrinkage test value by more than 25 percent.
 - a. If the required shrinkage limitation is not met during construction, take any or all the following actions, at no additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.
- G. Field Compression Tests
1. Field compression test specimens will be made at the frequency indicated for sampling above.
 2. Each set of test specimens will be a minimum of five cylinders.

3. Make compression test specimens for concrete in accordance with ASTM C31. Specimen size: Cylinders, 6-inch diameter by 12-inch high.
4. Perform compression tests in accordance with ASTM C 39. Test one cylinder at 7 days and two at 28 days. The remaining cylinders will be held to verify test results, if needed.

H. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete will be according to the requirements of ACI 350 and as specified herein.
2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results may not exceed 640 psi, when ordered at equivalent water content as estimated by slump.
3. If any concrete fails to meet these requirements, take immediate corrective action to increase the compressive strength for all subsequent batches of the type of concrete affected.
4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any three consecutive tests being below the specified compressive strength is 1 in 100. Calculate the required average strength using Criterion No. 3 of ACI 214 with the actual standard of deviation.
5. All concrete which fails to meet the ACI requirements and these Specifications, is subject to removal and replacement at no increase in cost to the Owner.

3.10 APPLICATION OF LOADS

- A. Do not allow traffic, construction equipment, or materials of any kind to be placed on elevated concrete slabs until the concrete has attained a minimum age of 7 days and 80% of the minimum specified 28-day strength as proven by concrete strength tests.
- B. Do not place backfill against cantilevered walls until the concrete has attained a minimum age of 7 days and 100% of the minimum specified 28-day concrete strength as proven by concrete strength tests.
- C. Do not place backfill against walls that are tied to elevated slabs or decks until both the slabs and walls have attained a minimum age of 7 days and 80% of the minimum specified 28-day strength as proven by concrete strength tests.

3.11 SCHEDULES

- A. Grout: As specified in Section 03 60 00 – Grouting.
- B. Unformed Concrete Surfaces: Apply finish as follows.

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Slabs not water bearing	U4
Slabs to be covered with built-up roofing	U2
Interior and exterior slabs where Drawings require only light broom finish	U4
Interior slabs and finished floors with architectural finishes	U3

	Area	Finish
Top surface of walls		U3

END OF SECTION

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**SECTION 03 60 00
GROUTING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Work includes various types of cementitious grout to be provided and installed per the Contract Documents
- B. Section includes the following types of grout:
 - 1. Cement grout.
 - 2. Nonshrink grout.
 - 3. Epoxy grout.
 - 4. Grout for repair of concrete.
 - 5. Pump and motor grout.
 - 6. Concrete topping gout and concrete fill.

1.2 RELATED SECTIONS

- 1. Section 03 30 00 – Cast-in-Place Concrete

1.3 REFERENCES

- A. American Concrete Institute (ACI) standards, most recent editions:

ACI 318	Building Code Requirements for Reinforced Concrete
ACI 308	Standard Practice for Curing Concrete

- B. American Society for Testing and Materials (ASTM) standards, most recent editions:

ASTM C78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94	Standard Specifications for Ready-Mixed Concrete
ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
ASTM C307	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
ASTM C348	Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
ASTM C469	Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.

ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
ASTM C827	Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete By Slant Shear
ASTM C884	Standard Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
ASTM C939	Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C1090	Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout
ASTM C1107	Packaged Dry, Hydraulic Cement Grout (Nonshrink)
ASTM C1181	Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts
ASTM C1202	Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
ASTM C1339	Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D696	Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

C. International Concrete Repair Institute (ICRI) standards, latest editions:

Guideline No 310.1R	Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion
Guideline No 320.2R	Guide for selecting and specifying Materials for repair of Concrete Surfaces

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 20 – Submittal Procedures.

- B. Product Data:
 - 1. Submit certified test results verifying the compressive strength, shrinkage, and expansion requirements indicated herein.
 - 2. Submit manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of nonshrink and epoxy grout used in the Work.
- C. Certification:
 - 1. Provide manufacturer's independent certification of compliance with ASTM C1107 without modification to the standard methods certifying that the Class B or C grout's post-hardening non-shrink properties are not based on gas expansion.
 - 2. Provide Manufacturer's certification that grouts have strengths of 3500 psi at 1 day, 6500 psi at 3 days and 7500 psi at 28 days when cured at 72 degrees F as well as meeting the 3, 7, and 28-day strengths when tested and cured at the 45 deg F and 95 degree F limits and all other requirements of ASTM C1107.
 - 3. The Contractor shall engage an independent testing laboratory to run a 24-hour grout evaluation in accordance with ASTM C1107 of each grout submitted for approval showing compliance with all aspects of the evaluation. Submit results to the Engineer for review.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Maintain all materials clean, dry and protected against dampness, freezing and foreign matter.
 - 1. Store non-shrink grout materials in temperature controlled environments above 40 degrees F and below 90 degrees F.
 - 2. Store epoxy grout components in temperature controlled environments above 60 degrees F and below 90 degrees F.
- C. Deliver epoxy resin, hardener, and aggregate in sealed pre-measured containers, palletized, and shrink-wrapped to prevent shipping damage.
- D. Immediately remove from the Project site any cement-based grout material which becomes damp or otherwise defective.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 - 1. Nonshrink, nonmetallic grout:
 - a. 5 Star Grout, Five Star Products, Inc.
 - b. Masterflow 928, BASF Building Systems, Inc.
 - c. NS Grout, Euclid Chemical Company.
 - d. Sika Grout 212, Sika Corporation.
 - e. Engineer approved equal.
 - 2. Epoxy grout:

- a. HP Epoxy Grout, Five Star Products, Inc.
 - b. Masterflow 648 CP Plus, BASF Building Systems, Inc.
 - c. E3-Flowable, Euclid Chemical Company.
 - d. Sikadur 42 Grout-Pak, Sika Corporation.
 - e. Engineer approved equal.
3. Grout for pumps and motors:
- a. Escoweld, ITW Polymer Technologies.
 - b. Chockfast Red, ITW Polymer Technologies.
 - c. DP Epoxy Grout, Five Star Products, Inc.
 - d. Engineer approved equal.

2.2 CEMENT GROUT

- A. Cement grout shall be composed of one-part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4,500 psi.
- B. Cement grout materials shall be as specified in Section 03 30 00 – Cast-in-Place Concrete.

2.3 NONSHRINK GROUT

- A. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water.
- B. Cement from kilns burning metal-rich hazardous waste fuel shall not be used.
- C. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout herein shall be that recommended by the manufacturer for the particular application. All grouts (Grade B or C) shall be tested for height change of the hardened grout at 1, 3, 14, and 28 days in accordance with ASTM C1090 and shall be tested for compression at 1, 3, 7, and 28 days in accordance with the modified ASTM C109 testing procedure.
- D. Class A non-shrink grouts: Not used.
- E. Class B or C high precision, fluid, extended working time, non-shrink grouts:
 - 1. Minimum 28-day compressive strength of 7500 PSI.
 - 2. No shrinkage (0.0 percent) and a maximum of 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827.
 - 3. No shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state
 - 4. When mixed to a fluid consistency of 20 to 30 seconds per ASTM C939 at temperature extremes of 45 to 90 degrees F shall have an extended working time of 30 minutes when tested in accordance with ASTM C1107.
- F. Application:
 - 1. Class B or C non-shrink grout shall be used for grouting under all base plates for structural steel members, grouting under all equipment base plates except for pumps and motors, and at all locations where grout is required by the Contract Documents except where epoxy grout or grout for pumps and motors is specifically required.

Class B or C non-shrink grout shall be used in place of Class A non-shrink grout for all applications. Class B or C non-shrink grout shall not be used for dry packing applications or repair of concrete.

2.4 EPOXY GROUT

- A. Epoxy grout shall be a pourable, nonshrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any nonreactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. The chemical formulation of the epoxy grout shall be as recommended by the manufacturer for the particular application.
- B. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.
- C. The epoxy grout shall develop a compressive strength of 5,000 psi in 24 hours and 10,000 psi in 7 days when tested in accordance with ASTM C579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C827.
- D. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by testing in accordance with ASTM C1339, for bearing area and flow.
- E. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30×10^{-6} inches/inch/degree F when tested according to ASTM C531 or ASTM D696.
- F. Application:
 - 1. Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout and for all other applications in the Contract Documents where grout type is not specifically indicated.

2.5 GROUT FOR REPAIR OF CONCRETE

- A. Vertical, overhead, and shotcrete applications:
 - 1. Shall not produce a vapor barrier.
 - 2. One component, reoplastic, cement based, shrinkage compensated, non-expansive, gray concrete product.
 - 3. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only the addition of water.
 - 4. Free of chlorides and other chemicals causing corrosion with the following properties:
 - a. Minimum Slant Shear Bond Strength: 2500 PSI at 28 days when tested in accordance with ASTM C882.
 - b. Minimum Compressive strength: 6,500 PSI at 28 days when tested in accordance with ASTM C109.
 - c. Minimum Tensile Bond Strength: 200 PSI at 28 days per ASTM C307.

- d. Minimum Flexural Strength: 1,200 PSI when tested in accordance with ASTM C348.
- e. Modulus of Elasticity: 3.6E6 PSI when tested in accordance with ASTM C469.
- f. Maximum Rapid Chloride Permeability: 772 coulombs when tested in accordance with ASTM C1202.

B. Horizontal and formed applications:

- 1. Shall not produce a vapor barrier.
- 2. One component, reoplastic, cement-based, shrinkage compensated, non-expansive, gray concrete product.
- 3. Flowable, extremely low permeability, sulfate resistant, easy to use and requiring only the addition of water.
- 4. Free of chlorides and other chemicals causing corrosion with the following properties:
 - a. Minimum Shear Bond Strength: 2150 PSI at 7 days.
 - b. Minimum Compressive Strength: 6000 PSI at 7 days when tested in accordance with ASTM C109.
 - c. Minimum Flexural Strength: 770 PSI at 28 days when tested in accordance with ASTM C78.
 - d. Maximum Chloride Permeability: 1,000 coulombs when tested in accordance with ASTM C1202.
 - e. Modulus of Elasticity: 4.8E6 PSI when tested in accordance with ASTM C469.

2.6 GROUT FOR PUMPS AND MOTORS

A. Grout for pumps and motors shall be epoxy grouts meeting the following minimum requirements:

- 1. Creep shall be less than 0.005 in/in when tested by ASTM C1181 method. The test shall be at 70 degrees F and 140 degrees F with a load of 400 PSI.
- 2. Linear shrinkage shall be less than 0.080 percent and thermal expansion less than 17E-6 in/in/degree F when tested by ASTM C531.
- 3. The compressive strength shall be a minimum of 12,000 PSI in 7 days when tested by ASTM C579 Method B, modified.
- 4. Bond strength of grout to Portland cement concrete shall be greater than 2,000 PSI when using ASTM C882 test method.
- 5. Grout shall pass the thermal compatibility test when overlaid on Portland cement concrete using test method ASTM C884.
- 6. Tensile strength and modulus of elasticity shall be determined by ASTM D638. The tensile strength shall not be less than 1,700 PSI and the modulus of elasticity shall not be less than 1.8E6 PSI.
- 7. Peak exothermic temperature shall not exceed 110 degrees F when a specimen 6 inches in diameter by 12 inches high is used. Gel time shall be at least 150 minutes.
- 8. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperatures as high as 150 degrees F, with a load of 2,000 PSI.

B. Primer, if required, shall conform to the written recommendations of the grout manufacturer.

C. Surface preparations shall conform to the written recommendations of the grout manufacturer.

- D. Placement and Curing
1. Placement and curing procedures shall be in accordance with the written recommendations of the grout manufacturer.
 2. A grouting performance demonstration/training session shall be conducted by the grout manufacturer's representative prior to foundation and baseplate preparation and the first grouting on site. This training session shall demonstrate proper preparation and installation methods and that the grouting material meets the strength requirements.

2.7 CONCRETE TOPPING GROUT AND CONCRETE FILL

- A. Grout for topping of slabs and concrete fill for built up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures as necessary, with strength as specified above.
- B. Where concrete topping is deeper than 6 inches, it will be considered "Concrete Fill" and may be placed using either grout as specified herein or "lean concrete", as specified in Section 03 30 00 – Cast-In-Place Concrete, when approved by Engineer.

2.8 CURING MATERIALS

- A. Curing materials shall be as specified in Section 03 30 00 – Cast-In-Place Concrete for cement grout and as recommended by the grout manufacturer for prepackaged grouts.

2.9 CONSISTENCY

- A. Use grouts with the consistency necessary to completely fill space to be grouted for the particular application. Where "dry pack" is called for in the Contract Documents, use grout with a consistency such that the grout is plastic and moldable but will not flow.
- B. Regardless of consistency called for on the Contract Documents, the type of grout to be used shall be as indicated herein for the particular application.

2.10 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement will not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the grout manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All surface preparation, curing, and protection of cement grout shall be as indicated in Section 03 30 00 – Cast-In-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete.
- B. Do not place grout on concrete or masonry substrates until those substrate materials have attained 28-day design strength unless authorized by Engineer.

3.2 MANUFACTURER'S SERVICES

- A. The manufacturer of nonshrink grout and epoxy grout shall provide onsite technical assistance upon request.
- B. Coordinate with the manufacturer all demonstrations, training sessions, and applicable site visits. The grout manufacturer shall conduct onsite, demonstration and training sessions for bleed tests, mixing, flow cone measurements, cube testing, application, and curing for each category and type of grout.
- C. Training by the manufacturer is required for all types of grout installations. Grout manufacturer's representative shall train Contractor to perform the grout Work including mixing of grouts to required consistency, testing, placing, and curing on actual project base plates, tie holes, rock pockets, and other applications.

3.3 GROUTING PROCEDURES

- A. Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Base Plate Grouting:
 - 1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a 1 inch thickness of grout or a thickness as indicated on the Contract Drawings.
 - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by Engineer, alternate grouting methods shall be submitted for acceptance by Engineer.
- C. Concrete Topping Grout:
 - 1. All mechanical, electrical, and finish Work shall be completed prior to placement of concrete topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.
 - 2. The minimum thickness of grout topping and concrete fill shall be one inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 6-inches wide by 1-1/2 inches deep.
 - 3. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is complete free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping of fill placement. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in

accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.

4. Concrete topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

D. Grout for Repair of Concrete

1. All repairs shall be performed in accordance with the manufacturer's recommendations and with ICRI Guideline No 310.1R and Guideline No 320.2R. These guidelines shall be followed for removal geometry, exposing and undercutting of reinforcing steel, cleaning and repair of reinforcing steel, and edge and surface condition of concrete and shall be followed regardless of the amount of corrosion present or not present in the reinforcing steel.
2. Remove unsound deteriorated concrete from Work by high pressure water blasting machines capable of scoring concrete surfaces to minimum amplitude roughness of 3/16-inch. Remove to provide for minimum thickness specified for mortar. If reinforcing is exposed in this process, then additional concrete shall be removed until the surface is a minimum of 1-inch or 1 bar diameter behind the exposed reinforcing.
3. Clean exposed reinforcing bars of rust and other deleterious materials which may prevent bonding of the repair product.
4. Keep surface at saturated surface dry (SSD) condition for a minimum of 24-hours prior to placement of repair material.
5. Place material in accordance with Manufacturer's written recommendations.
6. Cure material continuously for 7-days with water fog nozzles or other applications which provide a continuous wet curing of the repaired area in accordance with ACI 308.

E. CONSOLIDATION

1. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

END OF SECTION

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**DIVISION 31
EARTHWORK**

**SECTION 31 10 00
SITE PREPARATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section includes all those measures required during the Contractor's initial move onto the site to protect existing fences, structures and associated improvements, streets, and utilities downslope of construction areas from damage due to boulders, trees or other objects dislodged during the construction process: clearing, grubbing and stripping; and regrading of areas to receive embankment fill.
- B. The Contractor is required to protect and preserve all things designated to remain. Where Contractor's operation causes damage or injury to trees and plants designated to remain, an arborist or other qualified professional shall be employed by the Contractor, at no additional cost to the Owner, to repair the damage or provide adequate replacement to the Owner's satisfaction where damage is beyond repair.
- C. Submit Tree Protection Plan in accordance with Herriman City requirements.

1.2 SITE INSPECTION

- A. Prior to moving onto the Project site, the Contractor shall inspect the site conditions and review maps of the Owner's property and right-of-way lines.
- B. Contractor shall submit 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 preparation.
- C. The Contractor shall identify and accurately locate utilities and other subsurface structural, electrical, and mechanical conditions. Existing conditions shall be incorporated into the record drawings for the project.

1.3 DEFINITIONS

- A. The following definitions apply to the Work of this Section:
 - 1. Clearing is defined as cutting trees, removing fences and posts, removing curbs and other improvements to prepare the site for grubbing and stripping.
 - 2. Grubbing is defined as the below grade part of clearing to remove roots, small piping, irrigation systems, etc., to prepare the site for stripping.
 - 3. Stripping is defined as removing a surface layer of soil and organic material, sod, topsoil, and other unsuitable material as defined in Section 31 23 00 – Earthwork, to a depth that earthwork can proceed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
 - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. 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. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.
 - 1. Employ 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. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.

2. Arrange to shut off indicated utilities with utility companies.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Engineer's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.4 SITE ACCESS

- A. Develop any necessary access to the site, including barrier facilities to be installed at the beginning of construction in order to prohibit entry of unauthorized persons.
- B. Utility Interference: Where existing utilities interfere with the Work of this Section, notify the Engineer and work around the interferences until a directive is issued.

3.5 CLEARING, GRUBBING, AND STRIPPING

- A. All construction areas shall be cleared of grass and weeds to at least a depth of six inches and cleared of structures, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, or impair the Work's subsequent usefulness or obstruct its operation. Loose boulders within 10 feet of the top of cut lines shall be incorporated in landscaping or removed from the site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction, as directed by the Engineer.
- B. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Debris or waste shall be totally removed if they are found on the site. All objectionable material from the clearing and grubbing process shall be removed from the site and wasted in approved safe locations in compliance with state and federal regulations.
- C. The areas to be affected by construction that have not been pre-excavated to the subgrade elevation, topsoil shall be removed and placed in the designated stockpile areas, and/or incorporated into landscaped areas or other nonstructural embankments.
- D. For all areas that have not been previously disturbed, including staging areas and temporary construction easements, topsoil-salvaging operation shall immediately follow clearing operations. The area shall be stripped of topsoil to a depth of 8 inches. Unsuitable materials, specified in Section 31 23 00, shall not be considered topsoil. The Contractor shall strip to the depth indicated regardless of the material encountered. All stripped topsoil shall be stockpiled within stripped areas in stockpiles not to exceed 15 feet in height. Vegetation shall be ground or chipped to a mulching consistency and mixed with the stripped soil. Stockpiles shall be placed away from high construction traffic areas and shall be fenced and signed to prevent accidental use as fill prior to topsoil replacement.
- E. Upon completion of Work within the construction areas stripped of topsoil, the stored topsoil shall be respread over the disturbed areas. Topsoil shall be spread in about a 6-inch layer.

Respread topsoil shall match the existing terrain as much as possible. Interfaces between restored disturbed areas and undisturbed areas shall be chain dragged to eliminate obvious edges. All tracks and equipment marks shall be chain dragged or hand raked away. Replaced topsoil shall be thoroughly watered for dust control upon completion of the respreading operations. Once topsoil replacement has been completed, no vehicles or other motorized equipment shall be allowed to travel on the finished surface.

- F. Unless otherwise indicated, native trees larger than three inches in diameter at the base shall not be removed without the Engineer's approval. The removal of any trees, shrubs, fences, or other improvements outside of rights-of-way, if not necessary for the Contractor's choice of means and methods, shall be arranged with the property owner and be removed and replaced at no increased cost to the Owner.
- G. Except in areas to be excavated, holes and other holes resulting from Work of this section shall be backfilled with suitable material in accordance with Section 31 23 00 – Earthwork.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincides with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

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

END OF SECTION

**SECTION 31 23 00
EARTHWORK**

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall perform all earthwork indicated and required for construction of the Work, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

29 CFR 1926	OSHA Safety and Health Regulations for Construction
ASTM C 595	Standard Specification for Blended Hydraulic Cements
ASTM D 422	Method for Particle-Size Analysis of Soils
ASTM D 1556	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2,700 kN-m/m ³)
ASTM D 1633	Test Method for Compressive Strength of Molded Soil-Cement Cylinders
ASTM D 2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2487	Classification of Soils for Engineering Purposes
ASTM D 2901	Test Method for Cement Content of Freshly Mixed Soil Cement
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods
ASTM D 4253	Test Methods for Maximum Index Density of Soils using a Vibratory Table
ASTM D4254	Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4832	Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

ASTM D 5971	Practice for Sampling Freshly Mixed Controlled Low Strength Material (CLSM)
ASTM D 6023	Test Method for Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM)
ASTM D 6024	Test Method for Ball Drop on Controlled Low Strength Material (CLSM) to Determine Suitability for Load Application
ASTM D 6103	Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)

1.3 CONTRACTOR SUBMITTALS

- A. The Contractor's attention is directed to the provisions of Subpart P, 29 CFR 1926 of the OSHA Safety and Health Standards for Construction, which relate to protection of employees in excavations. The Contractor shall submit, for information to the Engineer, the project excavation plan and the name of the Contractor's competent person, prior to commencing any excavation.
- B. Submit samples of all materials proposed to be used in the work in accordance with the requirements in Section 01 33 20 – Submittal Procedures. Sample sizes shall be as determined by the testing laboratory.
- C. Submit dewatering and water removal plan prior to performing any dewatering or water removal.

PART 2 - PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

- A. General: Fill, backfill, and embankment materials shall be suitable material.
- B. Suitable Materials: Suitable material is defined as selected or processed clean, well graded earth material, sands and gravels free of excessive fines. Suitable materials to have less than 20 percent rock and boulders larger than 4 inches, and be free of all grass, roots, brush, vegetation, or other deleterious materials.
- C. Fill and backfill materials within 6 inches of any structure or pipe shall be smaller than 1 inch in any dimension.
 - 1. Suitable materials may be obtained from onsite excavations, may be processed onsite materials, or may be imported. If imported materials are required by this Section or to meet the quantity requirements of the Project, provide the imported materials at no additional expense to the Owner, unless a unit price item is included for imported materials in the bidding schedule. Onsite materials shall be stockpiled and segregated prior to use.
 - 2. The following types of suitable materials are defined:

Type A (Granular Backfill): Crushed rock or gravel, and sand well graded and readily compacted, non-plastic, meeting the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1-inch	100
No. 40	15 - 60
No. 200	0 - 15

Type B (Crushed Rock): Manufactured angular, crushed rock, non-plastic, meeting the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/8-inch	100
No. 4	30 - 50
No. 200	0 - 5

Type C (Sand Backfill): Sand, non-plastic, meeting the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/4-inch	100
No. 4	80 - 100
No. 10	30-50
No. 40	10-30
No. 200	7 - 15

Pea Gravel or Squeegee is not acceptable as sand backfill.

Type D (Select Backfill): Suitable material that can be readily compacted and meets the requirements of AASHTO M 145 classification A-1-a, non-plastic, well graded with a maximum particle size of 2 inches.

<u>Sieve Size</u>	<u>Percentage Passing</u>
2-inch	100
No. 10	30-50
No. 40	15-30
No. 200	0 - 15

Type E (Pea Gravel Backfill): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve and not more than 10 percent passing a No. 4 sieve.

Type F (Drainrock): Crushed rock or gravel conforming to one of the following gradation requirements, as shown on the Drawings or approved by the Engineer:

<u>Sieve Size</u>	<u>Percentage Passing</u>		
	<u>3-inch Max.</u>	<u>2-inch Max.</u>	<u>3/4-inch Max.</u>
3-inch	100	-	-
2-inch	90 - 100	100	-
1-1/2 inch	70 - 100	90 - 100	-
3/4 inch	0 - 50	0 - 15	100
1/2-inch	-	-	95 - 100
3/8-inch	0 - 10	0 - 5	70 - 100
No. 4	0 - 25	-	-
No. 8	0 - 5	-	-
No. 200	0 - 3	-	0 - 3

Type G (Type II Aggregate Base): Well-graded, clean, hard, tough, durable, and sound mineral aggregates consisting of crushed stone, or crushed gravel, free of organic matter and contamination from chemical or petroleum products meeting State specification requirements and conforming to the following Table and gradations:

Aggregate Properties			Standard/Ref
	Aggregate Class		
	A	B	
Dry Rodded Unit Weight	Not less than 75 lb/ft ³		AASHTO T 19
Liquid Limit/Plastic Index	Non-plastic	PI ≤ 6	AASHTO T 89 AASHTO 90
Aggregate Wear	Not to exceed 50 percent		AASHTO T 96
Gradation	Table 2		AASHTO T 11 AASHTO T 27
CBR with a 10 lb surcharge measured at 0.20 inch penetration	70% Minimum	N/A	AASHTO T 193
Two Fractured Faces	50% Min	N/A	AASHTO T 335

<u>Sieve Size</u>	<u>Percentage Passing</u>
1 ½ -inch	100
1-inch	90 - 100
¾-inch	70 - 85
½-inch	65 - 80
⅜-inch	55 - 75
No. 4	40 - 60
No. 16	25 - 40
No. 200	7 - 11

Type H (Graded Drainrock): Graded drainrock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting and drying. The material shall be uniformly graded and shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1-inch	100
¾ inch	90 - 100
⅜-inch	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. 30	5 - 15
No. 50	0 - 7
No. 200	0 - 3

Type I (Cement-Treated Backfill): Material which consists of Type F material, or any mixture of Types B, C, G, and H materials which has been cement-treated so that the cement content of the material is not less than 5 percent by weight when tested in accordance with ASTM D 2901. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D 1633.

Type K (Topsoil): Stockpile topsoil material which has been obtained at the site by removing soil to a depth as defined in Section 31 10 00 – Site Preparation. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris.

Type M (Aggregate Subbase): Crushed rock aggregate subbase material non-plastic that can be compacted readily by watering and rolling to form a stable base. The sand equivalent value shall not be less than 18 and shall meet one of the following gradation requirements, as shown on the Drawings or approved by the Engineer:

<u>Sieve Size</u>	<u>Percentage Passing</u>	
	<u>3-inch Max.</u>	<u>2-inch Max.</u>
3-inch	100 -	
2-inch	90 - 100	100
1-1/2 inch	-	95 - 100
1-inch	70 - 90	-
No. 4	30 - 65	30 - 65
No. 16	15 - 40	15 - 40
No. 200	2 - 12	2 - 12

Type N (trench plug): Low permeable fill material, a nondispersable clay material having a minimum plasticity index of 10.

Type O (Controlled Low Strength Material (CLSM), Flowable Fill): CLSM shall consist of a mixture of portland cement, pozzolan, coarse and fine aggregate, water, and approved admixtures, meeting the following requirements:

1. Blended Hydraulic Cement: Comply with ASTM C 595, Type IL (10) (MS), grey color.
2. Pozzolan: Provide fly ash conforming to ASTM C618, Type C or Type F.
3. Water: Potable, clean and free from objectionable quantities of silt, organic matter, alkali, salt and other impurities..
4. Aggregate:
 - a. Free from organic matter, clean imported sand and gravel, or selected material from the excavation, imported material, or a combination thereof as approved by the Engineer. Containing no more alkali, sulfates, or salts than the native materials at the site. The soluble sulfate content of aggregate in the mixture shall not exceed 0.3 percent by dry weight.
 - b. Well-graded mixture of crushed rock, soil or sand, with a nominal maximum size of 3/8 inch and conforming to the following sieve limits:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1/2-inch	100
3/8-inch	> 70
No. 200	<12 ¹

¹ If more than 5 percent of the aggregate passes the No. 200 sieve, the plasticity index must be less than 0.73 (liquid limit - 20) when tested in accordance with ASTM D-4318.

5. Proportion the CLSM to be a flowable, nonsegregating, self-consolidating low shrink slurry. The Contractor shall determine the materials and proportions used to meet the requirements of these Specifications.
6. Admixtures:
 - a. Air entraining admixture per ASTM C260
 - b. Water reducing admixture per ASTM C494
7. The unconfined compressive strength at 7 days shall be a minimum of 80 psi and a maximum of 200 psi. Contractor shall form a minimum of six test cylinders with proposed materials to confirm design strength and mix design. Four of the cylinders shall be broken at 7 days in conformance with applicable concrete cylinder

specifications and results provided to Engineer. The remaining two cylinders shall be broken by Contractor at discretion of Engineer. Initial mix design and cylinder breaks shall be completed at least 28 days prior to use of the material on the jobsite. Final mix approval and use of the material shall not occur prior to confirmation of strength by the cylinder breaks.

8. The temperature of the CLSM discharged into the trench shall be below 90 degrees F but above 50 degrees F. Air temperature is to be 40 degrees F and rising. Do not place against frozen subgrade or other materials having temperature less than 32 degrees F. Protect flowable fill from temperatures below 40 degrees F for 72 hours.
9. Finish flowable fill smooth and to the grade indicated, finish free from fins, bulges, ridges, offsets and honeycombing. Wood float, steel trowel or similar is not required.
10. CLSM backfill under concrete structures shall be protected during curing as specified Section 03 30 00 - Cast-in-Place Concrete.
11. CLSM shall be tested in accordance with ASTM D 4832, ASTM D 5971, ASTM D 6023, and ASTM D6103

Type P: (Suitable Trench Backfill): Suitable material that can be readily compacted, with less than 35 percent passing the No. 200 sieve and a plasticity index of 10 or less.

2.2 UNSUITABLE MATERIAL

- A. Unsuitable materials include but are not limited to the materials listed below.
 1. Soils which, when classified under ASTM D 2487 - Classification of Soils for Engineering Purposes, fall in the classifications of Pt, OH, CH, MH, or OL.
 2. Soils which cannot be compacted sufficiently to achieve the density indicated for the intended use.
 3. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, slag, and any material which may be classified as hazardous or toxic according to applicable regulations.
 4. Soils that contain greater concentrations of chloride or sulfate ions or have a soil resistivity or pH less than the existing onsite soils.
 5. Topsoil, except as allowed below.
- B. All unsuitable excavated material shall be disposed off site.

2.3 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

- A. Use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder.
- B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, notify the Engineer immediately. In case of conflict between types of pipe embedment backfills, use the agency-specified backfill material if that material provides a greater degree of support to the pipe, as determined by the Engineer. In case of conflict between types of trench or final backfill types, use the agency-specified backfill material if that material provides the greater in-place density after compaction.
- C. Fill and backfill types shall be used in accordance with the following provisions:
 1. Embankment fills shall be constructed of Type P material, as defined herein, or any mixture of Type P and Type A through Type F materials.

2. Pipe zone backfill, as defined under "Pipe and Utility Trench Backfill" below, shall consist of the following materials for each pipe material listed below.
 - a. Mortar coated pipe, concrete pipe, and uncoated ductile iron pipe shall be provided with Type A or C material in the pipe zone.
 - b. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other non-mortar coated pipe shall be backfilled with Type C material in the pipe zone.
 - c. Plastic pipe and vitrified clay pipe shall be backfilled with Type C material in the pipe zone.
 - d. Where pipelines are installed on grades exceeding 4 percent, and where backfill materials are graded such that there is less than 10 percent passing a No. 4 sieve, trench plugs of Type J or N material shall be provided at maximum intervals of 200 feet unless indicated otherwise.
 - e. Type O material shall be used in the pipe zone where shown on plans, specified, or required by the Engineer for special crossings or other locations, or where otherwise approved.
 - f. Type E material will not be allowed for backfill within the pipe zone.
3. Trench zone backfill for pipelines as defined under "Pipe and Utility Trench Backfill" shall be Type D backfill material.
4. Final backfill material for pipelines under paved areas, as defined under "Pipe and Utility Trench Backfill" shall be Type G backfill material. Final backfill under areas not paved shall be the same material as that used for trench backfill.
5. Trench backfill and final backfill for pipelines under structures shall be Type A or B, except where concrete encasement is required by the Contract Documents.
6. Aggregate base materials under pavements shall be Type G material constructed to the thicknesses indicated. Aggregate subbase shall be Type M material.
7. Backfill around structures shall be Type P material, or Types A through Type F materials, or any mixture thereof, except as shown.
8. Backfill materials beneath structures shall be as follows:
 - a. Drainrock materials under hydraulic structures or other water retaining structures with underdrain systems shall be Type H material.
 - b. Under concrete hydraulic structures or other water retaining structures without underdrain systems, Types F, G or H materials shall be used.
 - c. Under structures where groundwater must be removed to allow placement of concrete, Type F material shall be used. Before the Type F material is placed, filter type geotextile fabric shall be placed over the exposed foundation.
 - d. Under all other structures, Type F, G or H material shall be used.
9. Backfill used to replace pipeline trench overexcavation shall be a layer of Type F material encased in non-woven geotextile fabric to prevent migration of fines for wet trench conditions or the same material as used for the pipe zone backfill if the trench conditions are not wet.

2.4 PIPELINE MARKING TAPE

- A. **Metallic Tape:** Tape shall be minimum 5.5 mils thick aluminum foil imprinted on one side, encased in high visibility inert polyethylene jacket. Tape shall be a minimum of 6 inches wide. Imprinted lettering shall be 1 inch tall, permanent black, as indicated. Joining clips shall be manufacturer's standard tin or nickel coated. Tape shall be as manufactured by Reef Industries (Terra "D"), Allen (Detectatape), or equal.

- B. Plastic Tape: Tape shall be minimum 4-mil thick polyethylene which is impervious to alkalais acids, and chemicals and solvents which are likely in the soil. Tape shall be a minimum of 6 inches wide and lettering shall be 1-inch tall permanent black on a colored background. Tape shall be manufactured by Reef Industries (Terra Tape), Allen (Markline), or equal.
- C. Warning Tape: Warning tape manufactured for marking and identifying underground utilities continuously inscribed with a description of utility, colored as follows:
 - 1. Red; Electric.
 - 2. Yellow; Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water Systems.
 - 5. Green: Sewer Systems.

2.5 MATERIALS TESTING

- A. Schedule A: All soils testing of samples submitted by the Contractor will be done by a testing laboratory of the Owner's choice and at the Owner's expense. At its discretion, the Engineer may request that the Contractor supply samples for testing of any material used in the work.
- B. Schedule B: Contractor shall employ and pay for the services of a qualified independent testing consultant, approved by the City, to perform quality assurance for the testing: soil compaction control/material aggregate control. Contractor will be responsible for all construction quality control, testing including soils, backfill concrete, waterline, etc.
- C. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Method for Particle-Size Analysis of Soils.
- D. Determination of sand equivalent value will be performed using ASTM D 2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- E. Unified Soil Classification System: References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487. The Contractor shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.
- F. The testing for chloride, sulfate, resistivity, and pH will be done by a testing laboratory of the Owner's choice and at the Owner's expense.

PART 3 - EXECUTION

3.1 EXCAVATION – GENERAL

- A. General: Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including rock and all obstructions of any nature that would interfere with the proper execution and completion of the Work. The removal of said materials shall conform to the lines and grades indicated or ordered. Unless otherwise indicated, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. Furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations. Excavations shall be sloped or otherwise supported in a safe

manner in accordance with safety requirements of the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

- B. **Maximum Length of Open Trench:** The maximum length of open trench in roadways shall not exceed 200-feet day or night. The maximum length of open trenches in urban and rural areas shall not exceed 500-feet at each pipe installation heading beyond the end of the installed pipeline, or the requirements of the agency with jurisdiction, whichever is lesser.
- C. **Construction Delays:** In the case of any construction delay in excess of five calendar days, whether Contractor or Owner caused, the Contractor shall backfill the excavation, install temporary paving including temporary traffic markings, and restore traffic to pre-construction condition to minimize disruption to traffic and the community at no additional cost to the Owner.
- D. **Removal and Exclusion of Water:** Remove and exclude water, including storm water, groundwater, irrigation water, and wastewater, from all excavations. Dewatering wells, well points, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least 2 feet below the bottom of excavations before the excavation work begins at each location. Water shall be removed and excluded until backfilling is complete and all field soils testing has been completed. Dewatering to include filtering to prevent migration of the soil materials and fines from the subgrade.

3.2 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

- A. **Excavation Beneath Structures and Embankments:** Except where otherwise indicated for a particular structure or ordered by the Engineer, excavation shall be carried to the grade of the bottom of the footing or slab. Where indicated or ordered, areas beneath structures or fills shall be overexcavated. The subgrade areas beneath embankments shall be excavated to remove not less than the top 6 inches of native material and where such subgrade is sloped, the native material shall be benched. When such overexcavation is indicated, both overexcavation and subsequent backfill to the required grade shall be performed. When such overexcavation is not indicated but is ordered by the Engineer, such overexcavation and any resulting backfill will be paid for under a separate unit price bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price. After the required excavation or overexcavation has been completed, the exposed surface shall be excavated with a smooth-edged bucket to minimize disturbance, and rolled with heavy compaction equipment to obtain 95 percent of maximum density.
- B. **Excavation Beneath Paved Areas:** Excavation under areas to be paved shall extend to the bottom of the aggregate base or subbase, if such base is called for; otherwise it shall extend to the bottom of the paving thickness. After the required excavation has been completed, the top 12 inches of exposed surface shall be scarified, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density. The finished subgrade shall be even, self-draining, and in conformance with the slope of the finished pavement. Areas that could accumulate standing water shall be regraded to provide a self-draining subgrade.
- C. **Notification of Engineer:** Notify the Engineer at least 3 days in advance of completion of any structure excavation and allow the Engineer a review period of at least 1 day before the exposed foundation is compacted or is covered with backfill or with any construction materials.

3.3 PIPELINE AND UTILITY TRENCH EXCAVATION

- A. General: Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches with widths as indicated.
- B. Trench Bottom: Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe zone. Excavations for pipe bells and welding shall be made as required.
- C. Open Trench: The maximum amount of open trench permitted in any one location shall be 500 feet or 200 feet in roadways, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be protected in accordance with Section 01 71 50 – Protection and Restoration of Existing Facilities. The Contractor shall provide temporary 6-foot chain link fencing panels for protection of all open excavations and trenches within public streets, residential areas, and all other locations with the exception of unimproved open areas where excavations and/or pipeline trenches that can be safely sloped in accordance with current OSHA standards to provide safe access without the use of shoring devices. Temporary fencing panels shall fully enclose open excavations and trenches and shall remain in place during all non-working hours.
- D. Trench Overexcavation: Where trenches are indicated to be overexcavated, excavation shall be to the depth indicated and backfill shall be installed to the grade of the bottom of the pipe bedding.
- E. Overexcavation: When ordered by the Engineer, whether indicated on the Drawings or not, trenches shall be overexcavated beyond the depth and/or width shown. Such overexcavation shall be to the dimensions ordered. The trench shall then be backfilled to the grade of the bottom of the pipe bedding. Overexcavation less than 6 inches below the limits on the Drawings shall be done at no increase in cost to the Owner. When the overexcavation ordered by the Engineer is 6 inches or greater below the limits shown, or wider, additional payment will be made. Said additional payment will be made under separate unit price bid items for overexcavation if such bid items have been established; otherwise payment will be made in accordance with a negotiated price.
- F. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.
- G. If a moveable trench shield is used during excavation operations, the trench width shall be wider than the shield so that the shield is free to be lifted and then moved horizontally without binding against the trench sidewalls. If the trench walls cave in or slough, the trench shall be excavated as an open excavation with sloped sidewalls or with trench shoring, as indicated and as required by the pipe structural design.

3.4 OVEREXCAVATION NOT ORDERED OR INDICATED

- A. Any overexcavation carried below the grade ordered or indicated, shall be backfilled to the required grade with the indicated material and compaction. Such work shall be performed at no additional cost to the Owner.

3.5 EXCAVATION IN LAWN AREAS

- A. Where excavation occurs in lawn areas, the sod shall be carefully removed, dampened, and stockpiled to preserve it for replacement. Excavated material may be placed on the lawn; provided, that a drop cloth or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling and testing of the pipeline, the sod shall be replaced and lightly rolled in a manner so as to restore the lawn as near as possible to its original condition. Provide new sod if stockpiled sod has not been replaced within 72 hours.

3.6 EXCAVATION IN VICINITY OF TREES

- A. Except where trees are indicated to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the Engineer. Trees shall be supported during excavation by any means previously reviewed by the Engineer.

3.7 BACKFILL – GENERAL

- A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed. Structures shall not be constructed on CLSM backfill until the CLSM has obtained a 7-day minimum cure.
- B. Except for drainrock materials being placed in overexcavated areas or trenches, backfill shall be placed after all water is removed from the excavation, and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.
- C. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally. Do not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.
- D. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock materials removed. All materials disturbed from their intact condition that are 4 inches or larger in least dimension or aggregates of soil material thicker than 4 inches shall be removed from the excavation walls and base prior to placing pipe or any backfill material. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

3.8 PLACING AND SPREADING OF BACKFILL MATERIALS

- A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that the depth of each uncompacted layer shall not exceed 8 inches of compacted thickness.
- B. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the

pipe so that when compacted the pipe zone backfill will provide uniform bearing and side support.

- C. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved.
- D. Where the backfill material moisture content is too high to permit the indicated degree of compaction the material shall be dried or mixed with drier material until the moisture content is satisfactory.

3.9 COMPACTION OF EARTH FILL, BACKFILL, AND EMBANKMENT MATERIALS

- A. Each layer of Types A, B, C, G, H, and K backfill materials as defined herein, where the material is graded such that at least 10 percent passes a No. 4 sieve, shall be mechanically compacted to the indicated percentage of density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.
- B. Each layer of Type E and J backfill materials shall be compacted by means of at least 2 passes from a flat plate vibratory compactor. When such materials are used for pipe zone backfill, vibratory compaction shall be used at the top of the pipe zone or at vertical intervals of 24 inches, whichever is the least distance from the subgrade.
- C. Fill on reservoir and structure roofs shall be deposited at least 30 days after the concrete roof slab has been placed. Equipment weighing more than 10,000 pounds when loaded shall not be used on a roof. A roller weighing not more than 8,000 pounds shall be used to compact fill on a roof.
- D. Pipe zone backfill materials that are granular shall be compacted by using vibratory compactors.
- E. Equipment weighing more than 10,000 pounds shall not be used closer to structure walls than a horizontal distance equal to the depth of the fill at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations. Reduce the lift thickness as necessary to achieve the required compaction.
- F. Backfill around and over pipelines that is mechanically compacted shall be compacted using light, hand operated, vibratory compactors and rollers. Reduce the lift thickness as necessary to achieve the required compaction. After completion of at least 2 feet of compacted backfill over the top of pipeline, compaction equipment weighing no more than 8,000 pounds may be used to complete the trench backfill.
- G. Compaction Requirements: The following compaction test requirements shall be in accordance with ASTM D 1557, method C. Compaction shall be obtained with the moisture content within plus or minus 2 percent of the optimum moisture content. Where agency or utility company requirements govern, the highest compaction standards shall apply.

Location or Use of Fill	Percentage of Maximum Density
Pipe embedment backfill for flexible pipe	90
Pipe bedding and overexcavated zones under bedding for flexible pipe, including trench plugs	90
Pipe embedment backfill for steel yard piping	---
Pipe embedment backfill for rigid pipe	90
Pipe zone backfill portion above embedment for rigid pipe	90
Pipe bedding and overexcavated zones under bedding for rigid pipe	90
Final backfill, beneath paved areas or structures	95
Final backfill, not beneath paved areas or structures	90
Trench zone backfill, beneath paved areas and structures, including trench plugs	95
Trench zone backfill, not beneath paved areas or structures, including trench plugs	90
Embankments and fills	90
Embankments and fills beneath paved areas or structures	95
Backfill beneath structures and hydraulic structures	95
Backfill and fill around structures on reservoir or structure roof	90
Topsoil (Type K material)	80 (uncompacted placement) 90 for earthwork under topsoil – topsoil not to be compacted
Aggregate base or subbase (Type G or M material)	95

3.10 PLACEMENT OF CLSM

- A. Following placement and anchoring of the pipe, remove all loose soil from trench walls and floor. Remove any unstable soil at the top of the trench, which might fall into the trench during placement of the CLSM.
- B. Deliver the CLSM to the trench in ready mix trucks and utilize pump or chutes to place the CLSM in the trench. Direct CLSM to one side of the pipe, taking care not to displace the pipe at any time. Continue placing CLSM on one side of the pipe until CLSM has gone under the pipe and up the other side to a depth of 1.5 feet above the pipe bottom. Use at least two hand-held vibrators to continuously liquefy and move CLSM into all voids. Adjust water in mixture to maintain fluid consistency but maintain strength requirements. Continue placing CLSM on both sides of the pipe continuously using two vibrators for every 30 feet of pipe run.
- C. Maintain stability of pipe throughout CLSM placement. CLSM will likely require placement in lifts to prevent pipe flotation. No movement of the pipe caused by flotation will be allowed. If any movement occurs, the CLSM material shall be removed and the pipe placed back on line and grade. Any damage to the pipeline system caused by movement of the pipe shall be removed and/or repaired in full conformance with these Contract Documents at no additional cost to the Owner. Remove all sloughed material or other debris from top of previously placed CLSM.

3.11 PIPE AND UTILITY TRENCH BACKFILL

- A. Pipe Zone
 1. The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe and a plane at a point 12 inches above the top surface of the pipe. The bedding is defined as that portion of pipe zone backfill material between the bottom of the trench and the bottom of the pipe. The embedment is defined as that portion of the pipe zone material between the bedding and a plane at a point 6 inches above the top surface of the pipe.
 2. After compacting the bedding, perform a final trim using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells and welding shall be made as required.
 3. The pipe zone shall be backfilled with the indicated backfill material. Exercise care to prevent damage to the pipeline coating, cathodic bonds, and the pipe itself during the installation and backfill operations.
 4. If a moveable trench shield is used during backfill operations the shield shall be lifted to a location above each layer of backfill material prior to compaction of the layer. Do not displace the pipe or backfill while the shield is being moved.
- B. Trench Zone: After the pipe zone backfills have been placed, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade.
- C. Marking Tape Installation:
 1. Continuously install metallic marking tape along the pipe at a depth of 3 feet below finish grade.

2. Continuously install plastic marking tape along the pipe at the elevation indicated on the Drawings.
- D. Final Backfill: Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway subgrade.
- 3.12 FIELD TESTING
- A. General: All field soils testing will be done by a testing laboratory of the Owner's choice at the Owner's expense except as indicated below.
 - B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with Method C of ASTM D 1557. Field density in-place tests will be performed in accordance with ASTM D 1556 or by such other means acceptable to the Engineer.
 - C. In case the test of the fill or backfill show noncompliance with the required density, perform remedies as may be required to ensure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the Owner, paid by the Contractor, at no additional cost to the Owner.
 - D. Provide test trenches and excavations including excavation, trench support, and groundwater removal for the Owner's field soils testing operations. The trenches and excavations shall be provided at the locations and to the depths required by the Owner. All Work for test trenches and excavations shall be provided at no additional cost to the Owner.
 - E. Frequency of Testing
 1. Backfill around structures and in embankments shall be tested every 300 square ft of each lift of placement.
 2. CLSM shall be tested each batch being placed or every 300 cubic yards that is placed.
 3. Pipe backfill shall have one test every 80 feet (2 joints) of backfill placed, per lift at Engineer's discretion.

END OF SECTION

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**SECTION 31 32 19
GEOTEXTILES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install geotextiles, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCES

- A. ASTM International (ASTM) standards, most recent editions:

ASTM D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus.
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D 4595	Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
ASTM D 4884	Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Sewn Geotextiles.
ASTM D 4886	Standard Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method).

1.3 DEFINITIONS.

- A. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.
- B. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile provided.
- C. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile provided.
- D. Nondestructive Sample: Sample representative of finished geotextile, prepared for testing without destruction of geotextile.

- E. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.
- F. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D 4884.
- G. Woven geotextile: A geotextile fabric composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern.
- H. Nonwoven geotextile: A geotextile fabric composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Product Data.
 - 1. Manufacturer’s material specifications and product literature.
 - 2. Installation drawings showing geotextile sheet layout, location of seams, direction of overlap, and sewn seams.
 - 3. Description of proposed method of geotextile deployment, sewing equipment, sewing methods, and provisions for holding geotextile temporarily in place until permanently secured.
- C. Samples.
 - 1. Geotextile: One-piece, minimum 18-inches long, taken across full width of roll of each type and weight of geotextile. Label each with brand name and furnish documentation of lot and roll number from which each sample was obtained.
 - 2. Field Sewn Seam: 5-foot length of seam, 12-inches wide with seam along center, for each type and weight of geotextile.
 - 3. Securing Pin and Washer: 1 each.
- D. Certificates.
 - 1. Certification from geotextile manufacturer that products satisfy the indicated requirements.
 - 2. Field seam efficiency test results.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Deliver each roll with sufficient information attached to identify manufacturer and product name or number.
- C. Handle products in manner that maintains undamaged condition.
- D. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in a way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

PART 2 - PRODUCTS

2.1 NONWOVEN GEOTEXTILE

- A. Nonwoven geotextile shall be composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern. Products shall be calendared or finished so that yarns will retain their relative position with respect to each other.
- B. Polymeric yarn shall be long-chain synthetic polymers (polyester, polypropylene, or polyethylene) with stabilizers or inhibitors added to make filaments resistant to deterioration due to heat and ultraviolet light exposure.
- C. Geotextile Edges: Selvaged or finished to prevent outer material from separating from sheet.
- D. Unseamed Sheet Width: Minimum 6 feet.
- E. Nominal Weight Per Square Yard: 8 ounces.
- F. Physical Properties: Conform to physical property requirements below:

<u>Property</u>	<u>Requirement</u>	<u>Test Method</u>
Apparent Opening Size (AOS)	Max No. 80 U.S. Standard Sieve Size	ASTM D4751
Water Permittivity	1.4 sec. ⁻¹ , MinARV	ASTM D4491 (Falling Head)
Vertical Water Flow Rate	95 gpm/sq ft, MinARV	
Grab Tensile Strength	205 MinARV	ASTM D4632
Grab Tensile Elongation	50 percent, MaxARV	ASTM D4632
Trapezoidal Tear Strength	80 lb, MinARV	ASTM D4533
CBR Puncture Strength	500 lb, MinARV	ASTM D6241
Ultraviolet Radiation Resistance	70 percent strength retention, MinARV after 500 hours	ASTM D4355

1. *Minimum average roll value (weakest principal direction)*

2.2 SEWING THREAD

- A. Sewing thread shall be polypropylene, polyester, or Kevlar thread with durability equal to or greater than durability of geotextile sewn.

2.3 SECURING PINS

- A. Securing pins shall be steel rods or bars conforming to the following:
 - 1. 3/16-inch diameter.
 - 2. Pointed at one end; head on other end, sufficiently large to retain washer.
 - 3. Minimum Length: 12-inches.

- B. Steel Washers for Securing Pins:
 - 1. Outside Diameter: Not less than 1-1/2 inches.
 - 2. Inside Diameter: 1/4-inch.
 - 3. Thickness: 1/8-inch.
- C. Steel Wire Staples:
 - 1. U-shaped.
 - 2. 10-gauge.
 - 3. Minimum 6-inches long.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Laying Geotextile
 - 1. Notify the Engineer whenever geotextiles are to be placed. Do not place geotextile prior to obtaining Engineer's approval of underlying materials.
 - 2. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.
- B. Orientation on Slopes
 - 1. Orient geotextile with long dimension of each sheet parallel to direction of slope.
 - 2. Geotextile may be oriented with long dimension of sheet transverse to direction of slope only if sheet width, without unsewn seams, is sufficient to cover entire slope and anchor trench and extend at least 18-inches beyond toe of slope.
- C. Joints.
 - 1. Unseamed Joints.
 - a. Overlap unseamed joints to the following dimensions unless otherwise indicated:
 - b. Foundation/Subgrade Stabilization: Minimum 18-inches.
 - c. Riprap: Minimum 18-inches.
 - d. Drain Trenches: Minimum 18-inches, except overlap shall equal trench width if trench width is less than 18-inches.
 - e. Other Applications: Minimum 12-inches.
 - 2. Sewn Seams.
 - a. Use sewn seams wherever stress transfer from one geotextile sheet to another is necessary. Sewn seams, as approved by Engineer, also may be used instead of overlap at joints for applications that do not require stress transfer.
 - b. Seam efficiency shall be minimum 70 percent.
 - c. Type: "J" type seams are preferred, but flat or butterfly seams are acceptable.
 - d. Stitch Count: Minimum 3 to maximum 7 stitches per inch.
 - e. Stitch Type: Double-thread chain stitch, Type 401, Federal Standard No. 751a.
 - f. Stitch Location: 2-inches from geotextile sheet edges, or more if necessary to develop required seam strength.
 - g. Sewing Machines: Capable of penetrating 4 layers of geotextile.
- D. Securing Geotextile.
 - 1. Secure geotextile during installation as necessary with sand bags or other means approved by Engineer.
 - 2. Securing Pins

- a. Insert securing pins with washers through geotextile, midway between edges of overlaps and 6-inches from free edges.
- b. Spacing:

Slope	Maximum Pin Spacing (Feet)
Steeper than 3:1	2
3:1 to 4:1	3
Flatter than 4:1	5

- c. Install additional pins across each geotextile sheet as necessary to prevent slippage of geotextile or to prevent wind from blowing geotextile out of position.
- d. Push each securing pin through geotextile until washer bears against geotextile and secures it firmly to subgrade.

E. Placing Products over Geotextile.

- 1. Notify Engineer before placing material over geotextile. Do not cover installed geotextile prior to receiving authorization from the Engineer to proceed.
- 2. If tears, punctures, or other geotextile damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geotextile. Repair damage as indicated below.

F. Installing Geotextile in Trenches.

- 1. Place geotextile in a way that will completely envelope granular drain material to be placed in trench and with indicated overlap at joints. Overlap geotextile in direction of flow. Place geotextile in a way and with sufficient slack for geotextile to contact trench bottom and sides fully when trench is backfilled.
- 2. After granular drain material is placed to grade, fold geotextile over top of granular drain material, unless otherwise indicated. Maintain overlap until overlying fill or backfill is placed.

G. Riprap Applications.

- 1. Overlap geotextile at each joint with upstream sheet of geotextile overlapping downstream sheet. Sew joints where wave run-up may occur.

H. Geotextile-Reinforced Earth Wall Applications.

- 1. Sew exposed joints; extend sewn seams minimum 3-feet behind face of wall.
- 2. Protect exposed geotextile from damage and deterioration until permanent facing is applied.

I. Silt Fence Applications.

- 1. Install geotextile in one piece or continuously sewn to make one piece, for full length and height of fence, including portion of geotextile buried in toe trench.
- 2. Install bottom edge of sheet in toe trench and backfill in a way that securely anchors geotextile in trench.
- 3. Securely fasten geotextile to a wire mesh backing and each support post in a way that will not result in tearing of geotextile when fence is subjected to service loads.
- 4. Promptly repair or replace silt fence that becomes damaged.

3.2 REPAIRING GEOTEXTILE

- A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geotextile. Repair damaged geotextile by placing patch of undamaged geotextile over damaged area plus at least 18-inches in all directions beyond damaged area. Remove interfering material as necessary to expose damaged geotextile for repair. Sew patches or secure them with pins and washers, as indicated above for securing geotextile, or by other means approved by Engineer.

3.3 REPLACING CONTAMINATED GEOTEXTILE

- A. Protect geotextile from contamination that would interfere, in Engineer's opinion, with its intended function. Remove and replace contaminated geotextile with clean geotextile.

3.4 FIELD QUALITY CONTROL

- A. Testing: Test seam efficiency by preparing and testing minimum of one set of nondestructive samples per acre of each type and weight of geotextile provided for the Work. Test according to ASTM D4884 and submit written results to Engineer.

END OF SECTION

DIVISION 32
EXTERIOR IMPROVEMENTS

2. **Topsoil Analysis Report:** A report certified by an analytical laboratory which shows results of analyzing representative samples of topsoil proposed for use. Approval of the report does not constitute final acceptance of the topsoil.
 3. Supplier's information and testing information on compost for soil amendment.
- C. Certificate
1. Certificates shall accompany each product delivery stating source, quantity, and type of material. All certificates shall be submitted to the Landscape Architect at the time of delivery.
 2. Certificates of inspection of plant material, as may be required by Federal, State, or other authorities having jurisdiction, which accompany the shipment, shall be submitted to the Landscape Architect at the time of delivery.
 3. Landscaping Subcontractor guarantee to perform seed maintenance and weeding services during the one-year correction of defects period.

1.5 QUALITY ASSURANCE

- A. General: All plants shall be true to type or name as indicated in the Contract Documents and shall be tagged in accordance with the standard practice recommended by the Agricultural Code of the State of Utah however, determination of plant species or variety will be made by the Landscape Architect.
- B. All plants shall comply with Federal and Utah State laws requiring inspection for plant diseases and infestations.
- C. The Contractor shall obtain clearance from the County Agricultural Commissioner, as required by law, before planting plants delivered from outside the County in which they are to be planted. Evidence that such clearance has been obtained shall be filed with the Engineer or Landscape Architect.
- D. Inspections will be made by the Engineer or Landscape Architect. The Contractor shall request inspection at least 24 hours in advance of the time inspection is required. Inspection is required on the following stages of the Work:
 1. During preliminary grading, soil preparation, and initial weeding.
 2. When approved, amended topsoil is placed.
 3. When finish grading has been completed.
 4. When seed is to be applied.
 5. Once seed application has been complete and erosion control is in place.
 6. When all Work except the maintenance period has been completed.
 7. Final inspection before acceptance of the project.
 8. At the one-year project warranty inspection.

1.6 CLEANUP

- A. Upon completion of all planting operations, the portion of the Site used for a work or storage area by the Contractor shall be cleaned of all debris, superfluous materials, and equipment. All such materials and equipment shall be entirely removed from the Site in accordance with Section 01 70 10 – Project Closeout.

- B. All walks or pavement shall be swept or washed clean upon completion of the Work of this Section.
- C. During the entire Contract period, plant containers that have been cut or removed from plant materials shall be removed from the site daily.
- D. All fertilizer packaging shall be cleared from the site at the end of every day.

1.7 MAINTENANCE OF LANDSCAPING PLANTING PRIOR TO ACCEPTANCE OF PROJECT

- A. General: The Contractor shall be responsible for protecting and maintaining all seeded areas until final acceptance of all Work under the Contract.
- B. Protection: The Contractor shall provide adequate protection to all newly seeded areas including the installation of approved temporary fences to prevent trespassing and damage, as well as erosion control, until the end of the correction of defects period.
- C. The Contractor shall replace any materials or equipment that its employees or Subcontractors have damaged.
- D. Partial utilization of the project shall not relieve the Contractor of any of the requirements contained in the Contract Documents.
- E. Plants shall be maintained in a vigorous, thriving condition by watering, cultivating, weeding, pruning, fertilizing, spraying, and other operations necessary.
- F. Maintenance shall include, in addition to the foregoing, cleaning, the repair of erosion, reseed bare areas, and all other necessary maintenance work. Sidewalks, retaining walls and paved areas shall be kept clean while seeding and maintenance are in progress.

1.8 FINAL INSPECTION AND GUARANTEE

- A. Inspection of all planted areas will be part of final inspection under the Contract.
- B. Written notice requesting inspection shall be submitted to the Landscape Architect at least 10 days prior to the anticipated inspection date.
- C. Final acceptance prior to start of the guarantee period of the Contract will be on written approval by the Engineer or Landscape Architect, on the satisfactory completion of all Work, including maintenance, but exclusive of the replacement of plant material or reseed areas that have less than 60% coverage.
- D. Any delay in the completion of any item of work in the planting operation which extends the seeding into more than one season shall extend the correction period in accordance with the date of completion given above.
- E. The Contractor shall reseed, as soon as weather conditions permit, all bare areas or areas that show less than 60% seed germination which are noted at the end of the one-year correction period.

F. All Work under this Section shall be left in good order to the satisfaction of the Owner and the Landscape Architect, and the Contractor shall, without additional expense to the Owner.

1.9 MAINTENANCE AND GUARANTEE FOLLOWING ACCEPTANCE OF PROJECT

A. General: The Contractor shall be responsible for a period of one year after date of acceptance of the Work of this Section, for maintaining all seeded areas, including fertilizing, controlling insects and diseases and weeding. The Contractor shall obtain a written guarantee from the landscaping Subcontractor embodying the provisions of this paragraph.

B. The Work covered by the maintenance and guarantee portions of this paragraph includes providing all reseeded of seeding areas for the one year maintenance period or for 2 full growing seasons if the maintenance periods starts in the fall or winter, labor, materials, chemicals, equipment, and supplies and in performing all operations in connection with maintenance and guarantees.

C. The Contractor shall clean-up and remove unused or waste materials from the Site and leave the area in a neat condition satisfactory to the Owner whenever it performs work during the maintenance period.

D. Final Inspection: The Owner and Contractor shall make a final inspection at the end of the one-year maintenance and correction period. Any bare seed areas or less than 60% coverage at time of final inspection shall be reseeded within a time agreed upon by both parties. If it is outside of the seeding window for seeding, seeding shall take place within the next seeding window even though reseeded may run beyond the maintenance and correction period.

PART 2 - PRODUCTS

2.1 GENERAL

A. All landscaping materials including but not limited to, soil amendments, fertilizer, herbicides, pesticides, seed mixtures and erosion control materials shall be first-grade, commercial quality and shall have certificates indicating the source of material, analysis, quantity, or weight attached to each sack or container or furnished with each delivery. Delivery certificates shall be given to the Landscape Architect as each shipment of material is delivered. A list of the materials used, together with typical certificates of each material, shall be submitted to the Landscape Architect prior to final acceptance.

2.2 TOPSOIL

A. Imported topsoil shall be obtained from naturally drained areas and shall be fertile, friable loam suitable for plant growth. Topsoil shall be subject to inspection and approval by the Landscape Architect at the source of supply and upon delivery to the site. All laboratory soil testing shall be ordered and paid by the Contractor.

B. Onsite or imported topsoil shall be of uniform quality, free from toxic substances, subsoil, stiff or lumpy clay, hard clods, hardpan, rocks, disintegrated debris, plants, roots, seeds, and any other materials that would be toxic or harmful to plant growth. **Topsoil shall contain no noxious weeds or noxious weed seeds.**

- C. Topsoil used for this Work shall meet the following requirements.
1. Soluble salts (EJe) Less than 4 dS/m or mmho/cm
 2. ph Between 5.0 and 7.5
 3. Sand, silt, clay content Less than 30% clay
 - a. Less than 70% sand and
 - b. Less than 70% silt.
 4. Soil texture Sand clay loam (SLC)
 - a. sandy loam (SL)
 - b. clay loam (CL)
 5. Organic matter content (by weight) Minimum 0.5 Percent
 6. SAR (sodium absorption ratio) Less than 7
 7. Percent coarse fragments (rocks>2mm) Less than 5 percent
 8. Nitrate Nitrogen (ppm) Greater than 20
 9. Phosphorus (ppm) Greater than 15
 10. Potassium (ppm) Greater than 150
 11. Iron (ppm) Greater than 10

2.3 FERTILIZER AND AMENDMENTS

- A. Fertilizer shall be furnished in bags or other standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon.
- B. Chemical fertilizers shall be a mixed commercial fertilizer with percentages of nitrogen, phosphoric acid, and potash at 16-16-8 slow release formula. Fertilizers shall be uniform in composition, dry, and free flowing.
- C. Fertilizer tablets shall be 12 grams each 20-10-5 "Agriform," "Lesslie", or equal.
- D. Compost: Onsite topsoil shall be amended with one part compost to 5 parts topsoil. Compost shall consist of composed leaves and yard grass. Compost shall meet the following requirements:
 1. Compost shall be dark brown to black in color,
 2. Compost shall have no objectionable odor,
 3. Compost shall have a particle size of ½ inch or less,
 4. Compost shall have a pH of 5.0 to 7.8,
 5. Compost shall have a soluble salt concentration (mmhos/cm or dS/m) of less than 5 and
 6. Compost shall have a carbon-to-nitrogen ration of less than 25:1.

2.4 MULCH & COMPOST

- A. Shredded stringy bark mulch in planting beds shall be clean, pine bark free of sticks and pieces over 2 inches in size produced by "chipping and shredding" tree branches or similar means.
- B. Organic Compost material as outlined in "Compost Quality Guidelines for Landscaping" by Isaman, Koenig, Cerny, USU Extension, 3 March 2003.

2.5 PLANT MATERIALS

- A. Plants shall meet requirements of the Contract Documents and shall be in accordance with the botanical names and applicable standards of quality, size, condition, and type. They shall be true to name, genera, species, and variety in accordance with reference publications.
- B. Plant names are defined in "Standardized Plant Names" and "Bailey's Encyclopedia of Horticulture." When a name is not found in either reference, the accepted name used in the nursery trade shall apply.
- C. Plants shall be marked for identification. Each bundle of plants and at least 25 percent of each species and variety of separate plants in any one shipment shall have legible labels securely attached before delivery to the site.

2.6 NATIVE SEED

- A. Seed shall conform with applicable City, County, State, Federal regulations and meet Utah Seed Law. Seed shall be mixed by dealer. The Contractor shall furnish dealer's guaranteed germination figure for each variety. Grass seed shall not be delivered until samples have been approved in writing by the Engineer, Landscape Architect or its authorized landscape representative. Approval of samples, however, shall not affect the right of the Engineer, Landscape Architect or the authorized landscape representative to reject seed upon or after delivery. Seed that has become wet, moldy, or otherwise damaged prior to use will not be accepted.
- B. Grass seed shall be fresh, clean, new-crop seed, composed of the following varieties mixed in the proportions by weight. Purity and germination percentage shall be the results of testing.
- C. Weather Conditions: Fertilizing, seeding, or mulching operations will not be permitted when wind velocities exceed 5 miles per hour or when the ground is frozen, unduly wet, or otherwise not in a tillable conditions. Seeding shall not be conducted when temperatures exceed 80°F.
- D. Topsoil: Four inches of approved, onsite or imported, amended topsoil shall be placed in all areas delineated to be seeded. Imported, amended topsoil shall be placed and raked smooth prior to seeding or sodding
- E. Soil Preparation: The ground to be seeded shall be graded in conformance with the Drawings and shall be loose and reasonably free of large rocks, roots, and other material which will interfere with the work.
- F. Supply seed on a pure live seed (PLS) basis.
- G. Obtain seed from lots that have been tested by a state certified seed testing laboratory. (Association of Seed Analyst (AOSA) or Society of Commercial Seed Technologists (SCST). Seed germination tests older than 18 months for grass seed, and 9 months for shrub or tree seed are not acceptable.
- H. Do not use wet, moldy or otherwise damaged seed.

I. See seed mixes below:

SEED SCHEDULE FOR WOOD HOLLOW UPLAND SEED MIX BC&A (2026)			
SEED NO.	SPECIES NAME		SEED
	BOTANICAL NAME	COMMON NAME	Pounds (LBS) of Pure Live Seed (PLS)/Acre
<i>GRASSES</i>			
1	<i>Achnatherum hymenoides</i>	Indian ricegrass	4.00
2	<i>Elytrigia repens x Pseudoroegneria spicata</i> 'Newhy'	Newhy Hybrid wheatgrass	3.50
3	<i>Elymus lanceolatus ssp. lanceolatus</i>	Thickspike wheatgrass	3.50
4	<i>Elymus trachycaulus ssp. Trachycaulus</i> 'Pryor'	Pryor Slender wheatgrass	4.00
5	<i>Festuca ovina</i> 'Covar'	Covar Sheep fescue	1.50
6	<i>Poa secunda ssp. Sandbergii</i>	Sandberg bluegrass	1.00
<i>FORBS/SHRUBS/COVER CROP</i>			
7	<i>Artemisia frigida</i>	Fringed sagebrush	0.25
8	<i>Chrysothamnus viscidiflorus</i>	Douglas rabbitbrush	0.75
9	<i>Linum lewisii</i>	Lewis flax	1.00
10	<i>Oenothera pallida</i>	White Evening primrose	0.50
11	<i>Triticum aestivum x Secale cereale</i>	Triticale	6.00
TOTALS =			26.00

J. In disturbed areas, complete all weed removal, final grading, trench settling, surface preparation and irrigation work (if applicable) before seeding begins.

K. Roughen soil receiving seed.

L. Do not install when seed or soil is saturated or frozen.

M. All seed shall be installed via drill seeding or hydroseeding. Broadcast seeding is not permitted.

N. MAINTENANCE

1. During the maintenance period the contractor shall be responsible for removing weeds and maintaining the site to provide as good of conditions as possible for seed to grow.
2. Contractor shall plan on one re-seeding if the native stand has not established at the end of the warranty period.

2.7 DRILL SEEDING

A. Drill seeding of the native seed may occur either in the spring or fall. Seeding in the spring may occur between February 15 to April 15 or before temperatures exceed 75°F. Seeding in the fall may occur between September 15 to November 15 or until the ground is frozen. The actual seeding period must be approved by the Engineer or Landscape Architect because weather conditions vary from year to year. No seed shall be conducted until approved.

- B. All areas that are designated for seeding with the native seed mixture in the Contract Documents shall be seeded by drilling unless otherwise approved in writing by the Engineer or Landscape Architect. Only those areas that are too steep to drill may be hydroseeded.
- C. Seeding: Seed shall be uniformly drilled to an average depth of 1/4 to 1/2 inch at the rate specified using equipment having drills not more than 6-1/2 inches apart. Row markers shall be used with the drill seeder. Drill seeding shall take place 3 days after application of herbicide.
- D. Rolling: Immediately after seeding, the entire area shall be firmed with a roller not exceeding 90 pounds for each foot of roller width. Areas seeded with drills equipped with rollers shall not be rolled.
- E. Hydromulch: Apply hydromulch over the entire seeded area at a rate of 2000 pounds per acre. Hydromulching operation shall be conducted as described in Section 3.13 Hydroseeding.

2.8 HYDROSEEDING

- A. Hydroseeding shall only be used in areas that are too steep for drill seeding.
- B. Hydroseeding of the native seed mix may occur either in the spring or fall. Seeding in the spring may occur between February 15 to April 15 or before temperatures exceed 75°F. Seeding in the fall may occur between September 15 to November 15 or until the ground is frozen. The actual seeding period must be approved by the Engineer or Landscape Architect because weather conditions vary from year to year. No seed shall be conducted until approved.
- C. Hydromulch or slurry shall conform to the following:
 1. Echofiber or Conwed or approved equal wood fiber mulch, applied at a rate of 2000 pounds per acre.
 2. M-binder or Plantego tackifier, applied at a rate of 100 pounds per acre.
 3. 16-16-8 slow release fertilizer, applied at a rate of 150 pounds per acre
 4. Water at a rate of 4000 gallons per acre.
- D. Hydromulch shall be applied using a hydro-seeding equipment manufactured by Finn or Bowie or approved equal. Machines shall be equipped with heavy duty cast iron pumps and agitators capable of thoroughly mixing the slurry.
- E. Spray of hydromulch shall begin immediately after the tank is full and the slurry components are mixed.
- F. Apply hydromulch in a downward drilling motion using a fan stream nozzle. It is important to ensure that all of the components enter and mix with the topsoil.
- G. Only qualified and trained personnel shall perform hydroseeding to insure the uniformity of the hydroseeding application.

2.9 EROSION CONTROL BLANKET

- A. Erosion Control Blanket shall be AEC Premier Coconut or approved equivalent and placed on slopes 3:1 or greater.
- B. Erosion Control Blanket shall be installed after the application of seed.
- C. Erosion control blanket shall be keyed in at the top of the slope as per manufacturer specifications.
- D. Anchorage devices shall be 9-inch, two-legged staples furnished by the manufacturer, or staples of the proper length as recommended by the manufacturer for specific soil conditions.

PART 3 - EXECUTION

3.1 GENERAL

- A. The landscape work shall not be performed at any time when it may be subject to damage by climatic conditions.
- B. The Contractor shall carefully scale or otherwise verify all dimensions in the Contract Documents. Dimensions and plant locations shall be coordinated with Engineer or Landscape Architect and final location shall be Site-oriented by the planter and Engineer or Landscape Architect. Any discrepancies or inconsistencies shall be brought to the attention of the Engineer.
- C. In case of conflict between the Plant List totals and total plant count of the Contract Documents, the Contractor shall provide the higher number of plants.
- D. Delivery of materials may begin only after samples and tests have been approved by the Engineer or Landscape Architect. Materials provided shall be not less quality than the approved sample.
- E. Substitutions for the indicated plant materials may be considered pursuant to the Contract Documents.
- F. The Contractor shall provide temporary fencing, barricades, covering, or other protections to preserve existing landscaping items indicated to remain and to protect the adjacent properties and other structures when they may be damaged by the landscape work.
- G. Waste materials shall be removed and disposed of off the Site, unless otherwise indicated.
- H. It shall be the responsibility of the Contractor to obtain information regarding utilities in the area of work and to prevent damage to the same. The Contractor shall protect the utilities as necessary.
- I. Burning of combustible materials on the Site shall not be permitted.
- J. The Contractor shall protect structures, sidewalks, pavements, existing irrigation system, and other facilities that are subject to damage during landscape work. Open excavations shall be

provided with barricades and warning lights which conform to the requirements of governing authorities and the State's OSHA safety requirements from dusk to dawn each day and when needed for safety.

K. Planting areas include all areas to be landscaped unless indicated otherwise.

3.2 SOIL PREPARATION

A. The landscape work shall not begin until all other trades have repaired all areas of settlement, erosion, rutting, etc., and the soils have been re-established, recompacted, and refinished to finish grades. The Engineer or Landscape Architect shall be notified of all areas that prevent the landscape work from being executed.

B. Areas requiring grading by the landscaper including adjacent transition areas shall be uniformly level or sloping between finish elevations to within 0.10-ft above or below required finish elevations.

C. The landscape work shall not proceed until after walks, roads, vaults, trenching, and reservoir construction is in place. Work under the Contract shall be completed to a point where the landscape areas will not be disturbed. The subgrade shall be free of waste materials of all kinds.

D. During grading, waste materials in the planting areas such as weeds, rocks 3-inches and larger, building materials, concrete rubble, wires, cans, glass, lumber, masonry, sticks, etc., shall be removed from the Site. All weeds shall be dug out by the roots.

E. Fertilizers, soil additives, seed, etc. subject to moisture damage shall be kept dry in a weatherproof storage place.

F. After removal of waste materials, the planting and sod area subgrade shall be scarified and pulverized to a depth of not less than 6 inches, and all surface irregularities below the cover of topsoil shall be removed.

G. Finish grading shall consist of:

1. Final contouring of the planting areas.
2. Removal of 6 inches of hardpan material and placement of four inches of imported, amended topsoil over all areas to be planted, deeded or sodded unless indicated otherwise.
3. Placing all soil additives and fertilizers.
4. Tilling of planting areas.
5. After tilling, bringing areas to uniform grades by floating and/or hand raking.
6. Making minor adjustment of finish grades as directed by the Engineer or Landscape Architect.
7. Removing waste materials such as stones, roots, weeds or other undesirable foreign material and raking, disking, dragging, and smoothing soil ready for planting.
8. Finished grades shall be one inch below the top of curbs, sills and walkways in all areas for seed, one and a half inches for sod and three inches for areas with mulch or groundcover.
9. Finished grades shall be smoothed to eliminate puddling or standing water.

- H. Any unusual subsoil condition that will require special treatment shall be reported to the Engineer or Landscape Architect.
- I. Unless otherwise specified, seeding areas shall receive a minimum of 4 inches of topsoil.
- J. Surface drainage shall be provided as indicated by shaping the surfaces to facilitate the natural run-off of water. Low spots and pockets shall be filled with topsoil and graded to drain properly.
- K. Finish grade of all planting areas shall be 1-1/2 inches below finish grade of adjacent pavement of any kind.

3.7 ROCKS OR UNDERGROUND OBSTRUCTIONS

- A. In the event that rock or underground obstructions are encountered in the excavation of plant pits, alternative locations shall be selected by the L.A. Moving of landscape materials to alternative locations shall not entail additional costs to the OWNER.

END OF SECTION

DIVISION 33
UTILITIES

**SECTION 33 41 02
REINFORCED CONCRETE PIPE (ASTM C 76, MODIFIED)**

PART 1 - GENERAL

1.1 GENERAL

- A. This section covers the construction of reinforced concrete culvert and storm drain conduits, including connection to existing and new structures, all in accordance with the Contract Documents. This work shall be completed by the Contractor.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards:

ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
AASHTO M170	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C1479	Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

1.3 SUBMITTALS

- A. Furnish certificates to the Engineer guaranteeing that the pipe furnished hereunder is in compliance with the requirements of these Specifications.

1.4 QUALITY ASSURANCE

- A. Inspection: All pipe shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein. Notify the Engineer in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.
- B. During the manufacture of the pipe, the Engineer shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.
- C. Test: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.
- D. Perform said material tests at no additional cost to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor; provided that the CONTRACTOR's schedule is not delayed for the convenience of the Engineer.

- E. In addition to those tests specifically required, the Engineer may request additional samples of any material for testing by the Owner. Furnish the additional samples at no additional cost to the Owner.
- F. Any concrete pipe which arrives on site with voids, cracked, damaged, or with inadequate concrete cover over reinforcement or exposed reinforcement, or is cracked or damaged during installation, shall be cause for rejection. Remove precast section(s) from the project site and replace with new undamaged sections at no additional cost to Owner.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Handle concrete pipe in positions consistent with their shape and design. Lift and support only from the support points indicated on the shop drawings.
- B. Embedded Lifting or Handling Devices capable of supporting pipe in positions anticipated during manufacturing, storage, transportation and installation.
- C. Block and brace pipe during storage. Provide lateral bracing which is sufficient to prevent bowing and/or warping and will not inhibit curing of the exposed surfaces.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

- A. Reinforced Concrete Pipe: Ensure that Reinforced Concrete Pipe conforms to the requirements of ASTM Designation C76 meeting the pipe class as shown on the drawings. Ensure that bell and spigot joints, including rubber gaskets, conform to the requirements of the latest revision of ASTM C443. Design pipe joints so as to provide for self-centering and, when assembled, to compress the gasket to form a watertight seal. Ensure that the gasket is confined in a groove on the spigot end of pipes larger than 12 inches so that pipe movement or hydrostatic pressure cannot displace the gasket. All pipe shall be manufactured with Type II modified cement. Each pipe section shall be identified by a stamp indicating:
 - 1. Name of Manufacturer
 - 2. Date of Manufacture
 - 3. D-loading in pounds and/or Pipe Class

2.2 CONCRETE END SECTIONS

- A. End Sections: Precast reinforced concrete end sections shall have at least one line of reinforcement conforming to the requirements of AASHTO M170 equivalent to the square inches per linear foot for elliptical reinforcement for circular pipe, Class II, Wall B.

2.3 FABRICATION

- A. Maintain plant records and quality control program during fabrication of structural precast concrete sections. Make all quality control records available to Engineer upon request.
- B. Use molds that are rigid, and constructed of material that will result in uniform finished surfaces.

- C. If self-consolidating concrete is not used, thoroughly vibrate concrete to ensure proper consolidation, elimination of cold joints, and to minimize trapped air on at the concrete surface.
- D. Fabricate and provide the required lifting devices which are compatible with embedded components.
- E. Ensure reinforcing steel, anchors, inserts, plates, angle and other cast-in items are sufficiently embedded, properly secured, and correctly located. Ensure that the reinforcing steel is properly supported to prevent movement or shifting during fabrication. Inadequate concrete cover over reinforcing shall be cause for rejection.
- F. Chairs or spacers between the reinforcement and forms shall be stainless steel or a nonferrous material.
- G. Cure concrete pipe under identical conditions to develop specified concrete quality.

PART 3 - EXECUTION

3.1 GENERAL

- A. Perform laying, jointing, and testing for defects and for leakage in the presence of the Engineer, and obtain approval before acceptance. Material found to have defects will be rejected. Promptly remove such defective materials from the Site.
- B. Ensure that installation conforms to the requirements of ASTM C1479, instructions furnished by the pipe manufacturer, and to the supplementary requirements herein. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.2 TRENCHING AND BACKFILL

- A. Ensure that trench excavation and backfill shall conform to the requirements of Section 31 23 00 – Earthwork.

3.3 INSTALLATION

- A. Install the pipe accurately to the defined line and grade. Ensure that variance from established line and grade is not greater than one thirty-second ($1/32$) of an inch per inch of pipe diameter and not to exceed one-half ($1/2$) inch, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe due to non-concentricity of joining surface and pipe interior surfaces does not exceed one sixty-fourth ($1/64$) inch per inch of pipe diameter or one-half ($1/2$) inch maximum.
- B. Install all concrete pipe proceeding up the grade on a stable foundation with joints closely and accurately fitted. Fit rubber gaskets properly in place and take care in joining the pipe units to avoid twisting of gaskets. Ensure that joints are clean and dry before uniformly

applying a joint lubricant, as recommended by the pipe supplier, to the mating jointing surfaces to facilitate easy positive joint closure.

- C. Install pipe with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.
- D. Place circular concrete pipe that contains elliptical reinforcing so that the reference line designating the top of the pipe is not more than 5 degrees from the vertical plane through the longitudinal axis of the pipe.
- E. Compact pipe zone material around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejointed as for a new pipe. When laying is not in progress, close the ends of the pipe with a tight-fitting stopper to prevent the entrance of foreign material.
- F. In addition to the above-mentioned requirements, ensure that all pipe installation complies with the specific requirements of the pipe manufacturer.
- G. During pipe installation, sufficiently dewater the trench so that the joints will be free of water when jointed.
- H. Grout all fittings to provide a smooth interior and exterior surface.

END OF SECTION