610 Main Street, Blanca, CO 81123 (719)379-3467

Water Supply Reserve Fund
Water Activity Final Deliverable
October 2018

Applicant & Grantee:	Trinchera Irrigation Company
Water Activity Name:	Phase II – Engineering Services for Mountain Home Reservoir Dam Outlet Works Upgrade
WSRF Grant Number:	POGG1-2017-1040
County:	Costilla
Water Source:	Trinchera Creek
Amount Funded:	$70,000 Rio Grande Basin Account
Matching Funds:	$30,000 Applicant Match

Water Activity Summary: Trinchera Irrigation Company (TIC) is executing Phase II of a 3 Phase project to improve the Safety and Functionality of their Mountain Home Reservoir. The Phase I Study determined that the Valve Gates of the Outlet Works were in need of an upgrade. Phase II was to complete Engineering: (1) evaluate alternatives, long term improvements, and develop engineering recommendations and safe storage methods; (2) develop construction cost estimates; (3) conduct site reconnaissance; (4) develop preliminary design drawings and specs; (5) draft and deliver final design, construction schedule, and cost estimate. Phase III will be to perform the construction of the rehabilitation to the Dam Outlet Works.

Final Deliverable: Engineering Analytics, Inc. (EAI) has completed the five tasks and submitted the final Design Report, Specifications and Drawings to the Colorado State Engineers Office. The State Engineer accepted and approved all the documents on October 4, 2018. We are now in the process of Phase III construction

Issues/Obstacles Encountered: To compound matters an exceptional drought occurred during the winter of 2017-2018. The snowpack was very minimal. On March 4, 2018 the SnoTel pillow precipitation showed 4.3 inches. The normal was 8.3 inches, therefore, it was only at 52% of normal. Spring runoff in the TIC watershed usually peaks in mid-June. The runoff was almost nonexistent this spring and occurred in March—before the irrigation season officially begins. In order to efficiently use any available water TIC asked the Colorado Division of Water Resources for an earlier irrigation start date. This request was granted. Without a spring runoff the storage water in the Mtn. Home and Smith Reservoirs was the main source of irrigation water for the current growing season. This water was being supplemented by well pumping which greatly impacted the groundwater levels. The drought continued throughout the summer with hardly

any measurable rain. As of August 7, 2018 Mountain Home Reservoir had approximately 1884 AF of water. This water was needed in order for the shareholders to finish growing their crops. Farmers did their best to conserve water and still stay in business. Some fields were never planted this year and others were not watered after the first cutting of hay occurred. Shareholders made using water efficiently even more of a priority. When TIC began this project in 2014 the main goal was to preserve remaining water in the reservoir at the end of the Irrigation Season. Due to circumstances beyond their control it became apparent that the Mtn. Home Reservoir would be drained toward the end of August 2018 in order to supply water to the shareholders.

In addition to the outlet gates, the age of the outlet pipelines is also of concern. With high water levels in the reservoir in 2017 and trying to avoid draining the reservoir the initial plan for work on the Mtn. Home Reservoir outlet gates was to be done with water in the reservoir. With water in the reservoir work on the outlet pipelines was to be incorporated into a future project. However, due to drought conditions the TIC decided to use the remaining water for irrigation which resulted in draining the reservoir for construction. With the reservoir drained work to repair the outlet pipelines can now be conducted as part of the outlet rehabilitation project. This is intended to eliminate the need to drain the reservoir in the future in order to complete repairs of the outlet pipelines. With the reservoir drained the need for a bulkhead and divers was eliminated resulting in a smaller increase in overall construction costs to complete work on both the outlet gates and pipelines.

Funding Summary: With a change of plans after the decision to move forward with draining the reservoir it was necessary to update the Drawings and Plans to indicate the addition of the conduit lining. This extra Engineering increased the Phase II expenses by $10,733.

Funding Source	Cash	Amount Paid	Balance
Trinchera Irrigation Company	$13,000	$29,781	$0
Trinchera Blanca Foundation	$17,000	$17,952	$0
Subtotal	$30,000	$47,733	$0
WSRF Rio Grande Basin Account	$70,000	$63,000	$7,000
Total Project Costs	$100,000	$110,733	$7,000

Matching Commitments: All matching grant funds have been received. The Grant from the Trinchera Blanca Foundation was $30,000 split between Phase II and Phase III.

Construction Specifications
Mountain Home Reservoir Outlet Rehabilitation
Costilla County, Colorado

Water Division 3, Water District 35, C-1739B
Dam ID: 350102

Prepared for:

Trinchera Irrigation Company
610 Main Street
P.O. Box 41
Blanca, CO, 81123

Prepared by:

Engineering Analytics, Inc.

1600 Specht Point Road, Suite 209
Fort Collins, Colorado 80525
(970) 488-3111
Fax (970) 488-3112

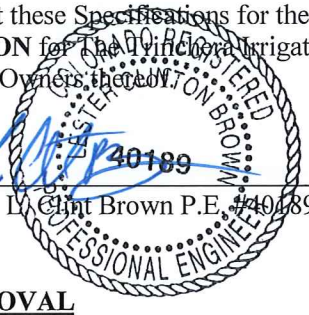
Project No. 110718

September 2018

CERTIFICATES
MOUNTAIN HOME RESERVOIR OUTLET REHABILITATION

ENGINEER'S CERTIFICATION

I hereby certify that these Specifications for the **MOUNTAIN HOME RESERVOIR DAM OUTLET REHABILITATION** for The Trinchera Irrigation Company were prepared by me, or under my direct supervision for the Owners, thereof.



40189
L. Clint Brown P.E. #40189

October 2, 2018
Date

OWNER'S APPROVAL

I, Tracy Kester, President, The Trinchera Irrigation Company, Owner, whose address is 610 Main Street, P.O. Box 41, Blanca, Colorado, 81123, do hereby accept and approve these Plans and Specifications for the **MOUNTAIN HOME RESERVOIR OUTLET REHABILITATION**

Tracy Kester
Tracy Kester, President

October 2, 2018
Date

STATE ENGINEER'S APPROVAL

Approved on the 4th day of October, 2018

State Engineer: Kevin G. Rein

by:
William T. McCormick III
Chief, Dam Safety Branch
CO P.E. #29127

MOUNTAIN HOME RESERVOIR
OUTLET REHABILITATION

CONSTRUCTION SPECIFICATIONS

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DIVISION 1 – GENERAL REQUIREMENTS

SECTION 01010

GENERAL DESCRIPTION AND SCOPE OF THE WORK

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the general project description and scope of the construction work under these specifications designated MOUNTAIN HOME RESERVOIR OUTLET REHABILITATION for the Trinchera Irrigation Company.

B. The PROJECT is located in Costilla County, north and west of the town of Fort Garland.

1.2. WORK INCLUDED UNDER THESE SPECIFICATIONS

A. General

1. The work under these specifications shall include furnishing all equipment and materials; providing all labor, supervision, administration and management; and supplying all construction equipment, materials, and services necessary to perform the work complete in accordance with the SPECIFICATIONS, DRAWINGS, and other contract documents, except as specifically excluded under WORK FURNISHED BY THE OWNER.

B. Description of work

1. Removal of the existing trash rack at intake structure.
2. Installation of temporary bulkhead at upstream end of outlet conduit at existing intake structure to facilitate construction.
3. Installation of a new trash rack at intake structure.
4. Removal of the existing knife gates, stems, operators, and concrete encasement.
5. Installation of new knife gates, stems, operators, lined HDPE pipes, and concrete encasement
6. Rehabilitation of valve chamber concrete including spray-lining the concrete walls with Castagra Ecodur, replacing the concrete floor, and protecting deteriorated masonry/Portland Cement walls with stainless steel aprons.

1.3. WORK FURNISHED BY THE OWNER

A. The following items of work will be furnished by the Owner.

1. Existing survey control monuments.
2. Quality Assurance Testing of all onsite earthwork and concrete materials placed.
3. Non-potable water for construction use may be obtained from the Owner. The Contractor shall supply all materials and equipment to convey and distribute the water.

1.4. VERIFICATION OF EXISTING CONDITIONS

A. The contract drawings are based on the existing drawings for the dam and the Engineer has conducted a limited amount of surveying and measurements of the structures. The Contractor shall inspect the site and all structures before work begins to confirm and verify the site conditions and physical dimensions and conditions of the existing structures.

B. Verification of the conditions shall be at the Contractor's option; however, failure to do so constitutes acceptance of the information provided with regard to the structure dimensions and conditions.

C. The Contractor shall redline all drawings during construction highlighting any changes made that are not shown on the contract drawings. The Engineer will use this to develop a set of As-Constructed Drawings at the completion of the project.

***** END OF SECTION *****

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***** END OF SECTION *****

SECTION 01310

CONSTRUCTION SCHEDULE

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the schedule requirements for the project and the required input from the Contractor with regard to the project planning.

1.2. MILESTONE DATES

A. The following dates are milestone completion dates that the Contractor must base his bid upon.

	Activity	Completion Date
1.	Notice-of-Award	June 1, 2018
2.	Order Gates & Thimbles	July 1, 2018
3.	Start Construction	September 15, 2018
4.	Trash Rack Removal and Installation	October 1, 2018
5.	Bulkhead Installed	October 15, 2018
6.	Remove Existing Gates, Valves, Operators	November 1, 2018
7.	Line Valve Chamber Walls	November 15, 2018
8.	Install New Valves	December 1, 2018
9.	Operate and Test Valves	December 15, 2018
10.	Substantial Completion	January 1, 2019
11.	Project complete	February 1, 2019

1.3. CONTRACTOR'S DETAILED SCHEDULE

A. Following the Contract Award, the Contractor shall submit a detailed graphic schedule showing a detailed breakdown of work activities and completion dates.

1. This plan shall be submitted to the Engineer no later than July 1, 2018.
2. This schedule shall detail all major components of construction regardless of the length of construction time.

B. Procurement Schedule. The Contractor shall submit a procurement schedule for all items that cannot be provided from local (Colorado) suppliers. The lead time expected and shop drawing schedule shall be included.

1.4. SCHEDULE MEETING

A. The Contractor and Engineer shall meet on a weekly basis to review the schedule implementation and assess Project progress.

***** END OF SECTION *****

SECTION 01340

SHOP DRAWINGS, SAMPLES, AND OPERATION AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the submittal and review of Shop Drawings, Samples and Operation and Maintenance Manuals. Refer to General Conditions for basic requirements and responsibilities.

1.2. WORK INCLUDED UNDER THESE SPECIFICATIONS

A. Submit Shop Drawings, Samples, Operation and Maintenance Manuals and other submittals as required by individual specification sections in accordance with the accepted schedule of Shop Drawing Submissions. The Engineer will not accept Shop Drawings or other submittals from anyone but the Contractor.

B. Do not submit operation and maintenance data with Shop Drawings unless so specified or required by the Engineer to determine if equipment will comply with the Contract Documents.

C. Identify in writing all deviations of submittal from the Contract Documents.

D. Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is reviewed. Partial submittals may be rejected as not complying with the Contract Documents.

E. Submit the information identified by the code symbol in the individual specification sections or, if not so identified, submit the appropriate information outlined below required to define each item proposed to be furnished. The information to be submitted for each code symbol is defined as follows:

DATA REFERENCE SYMBOLS AND DESCRIPTIONS

Symbol	Description
A	Letters of Certification of Compliance on materials, equipment, etc.
B	Samples
C	Final Certified drawings showing outline dimensions, foundation layout or mounting information, and other pertinent dimensions.
D	Field erection instructions, assembly drawings and/or diagrams detail reference drawings list, and lists of erection details.
E	Shop detail drawings showing individual subassemblies and fabricated pieces with material specifications and other applicable data.
F	Installation instructions, operating and maintenance manuals, and preventive maintenance instructions and recommended frequency.
G	Schematic diagrams of power, control, and piping systems.
H	General Bulletins and catalog cuts describing complete apparatus including operating principles and fundamentals.
I	Service data sheets showing design performance, utility requirements, etc., as applicable to the specific duty of the equipment.
J	Head capacity curves for pumps, with impeller size furnished, and maximum size available indicated.
K	Curves and/or data for over-all range of operation from minimum to maximum capacity or load, showing utilities motive medium required, total or incremental differential head, and other pertinent information applicable to the equipment or component assemblies.
L	Materials of construction of all components.
M	Renewal parts list with diagrammatic or cross-section drawings showing part identification. Include material analysis or trade designation for each significant part on parts lists.
N	Stuffing box sizes; packing sizes; and mechanical seal details, arrangement, specifications, etc., if furnished in equipment.
O	Bearing manufacturer's standard identification and/or interchangeable number for all anti-friction bearings in the equipment proper and its accessory items.
P	Material gradation, design mix, job mix formula, and/or material analysis.

F. MINIMUM NUMBER REQUIRED

1. Shop Drawings

a. Number the Contractor requires plus four (4) copies which will be utilized by the Engineer for review.
b. In lieu of above, submit a reproducible transparency and one (1) copy. The Engineer will return the transparency with stamp and comments noted thereon.
c. Submit two (2) additional copies for includion in the Operation and Maintenance manuals where Operation and Maintenance manuals are called for. Where field modifications are made after acceptance, indicate "as-constructed" conditions, mark copies "AS-CONSTRUCTED", and submit prior to Substantial Completion.

2. Samples: Two (2) unless required otherwise by individual specification sections.

3. Operation and Maintenance Manuals: The number required by the Contractor plus two (2) copies to the Engineer.

1.3. RESUBMITTAL REQUIREMENTS

A. Make corrections or changes required by the Engineer and re-submit as specified in Article 1.2 until accepted.

B. Identify in writing, all revisions other than those called for by the Engineer on previous submissions.

C. Any Need for one or more re-submissions will not entitle the Contractor to an extension of Contract Time.

1.4. SHOP DRAWINGS

A. Include the following pertinent information for each submittal:

1. Field dimensions, clearly identified as such.
2. Applicable standards, such as ASTM or Federal Specification numbers.
3. Motors: Include horsepower, voltage, temperature rating, service factor, full load current, full load rotational speed, power factor at full load, efficiency at full load, code letter, and design letter.
4. Color charts and similar items.

B. Manufacturer's standard drawings, schematics, and diagrams:

1. Clearly mark each copy to identify pertinent products and modesl and to describe eactly which parts of the drawings apply to the equipment being furnished.
2. Delete information not applicable to the Work.

C. Reproductions or copies of portions of the Contract Douments are not acceptable as complete fabrication or erection drawings. However, they may be used as a drawings upon which to indicat information on erection or to identify detail drawings.

D. Format

1. Minimum sheet size: 8-1/2" x 11".

a. Date of submission.
b. Project title and number.
c. Names of Contractor, Supplier, and Manufacturer.
d. Specification section number, intended use of item in the Work and equipment designation.
e. Identify details by reference to sheet, detail, schedule, or room numbers shown in the Contract Documents.
f. Deviations from the Contract Documents.
g. Revisions on re-submittals.
h. The Contractor's stamp, initialed or signed, certifying review of submittal, verification of products, field measurement and field construction criteria, and coordination of the information within the submittal with requirements of the Work and the Contract Documents.
i. Provide a clear space approximately 3-1/2" x 2-1/12" for the Engineer's stamp.

1.5. SAMPLES

A. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices and the full range of color, texture, and pattern.

1.6. OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance manuals by the time the Work is fifty percent (50%) complete for all equipment so designated in the individual Specification Sections and for which the Shop Drawings have been reviewed and marked "No Exceptions Taken" or "Make Corrections Noted". In addition, submit instruction books and other pertinent information for equipment not so designated which required special instruction or knowledge for proper operation and maintenance.

B. Submit Operation and Maintenance manuals for equipment by the time Work is ninety (90%) complete.

C. Do not start or operate equipment until the respective operation and maintenance data has been reviewed, approved, and copies made available at the site.

D. The Operation and Maintenance manuals shall be in addition to instructions or parts lists packed with or attached to equipment when delivered.

E. Included, as a minimum, the following information:

1. Equipment function, normal operating characteristics, and limiting conditions, complete motor data, test data, and performance curbes where applicable.
2. Operating instruction for start-up, routine, and normal operations, regulations and control, shutdown, and emergency conditions.
3. Lubrication and routine maintenance instructions.
4. Guide to "troubleshooting".
5. Parts lists, predicted life of parts subject to wear and recommended list of spare parts to be on hand.
6. Outline, cross-section, and assembly drawings, engineering data, and wiring diagrams.
7. Copy of accepted or as-constructed Shop Drawings.
8. Temperature control diagrams.
9. System balance report including a description of system operation as prepared by the balancing contractor which includes a schedule of inspection and maintenance.
10. System Schematic Flow Diagrams.

F. Format

1. Submit in a format suitable for binding in a three-ring binder or post binder.
2. Minimum sheet size: 8-1/2" x 11".
3. Fold drawings larger than 11" x 17" and insert into individual pockets bound into the manuals.
4. Enclose sheets/pages subject to frequent usage by operators in clear plastic.

5. Idividually annotate standard drawings which are furnished. Describe exactly which parts of the drawing apply to the equipment being furnished.
6. Identify each submission with the following:

    a. Date of submission.
    b. Project title and number.
    c. Names of Contractor, Supplier, and Manufacturers, include telephone numbers and addresses.
    d. Names of subcontractors with telephone numbers and addresses, contracted by Contractor for servicing and maintenance of portions of the project.
    e. Specification section number, intended uses of item in the Work, and equipment designation.
    f. Identify details by reference to sheet detail, schedule or room numbers shown in the Contract Documents.

1.7. REVIEW OF SUBMITTALS

A. A minimum of fourteen (14) days will be required for the Engineer to review each submittal or re-submittal following the receipt of said submittal in the Engineer's office of all information required for review of the submittal. The Engineer will notify the Contractor when the review time must be extended in order to correlate the submittal with other forthcoming submittals or for any other reason which prevents the Engineer's timely review.

B. The Engineer will review submittals, affix a stamp, and initials or signature will indicate subsequent action to be taken and will return the submittals to the Contractor for distribution. The review actions listed on The Engineer's stamp are defined as follows:

1. **NO EXCEPTION TAKEN** - Signifies material or equipment represented by the Submittal conforms to the design concept and complies with the information given in the Contract Documents. Contractor is to proceed with fabrication or procurement of the items and with related work.
2. **MAKE CORRECTIONS NOTED** - Signifies material or equipment represented by the submittal conforms to the design concept, and complies with the information given in the Contract Documents and in accordance with the Engineer's notations. The Contractor is to proceed with the Work in accordance with the Engineer's notations.
3. **REVISE AND RESUBMIT** - Signifies material or equipment represented by the submittal conforms to the basic design concept; however, it does not comply with the information given in the Contract Documents. The Contractor is to submit a revised submittal responsive to

the notations marked on the returned submittal and to the information in the Contract Documents.

4. **REJECTED** - Signifies material or equipment represented by the submittal does not conform to the design concept to comply with the information given in the Contract Documents and is not acceptable for use in the Work. The Contractor is to submit material or equipment responsive to the Contract Documents.
5. **SUBMIT SPECIFIED ITEM** - Signifies material or equipment represented by the submittal is not the item specified in the Contract Documents and is not to be incorporated into the Work. The Contractor is to submit only the material or equipment specified in the Contract Documents.

C. Engineer will return the number of copies of submittals specified below depending on the action taken. This is based on all drawings and data sheets being submitted in electronic format. All electronic data shall be submitted as a PDF.

D. For Operation & Maintenance Manuals, two (2) copies shall be submitted for review and only one (1) copy will be returned to the Contractor with approval as noted. For Manuals noted as NET, the Contractor shall submit three (3) additional copies to the Engineer for distribution.

Action by The Engineer	**No. Retained by The Engineer**	**No. Returned** To The Contractor**	**No. Required for Resubmittal**
No Exception Taken	1	1	0
Make Corrections Noted	1	1	0
Revise and Resubmit	1	1	1
Rejected*	1	1	1
Submit Specified Item*	1	1	1

E. Distribute reproductions or copies of Shop Drawings which carry the Engineer's stamp of acceptance to the Contractor's personnel, the job site file, the project record document file, the subcontractors, the suppliers, the manufacturer and other affected contractors.

F. Distribute samples which carry the Engineer's stamp of acceptance to the project record file and the affected supplier or manufacturer.

***** END OF SECTION *****

SECTION 01410

TESTING

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the responsibilities of the various agencies or parties performing testing services as specified herein or required by the Contract Documents.

B. This section also covers the specific testing requirements described and quantified in the individual Sections of these Specifications.

C. The Contractor shall provide such equipment and facilities as the Engineer may require for conducting field tests and for collecting and forwarding samples.

D. Any materials or equipment represented by samples may not be used until test, if required, have been made and the materials or equipment are found to be acceptable.

E. Any product which becomes unfit for use after approval hereof shall not be incorporated into the work.

F. Materials or Equipment proposed to be used may be tested at any time during their preparation or use. Furnish the required samples without charge and give sufficient notice of the placing of orders to permi the testing. Products may be sampled either prior to shipment or after being received at the site of the Work.

G. Where applicable, test shall be made by an accredited testing laboratory approved by the Engineer and Owner. Except as otherwise provided, sampling and testing of all materials and the laboratory methods and testing equipment shall be in accordance with the latest standards and methods of the American Society for Testing and Materials (ASTM).

H. Where additional or specified information concerning testing methods, sample sizes, etc., is required, such information is included under the applicable sections of the Specifications. Any modification of, or elaboration on, the test procedures which may be included for specific materials under their respective sections in the Specifications shall take precedence over the procedures referenced in Article 1.1.C.

I. Reports of test shall be distributed as follows:

1. Contractor – One Copy

2. Owner – One Copy

3. Engineer – Two Copies

1.2. OWNER'S RESPONSIBILITIES

A. The Owner shall be responsible for and shall pay all costs in connection with testing for the following:

1. Tests called for by the Specifications of materials delivered to the site related to Quality Assurance of concrete and earthworks.

2. Tests not called for by the Specifications, but deemed necessary by the Engineer.

1.3. CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall pay all costs in connection with testing required for the following:

1. Retesting for Work or materials found defective or unsatisfactory, including tests covered under Article 1.2 above.

a. Quantity and nature of tests to be determined by Owner or Engineer.

b. Tests to be performed in presence of Engineer.

c. Contractor is liable for corrective action which Owner feels is required, including complete removal and replacement of defective material or equipment.

2. Testing required under Section 01340 for acceptance of materials.

3. Testing called for by the Specifications not performed under Article 1.2.

1.4. CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General

1. The Contractor's quality control system is the means by which he assures himself that his construction complies with the requirements of the Contract Documents. Controls shall be adequate to cover all construction operations and should be keyed to the proposed construction schedule.

2. The Contractor shall establish a quality control system to perform sufficient inspection and tests of all items of Work, including that of his subcontractors, to ensure conformance to the functional performance of this project.

3. This control shall be established for all construction except where the Contract Documents provide for specific compliance tests by testing laboratories employed by the Owner.

4. Contractor's control system shall specifically include all testing required by the various sections of the Specifications.

B. Records

1. Maintain correct records on an appropriate form for all inspections and test performed, instructions received from the Engineer or Owner and actions taken as a result of those instructions.

2. These records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.)

3. Document inspections and tests as required by each section of the Specifications.

4. Provide copies to the Engineer weekly.

***** END OF SECTION *****

SECTION 01500

CONSTRUCTION SERVICES

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the requirements for construction services to be provided by the Contractor and the Owner in the prosecution of the work.

1.2. CONSTRUCTION PLANT AND TEMPORARY FACILITIES

A. General
   1. Except as otherwise specified to be furnished by the Owner, the Contractor shall furnish all construction plants and temporary facilities which are required for prosecution of the work but will not be incorporated in the completed work.

B. Temporary Structure
   1. All temporary structures for offices and warehouses shall be furnished by the Contractor and shall remain the property of the Contractor.
   2. When the work is completed, all such temporary structures and facilities shall be removed from the site and the area restored to its original condition.
   3. Temporary structures or trailers shall be place only in locations assigned by the Engineer.

1.3. CONSTRCUTION UTILITES

A. All construction utilities required for prosecution of the work shall be provided by the Contractor.

1.4. WATER

A. The Contractor shall supply all water for drinking purposes and all dispensers required.

B. Non-potable construction water used for moisture conditioning the soil, and for dust suppression shall be supplied by the Owner.

   1. However, the Contractor shall provide all retaining or holding structures and all equipment and labor required to store, pump, and transport the water to the place of use on the project site.

C. There shall be no water in the reservoir throughout the duration of construction.

1.5. SANITARY FACILITIES

A. The Contractor shall furnish and maintain chemical toilets for use by all personnel working on the project site.
B. These shall be cleaned and pumped on a weekly basis or less as required to provide clean, sanitary facilities.

***** END OF SECTION *****

SECTION 01600

STATE ENGINEER'S REQUIREMENTS

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the Colorado State Engineer's requirements as they relate to the MOUNTAIN HOME RESERVOIR OUTLET REHABILITATION.

B. The requirements specified herein are in addition to the various other requirements specified in other section of these Specifications.

1.2. STATE ENGINEER'S STATUS

A. The State Engineer shall have the authority to require that the materials used in the work and that the construction performed be to his satisfaction in accordance with the approved Plans and Specifications. Communication between the State Engineer and the Contractor shall be through the Engineer.

1.3. INSPECTION

A. The Engineer will monitor the quality of construction as specified by Rule 9 from the State of Colorado Rules & Regulations for Dam Safety and Dam Construction (2-CCR 402-1). The engineer monitoring the construction is responsible for the quality of construction, compliance with the approved design and specifications, preparation of the necessary documentation for the State Engineer's review and approval of all construction change orders, and preparation of the project completion documents required in Rule 10.

B. The Engineer will keep the State Engineer informed of proposed construction schedules and will coordinate with the State Engineer with regard to required periodic inspections by the Office of the State Engineer.

C. The Engineer will notify the State Engineer of the date of completion of the construction for the State Engineer's final inspection. The Engineer will certify that the work was performed in compliance with the Plans and Specifications on file, prior to calling for the State Engineer's final inspection.

D. The Engineer will provide adequate inspection during the period of construcitno and will call for periodic inspections by the Office of the State Engineer.

1.4. CHANGES TO THE PLANS AND SPECIFICATIONS

A. The Plans and Specifications for the reservoir project may not be materially changed without the written consent of the State Engineer.

B. The Plans and Specifications for the project as approved by the State Engineer will govern in the event of conflict with other requirements in the Contract Documents.

1.5. COMPLETION OF THE PROJECT

A. The project is not considered complete until the State Engineer states such in writing. The Project Manager will prepare the project completion documents required in Rule 10 (Rules and Regulations for Dam Safety and Dam Construction) for the State Engineer's review and acceptance prior to Final Completion.

***** END OF SECTION *****

DIVISION 2 – SITE WORK

SECTION 02220

DEMOLITION

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the demolition of the existing knife gates, outlet pipes, gate stems and operators, concrete encasement, and other appurtenant items.

1.2. PROTECTION

A. Health and Safety Plan (HASP)

1. Contractor shall regularly prepare and implement a HASP that identifies and meets current regulatory requirements for all work to be conducted.

B. Perform demolition in such a manner as to eliminate hazards to persons and property and to minimize interference with use of adjacent areas.

C. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition operations.

D. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

E. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contactor shall take necessary precautions to avoid damage to existing items to remain in place or to be reused. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing and supports as required.

1.3. ENVIRONMENTAL CONTROLS

A. Comply with all applicable environmental regulations.

B. Execute work in a manner that protects the environment from contaminants including, but not limited to, any lubricants in the existing valves, stems and operators.

1.4. PERMITS

A. Contractor shall obtain and maintain all necessary permits for the demolition work being conducted.

1.5. LICENSES

A. Contractor shall possess all necessary licenses for the type of demolition work being conducted.

B. Licenses shall be kept current for the duration of the project.

C. Contractor shall submit a copy of all current licenses.

1.6. INSURANCE

A. Insurance shall be as required by the Supplementary Condition. Insurance shall specifically cover all types of demolition to be used on the project. The certificate of insurance must indicate that all types of work to be conducted on the project are covered.

1.7. SUBMITTALS

A. Health and Safety Plan (HASP).

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1. PREPARATION

A. Utility Services.

1. Locate and identify all existing utilities prior to any demolition. Arrange and pay for disconnecting, removing, and capping utility services within areas of demolition if required. Notify the affected utility company in advance and obtain approval before starting this work.

2. Place markers to indicate location of disconnected services. Identify service lines and capping locations on project record documents.

3.2. DEMOLITION

A. Completely demolish valves, pipes, stems, operators and any other appurtenant items as shown on the drawings.

3.3. SALVAGE

A. Contractor shall coordinate with Owner to identify any existing controls or equipment in the outlet tower that the Owner desires to salvage.

B. Contractor may salvage ay items not desired by the owner.

3.4. CLEAN-UP

A. Properly dispose of all other construction wastes and trash.

***** END OF SECTION *****

SECTION 02321

DEWATERING, EROSION, AND SEDIMENT CONTROL

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers dewatering the required excavations; water diversion plan; prevention of excessive erosion of excavated areas, stockpiles earth materials, and other erodible areas; and the control of sediment to limit siltation and pollution of the stream course below the reservoir.

B. The Contractor shall employ all necessary means to control the surface runoff to protect the work area and minimize pollution to the downstream water course in accordance with all State and Federal water quality standards and in accordance with these specifications.

1.2. REFERENCES

A. Department of Labor. Safety and health Regulations for Construction. Subpart

1.3. DEWATERING

A. General

1. The Contractor shall employ the necessary dewatering techniques and supply all pumps, piping and other necessary to control ground water or seepage in the required excavations.
2. Seepage water shall be controlled so as not to deteriorate the adjacent overburden materials.
3. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the construction required therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
4. All excavations which extend down to or below static ground water elevations shall be dewatered by lowering and maintaining the groundwater surface beneath such excavations.
5. It is the Contactor’s sole responsibility to construct and maintain any and all necessary diversion, dewatering, and sediment control structures and components necessary to protect the work site, any structures thereon, and any watercourses from damage or deterioration due to water and runoff.
6. The Owner and Engineer will assume no responsibility for loss or damage to any of the water diversion or control components or the permanent structures, embankments, outlet works, or other specified work.

7. Neither the Owner nor Engineer will assume responsibility for lost time or production due to failure of the Contractor's methods, techniques or components.

B. Design

1. The Contractor shall design all dewatering and water control facilities using good engineering and construction principles and practices.
2. The dewatering systems shall be designed to avoid the migration of fines and to prevent slumps and blowouts in the excavations.
3. Discharge of water into downstream water courses shall be controlled and shall meet all State and Federal water quality regulations.
4. The Contractor shall have personnel on site that are knowledgeable with the latest State and Federal water quality requirements and shall follow said standards.

1.4. WATER DIVERSION PLAN

A. The Contractor shall develop a detailed water diversion plan to divert reservoir inflows during construction.

B. The diversion plan shall consist of the following items:

1. The design storm for the construction period, including the estimated volume or flow rate that must be managed, clearly stated in the report.
2. Design drawings and specifications depicting the construction of cofferdams, spillways, conduits, gates, or other temporary features that may be required to control the water
3. Stability analysis of the cofferdam, under both normal and design flood loading conditions.
4. Hydraulic calculations shooing the capacity of spillways or conduits used for diversion.
5. A plan for the removal or abandonment of cofferdams, spillways, conduits, or other temporary features after construction is complete.

1.5. SEDIMENT AND EROSION CONTROL

A. Sediment shall be trapped or retained in amounts as required to comply with the control of turbidity in the stream.

B. Sediment retention basins shall be constructed only when there are no other more economical measures which can be employed to prevent excessive sediment from entering the stream during storm runoff.

C. The Contractor shall control his operations so that excessive sediment or siltation, due to construction operations, shall not be introduced into the stream from storm runoff in concentrations that ill impair natural or developed fisheries and domestic water supplies downstream from the construction area.

D. The Contractor shall comply with all applicable Federal, State, and County laws, orders, and regulations concerning the prevention, control, and abatement of water pollution ad turbidity.

E. The Contractor shall obtain all permits required by State and Federal water quality control regulations including Colorado Department of Public Health and Environment Water Quality Control Commission Regulation 61.

1. Storm water management plans required for such permits shall be prepared in accordance with the permitting agency's requirements and shall be maintained by the Contractor.
2. Water quality permits that cannot be closed by the date of final completion may be transferred to the Owner at the date of final completion.
3. It is the Contractor's responsibility to complete applications for the transfer of applicable permits and the Contractor will not be relieved of responsibility for sediment and erosion control until the transfer of permit is complete and accepted by the permitting agency.
4. All applicable sedimentation and erosion control measures required by the permits and storm water management plans shall be in place and in a good state of repair at the time of transfer.
5. The Contractor shall also submit any storm water management plans required for the permits to the Owner prior to applying for transfer of the permits.

F. The Contractor shall also comply with the occupational health and environmental controls set forth in Subpart D of the Department of Labor "Safety and Health Regulations for Construction".

G. The measures taken shall be the Contractor's responsibility and remedy to meet the applicable laws and standards.

1.6. PREVENTION OF EROSION

A. The Contractor shall protect open excavations, trenches, and the like with silt fencing, straw bale berms, sand and gravel check dams, and or other silt traps or barriers as required to prevent excessive erosion of open earth areas and excavated piles from storm runoff.

B. The Contractor shall protect stockpiled earth materials to prevent erosion at the base.

C. Where natural drainage ways are intercepted by construction activities, such drainage ways shall be diverted around the construction site and through a culvert.

D. The diverted drainage way shall be paved with asphalt or concrete, where necessary, to prevent pickup and delivery of excessive sediment to the stream.

1.7. WATER QUALITY

A. The Contractor shall not degrade the quality of water in ay watercourse by runoff of sediment or by the introduction of foreign materials used on the project.

B. The Contractor shall abide by all regulations of the State and Federal water quality control acts.

1.8. REMOVAL OF STRUCTURES

A. The Contractor shall remove all equipment and structures utilized for the control of water, except as noted on the drawings.

B. All erosion and sediment control structures, dewatering equipment and components, and all temporary diversion structures shall be completely removed from the Work Site upon completion of the work.

C. Removal shall also provide for cleanup and restoration of the site to its original condition, including planting of the site to near original conditions

***** END OF SECTION *****

SECTION 02617

HDPE PIPE

PART l – GENERAL

1.1 DESCRIPTION

A. This section covers the materials and installation for the lined HDPE piping system shown on the Drawings.

B. The system consists of 24-inch HDPE pipe lining the existing 30-inch conduit, as shown on the Drawings.

1.2 SUBMITTALS

A. Product Data

1. Manufacturer's and local representative name, location, and telephone number.

2. Submit manufacturer's material data and literature for product.

B. Shop Drawings: Layout drawings, showing locations and dimensions of all pipe, fittings, and centralizers for the 24-inch HDPE pipe.

C. Installation Work Plan: Provide work plan that includes:

1. Installation sequence, procedures, and equipment that will be used to install the pipe in the existing conduit and in a trench.

2. Materials and procedures to support HDPE pipe within existing conduit and provide adequate space for grout.

3. Equipment to be used to insert HDPE pipe into existing conduit.

D. Manufacturer's certificates of compliance with reference standards, catalog work sheets showing illustrated cuts of items to be furnished, including scale details and dimensions.

1.3 REFERENCES AND STANDARDS

A. The following is a list of standards that may be referenced in this Section:

1. American Water Works Association (AWWA):
    a. C906 - Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4" (100 mm) through 63" (1,575 mm) for Water Distribution and Transmission.

2. American Society for Testing and Materials (ASTM):
    a. D638 - Test Method for Tensile Properties of Plastics
    b. D790 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
    c. D1238 -Test Method for Flow Rates of Thermal Plastic by Extrusion Plastometer .
    d. D1248 - Specifications for Polyethylene Plastics Molding and Extrusion Materials
    e. D1505 - Test Method for Short Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
    f. D1599 - Test Method for Short Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
    g. D1693 - Test Method for Environmental Stress Cracking of Ethylene Plastics
    h. D2122 - Method for Determining Dimensions of Thermal Plastic Pipe and Fittings
    i. D2657 - Standard Practice for Heat Joining Polyolefin Pipe and Fittings
    j. D2837 - Method for Obtaining Hydrostatic Design Basis for Thermal Plastic Pipe Materials
    k. D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
    l. D3350 - Specification for Polyethylene Plastics Pipe and Fittings Material
    m. D4218 -Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
    n. F714 - Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter

o. F585 - Standard Practice for Insertion of Flexible Polyethylene Pipe Into Existing Sewers

p. F894 - Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain

q. F1248 - Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe

3. Plastics Pipe Institute (PPI):

a. TR-33/2003: Genetic Butt Fusion Joining Procedure for Polyethylene Gas Pipe

b. PPI Handbook of Polyethylene Pipe

1.4 RELATED SECTIONS

A. Section 02300 – EARTHWORK

1.5 QUALITY ASSURANCE

A. During transporting, storing, and installation of the pipe and pipe fittings, the pipe and pipe fittings shall not be dropped or subjected to any unnecessary jar, impact, or other treatment that could damage the pipe.

B. Pipe shall not be stored under conditions that would cause injury to the pipe. Any length of pipe that, in the opinion of Engineer, is damaged beyond repair by Contractor in hauling, handling, unloading, storing, or otherwise shall be removed from the work site and replaced by and at the expense of Contractor.

C.

PART 2 – PRODUCTS

2.1. HDPE PIPE

A. HDPE pipe shall be polyethylene pipe and fittings fabricated using extra high molecular weight, high density ethylene/hexane copolymer PE3408 polyethylene resin meeting the listed nominal physical property and pipe performance requirements listed in the following table and specified in this Section of the Specifications.

HDPE PIPE PROPERTIES

Property	Specifications	Units	Nominal Values
Material Designation	PPI/ASTM	--	PE3408
Material Classification	ASTM D1248	--	Ill C 5 P34
Cell Classification	ASTM D3350	--	345434C
Density (3)	ASTM D1505	gm/cm^3	0.955
Melt Flow (4)	ASTM D1238	gm/10 min	0.11@2.16kg
Flex Modulus (5)	ASTM D790	psi	135,000
Tensile Str. (4)	ASTM D638	psi	3,200
ESCR (3)	ASTM D1693	F_o, Hrs	P_0 > 5,000
HDB@ 73°F (4)	ASTM D2837	Psi	1,600
U-V Stabilizer (C)	ASTM D1603	%C	2.5
Hardness	ASTM D2240	Shore "D"	65
Compressive Strength (Yield)	ASTM D695	Psi	1,600
Tensile Strength@ Yield (Type IV Spec.)	ASTM D638 (2"/min)	psi	3,200
Elongation @ Yield	ASTM D638	%, minimum	8
Elongation lei) Break	ASTM D638	%, minimum	750
Modulus of Elasticity	ASTM D638	psi	130,000
ESCR (Cond. A,B,C: Mold. Slab)	ASTM D1693	$F_{0,}$ Hrs	$F_{0,}$ > 5,000
(Compressed Rim:i [Pipe])	ASTM F1248	F_{50}, Hrs	Fso, > 1,000
Impact Strength (IZOD (.125" thick)	ASTM D696 (Method A)	In-lb/in Notch	42
Linear Thermal Expansion Coef.	ASTM D696	in/in/°F	1.2 x 10-4
Thermal Conductivity	ASTM D746	BTU - in/ft"/hrs/°F	2.7
Brittleness Temo.	ASTM D746	^{0}F	< -170°F
Vicat Soft. Temp.	ASTM D1525	^{0}F	+257°F
Heat Fusion Cond.	--	psi(@ °F	75 (@ 400°F

Note:
Average Melt Index Value with a standard deviation of 0.01.

B. HDPE pipe sections shall be fabricated in lengths not greater than 60 feet. Ends of the sections shall be prepared for field fusion.

C. HDPE pipe shall have a nominal IPS (Iron Pipe Size) diameter of 24 inches. The SDR (Standard Dimension Ration) of the pipe shall be DR 32.5. The pressure rating of the pipe shall be 63 psi. The pipe shall be to the dimensions and tolerances specified in ASTM F714.

D. The HDPE pipe shall be in compliance with the physical and performance requirements of this Specification and extruded from resin that satisfied ASTM D 3350 with a cell classification of 345434C; and ASTM D1248 pipe grade resin Type III, Class C, Category 5, grade P34 polyethylene compound. The pipe shall exhibit the short term tensile and compressive physical properties listed in Paragraph 2.1, A of this section. The pipe shall provide long term endurance characteristics recognized by: the compressed ring environmental stress crack

resistance greater than 1,000 hours; and the IZOD impact strength (toughness) greater than 42 in-lb/notch.

E. HDPE pipe fittings shall be standard commercial products manufactured by injection molding or by extrusion and machining, or shall be fabricated from HDPE pipe conforming to this Specification. The fittings shall be fully pressure rated by the manufacturer to provide a working pressure equal to the pipe for 50 years service at 73.4°F with an included 2:1 safety factor. The fittings shall be manufactured from the same resin type, grade, and cell classifications as the pipe itself. The manufacture of the fittings shall be in accordance with good commercial practice to provide fittings homogeneous throughout and free from cracks, holes, foreign inclusions, voids, or other injurious defects. The fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties. The minimum "quick-burst" strength of the fittings shall not be less than that of the pipe with which the fittings are to be used. Fittings, end caps, and couplings shall be from the same manufacturer as the pipe when possible.

2.2 WALL PENETRATION MATERIALS

A. Wall Penetration Description: No. 5 hoop reinforcement bar around the wall penetration with a wall sleeve and modular seal sized per the normal pipe diameter.

B. Install wall penetration materials per manufacturer's recommendations.

C. Modular Seal

1. Model L Link-Seal Modular Seal; PSI-ThunderLine/Link-Seal; Houston, TX, or equal.

D. Wall Sleeve

1. Model CS Century Line Wall Sleeve; PSI-ThunderLine/Link-Seal; Houston, TX, or equal.

PART 3 – EXECUTION

3.1 STORAGE AND HANDLING OF MATERIALS

A. Inspect the pipe and fittings at the time of delivery. Any pipe or fittings which are found to be defective shall be rejected and removed immediately from the site.

B. Pipe shall be unloaded, stored, and handled so as to avoid damage to the pipe, lining, coating, and gaskets.

C. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe shall be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.

D. Any damage to the pipe incurred as a result of unloading, storage, or handling shall be repaired by Contractor to the satisfaction of Engineer.

E. Any pipe that is damaged during unloading, storage, handling, or installation, which cannot be repaired to the satisfaction of Engineer shall be immediately removed from the site by Contractor.

F. Protect pipe from sunlight during storage.

3.2 HDPE PIPE FABRICATION, ASSEMBLY, AND INSTALLATION

A. 30-Inch Conduits
   1. The HDPE piping shall be installed in the existing 30-inch conduits.

B. Sections of pipe having been discovered with cuts or gouges in excess of 10 percent of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method.

C. Fused segments of pipe shall be handled so as to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable-type chokers shall be avoided. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections. Care shall be exercised to avoid cutting or gouging the pipe.

D. The HDPE pipe shall be tested in accordance with the manufacturer's recommendations, or in accordance with the guidelines and procedures taken from PPI Technical Report TR 31/9-789, at the pressure rated capacity of the pipe based on the temperature at the time of hydro-test. Refer to the manufacturer's temperature related pressure ratings, and hydro-test the pipe at 1.5 times that pressure rating for 2 to 3 hours per TR 31/9.

E. Slip-lined pipe shall be installed using equipment and methods that will allow safe installation without potential for damage to the pipe. Slings and other handling equipment shall meet the recommendations of the pipe manufacturer and shall be subject to the approval of Engineer.

F. Sections of HDPE pipe shall be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer.

G. Butt fusion joining shall be 100 percent efficient, offering a joint weld strength equal to or greater than the tensile strength of the pipe. Socket fusion shall not be used. Extrusion welding or hot gas welding of HDPE pipe shall not be used.

H. Fabrication of all pipe, fittings, flanges, and accessories shall conform to applicable AWWA, ASTM, AISC, and AWS requirements. The amount of field fabrication necessary for completion of the work shall be limited to the extent practicable.

I. Each pipe section or fitting shall be thoroughly cleaned of all foreign material and carefully examined for cracks and defects before installing in the trench or in the existing conduit. The interior of all installed pipe shall be kept free of debris at all times.

J. All pipe cuts shall be straight and true, leaving a smooth end without damage to the pipe. Pipe cutting equipment and procedures shall conform to the recommendations of the pipe manufacturer.

K. All burrs shall be removed from the ends of cut pipe.

L. Fittings and other appurtenant structures shall be constructed at the locations shown on the drawings.

M. Provide spacers to maintain required minimum distance between HDPE pipe and existing conduit.

N. Removal of Water
   1. At all times, provide and maintain ample means and devices to remove and dispose of water entering the conduit during the laying operation.
   2. Do not lay pipe in standing water.

O. Pipe and appurtenant structures shall not be installed when the bottom of the excavation is frozen, or when there is a possibility that ice or frost will penetrate the bottom of the excavation. No pipe or appurtenant structures shall be installed unless backfilling can be completed before the formation of ice or frost.

P. Pipe shall be adequately supported to prevent deflections in excess of those recommended by the pipe manufacturer and to maintain required spacing to

existing conduit.

Q. Testing

1. The Contractor shall inspect all of the piping using a remote camera.
   a. The camera inspection should be performed after slip lining has been completed and grouted.
2. The Contractor shall provide the Engineer with a complete video log of the piping in VHS or DVD format.

3.3. PERFORMANCE

A. If there is any indication of plugging of the pipes, the pipes shall be unplugged and the cause of the plugging shall be remedied by the Contractor at the Contractor's expense.

***** END OF SECTION *****

DIVISION 3 – CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers all cast-in-place concrete and includes reinforcing steel, forms, finishing, curing, and other appurtenant work.

B. The Contractor shall inform the Engineer at least forty-eight (48) hours in advance of the times and places at which he intends to place concrete.

C. The Owner will provide Quality Assurance field testing of concrete and concrete materials as described hereinafter under Article 3.4.

D. The Contractor shall provide all other testing, other tests, and reports specified herein.

E. All concrete to be placed shall be placed in forms and shall not be bank-poured unless specifically indicated as such on the Drawings

1.2. QUALITY ASSURANCE

A. Reference Standards

1. Except as noted or modified in this Section, all concrete materials, transporting, placing, finishing, and curing shall conform to the requirements of the following standard specifications:
   a. Federal, state, and local codes, regulations, and ordinances.
   b. American Concrete Institute Standards (ACI).
      1) 117 Standard Tolerances for Concrete Construction Materials.
      2) 207.1R Mass Concrete.
      3) 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
      4) 301 Specifications for Structural Concrete for Buildings
      5) 304 Guide for Transporting Concrete
      6) Committee 304.2R – Placing Concrete by Pumping Methods.
      7) 304.6R Guide for the Use of Volumetric-Measuring and Continuous-Mixing Concrete Equipment.
      8) 305 Hot-Weather Concreting
      9) 306 Cold-Weather Concreting

10) 309 Guide for Consolidation of Concrete.
11) 311.4R Guide for Concrete Inspection.
12) 318 Building Code Requirements for Reinforced Concrete.
13) 503.1 Standard Specification for Bonding Hardened Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive.
14) 546 Concrete Repair Guide

B. The Contractor shall keep at least one (1) copy of above listed ACI publications, latest edition, in the project field office at all times.

C. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, and regulations or within any document itself, the more stringent conditions as determined by the Engineer shall govern.

PART 2 – PRODUCTS

2.1. MATERIALS

A. Where the use of the following materials is specified herein, such materials shall be in accordance with these requirements.

B. Concrete Materials

1. Cement
   a. ASTM C 150, Type II or Type I-II.

2. Fine Aggregate
   a. Clean natural sand, ASTM C33.

3. Coarse Aggregate
   a. Crushed stone, washed gravel, or other acceptable inert granular material conforming to ASTM C33 size 67, except that clay and shale particles shall not exceed one percent (1%).

4. Water
   a. Clean and free from mud, oil, organic matter, or other deleterious substances.

5. Plasticizer
   a. ASTM C 494; Grace “WRDA”, Master Builders “MasterPozzolith”, Sika Chemical “Plastocrete 161”, or acceptable equal.

6. Air entraining agent
    a. ASTM C 260; Grace “Darex AEA”, Master Builders “VR 10”, Sika Chemical “AER”, or acceptable equal.

C. Reinforcing Steel

1. Rebar
    a. Bars not otherwise ASTM A 615 Grade 60 bar noted.

2. Stirrups and ties
    a. ASTM A 615 Grade 60, No. 5 and smaller.

3. Bar supports
    a. CRSI Class 3 where in contact with formed surfaces that will not be exposed.
    b. CRSI Class 1 for use in contact with forms for exposed surfaces.

4. Welded wire fabric
    a. ASTM A 185.

D. Forms

1. Plywood
    a. Product Standard PS 1-09, waterproof, resin-bonded, exterior type Douglas fir; face adjacent to concrete Grade B or better.

2. Fiberboard
    a. Federal Specification LLL-B-810, Type II; tempered, waterproof, screen back.

3. Lumber
    a. Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.

4. Chamfer strips
    a. Clear pine, surface against concrete planed.

5. Form coating
    a. Nox-Crete “Nox-Crete Form Coating”, L&M “Debond”, or Acrow-Richmond “Rich-Cote”.

6. Polyethylene film
    a. Federal Specification L-P-378, Type I; six (6) mil.

E. Expansion Joint Materials

1. Filler
   a. Preformed HDPE Plastic Expansion Board.
   b. Thickness: Three-quarters inch (3/4”)
   c. Height : Five and one-half inches (5-1/2”)
   d. Manufacturer:
      1) Sika “Greenstreak”
      2) Or equal

2. Sealer
   a. Flexible, modified PVC paving cap seal.
   b. Provide factory fabricated intersections for ells, tees, wyes, and crosses.
   c. Manufacturer and products:
      1) Greenstreak G-Seal
         a) Joints adjacent to existing concrete: Profile 617
         b) Joints in new concrete: Profile 605

F. Miscellaneous

1. Epoxy bonding agent
   a. Sika Chemical “Sikadur 32 Hi-Mod” or acceptable compound equal.

2. Membrane curing
   a. ASTM C 1315; Grace “Dekote”, L&M “Dress & Seal”, ProSoCo “Kure & Seal”, or equal.

3. Water stops
   a. PVC
      1) Ribbed or serrated, six (6) inches by 3/8-inch or as otherwise indicated on the Drawings.
      2) When placed in joint between existing concrete and new concrete structures: Vinylex RET638 and Greenstreak epoxy gel 7300 or equal.
   b. Hydrophilic
      1) Southern Metal & Plastic Products “Water-Tite” or approved equal.

4. Epoxy anchors
   a. Hilti HAS rod; Hilti HIT Epoxy.

5. Stainless Steel Anchors
   a. RedHead or Hilti; type as required for the specific application.

b. 316 Stainless Steel

2.2. DESIGN MIX

A. Each concrete mix shall be designed and concrete shall be controlled within the following limiting requirements.

B. Mix proportions shall be determined in accordance with ACI 211.1.

C. The acceptability of concrete will be judged on the bases of compliance with all of the specified requirements and not on the basis of strength alone.

D. Concrete Strength

1. The concrete mix classes to be supplied for the project are listed in Table 0300.1.

2. The location of use of the various classes is as indicated on the Drawings and as indicated as follows:
   a. Class 1 Concrete – Pipe Encasement Concrete and Structural Concrete for reinforced concrete structures.

3. For the classes listed, the quantity of Portland cement, expressed in pounds per cubic yard, shall not be less than that indicated in Table 0300.1.

4. Flyash may be substituted for cement but shall not exceed twenty percent (20%) of the total pozzolanic material.

5. It is intended that all concrete exceed the specified minimum strength and meet all requirements of ACI-318.

6. The Engineer shall be the sole judge of the quality of the concrete and tests.

Table 03300.1
CONCRETE MIX REQUIREMENTS

Class	Minimum 28-Day Strength (PSI)	Minimum Cement Content (LBS)	Entrained Air Content (Percent)	Maximum Slump (In)	Maximum W/C Ratio
1	4000	611	5% - 8%	4.0	0.42

E. Water-Cement Ratio

1. The water to cement ratio shall not exceed the values listed in Table 0300.1.

F. Slump

1. Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction.

2. Unless otherwise authorized by the Engineer, slump shall not exceed the values listed in Table 0300.1.

G. Total Air Content

1. The total volumetric air content of the concrete shall be within the limits listed in Table 03300.1.

2. In general, concrete which will be buried and not exposed to weather is not required to utilize entrained air.

3. All Class 1 Concrete will require air entraining.

H. Initial Set

1. For the Class 1 Concrete, the initial set as determined by ASTM C 403 shall not be attained until at least five (5) hours after the water and cement are added to the aggregates.

2. The quantity of retarding admixture shall be adjusted as necessary to compensate for variations in temperature and job conditions.

I. Ratio to Fine to Total Aggregates

1. The ratio of fine to total aggregates based on solid volumes (not weights) shall be as shown in Table 03300.2:

Table 03300.2
AGGREGATE REQUIREMENTS

Coarse Aggregate Size	Minimum Ratio	Maximum Ratio
3/4 inch to No. 4	0.40	0.50
1 inch to No. 4	0.35	0.45

J. Admixtures

1. The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations for compliance with these specifications.

2. A plasticizing admixture shall be included in all concrete, unless otherwise accepted by the Engineer.

3. A plasticizing retarder admixture may be used as approved by the Engineer and shall be adjusted as specified under Article 2.2.H.

2.3. DESIGN MIX REVIEW

A. General

1. The source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to the Engineer for review before the concrete work is started.

2. The mix design and all materials shall be tested and certified in a report prepared by an independent testing laboratory and submitted to the Engineer for review.

3. Review of these reports will be for general acceptability only and continued compliance with all contract provisions will be required.

B. Materials

1. Cement
   a. Reports on cement shall include the type, brand, manufacturer, composition, and method of handling.

2. Admixtures

a. Reports on admixtures shall include the ASTM C 494 classification, brand, manufacturer, and active chemical ingredients.
b. All admixtures shall be the products of one (1) manufacturer.

3. Aggregates
   a. Reports on aggregates shall include the source location, type, gradation, deleterious substances, soundness, abrasion loss, and the results of all tests required to verify compliance with ASTM C 33.

4. Proportions
   a. Using concrete materials acceptable to the Engineer, a tentative concrete mix shall be designed and tested for each size and gradation of aggregates and for each consistency intended for use on the work.
   b. Design quantities and test results of each mix shall be submitted for review.
   c. Acceptable mixes shall be subject to field adjustment as necessary to meet the requirements of these specifications.
   d. The report for each tentative concrete mix submitted for review shall contain the following information:
      1) Slump on which design is based
      2) Total gallons of water per cubic yard
      3) Cement content
      4) Ratio of fine to total aggregates.
      5) Weight (surface dry) of each aggregate per cubic yard.
      6) Quantity of each admixture.
      7) Air content
      8) Compressive strength based on (7) day and twenty-eight (28) compression tests
      9) Time of initial set

C. Testing

1. Aggregates shall be sampled and tested in accordance with ASTM C 33.
   a. Aggregate soundness may be determined by either the sodium sulfate or magnesium sulfate test in accordance with ASTM C 88/
   b. The bulk specific gravity of each aggregate shall be determined in accordance with ASTM C 127 and ASTM C 128.

2. Two (2) sets of compression test cylinders, three (3) cylinders per set, shall be made from each proposed concrete mix.
   a. One (1) set of three (3) cylinders shall be tested at an age of seven (7) days and the other set shall be tested at an age of twenty-eight (28) days. All six cylinders shall be cast from a single batch.

b. Concrete test specimens shall be made, cured, and stored in conformity with ASTM C 192 and tested in conformity with ASTM C 39.

3. Slump shall be determined in accordance with ASTM C 143 and total air content shall be determined in conformity with ASTM C 231.

4. Initial set tests shall be made at ambient temperatures of seventy degrees Fahrenheit (70˚F) and ninety degrees Fahrenheit (90˚F) to determine compliance with the initial set time specified hereinafter.
   a. The test at seventy degrees Fahrenheit (70˚) shall be made using concrete containing the specified plasticizing and air entraining admixtures.
   b. The test at ninety degrees Fahrenheit (90˚) shall be made using concrete containing the specified plasticizing retarder and air entraining admixtures.
   c. Initial set shall be determined in accordance with ASTM C 403.

PART 3 – PRODUCTS

3.1. BATCHING AND MIXING

A. Batching and mixing shall be performed with suitable equipment by an acceptable ready-mix concrete supplier.

B. Personnel at the batching and mixing plant shall be qualified and experienced.

C. The batch plant shall meet the requirements of the NRMCA for Plant Certification and ASTM C 685 and C 94.

D. All scales, volumetric feed systems, and weigh bins shall be calibrated and checked according to ASTM C 685 prior to production.

E. When a truck mixer is used for the complete mixing of the concrete, the mixing operation shall begin within thirty (30) minutes after the cement has been intermingled with the aggregates.

3.2. DELIVERY

A. A delivery ticket shall be prepared for each load of concrete delivered.

B. A copy of each ticket shall be handed to the Engineer by the truck operator at the time of delivery.

C. Tickets shall show the mix identification, the number of yards delivered, the quantities of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, the amount of water that may be added at the placement site, and the numerical sequence of the delivery.

D. When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within ninety (90) minutes or before the drum has been revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates, unless a longer time is specifically accepted by the Engineer.

E. In hot weather, or under condition contributing to quick stiffening of the concrete, a time less than ninety (90) minutes may be required by the Engineer.

F. When a truck mixer is used for the complete mixing of the concrete, the mixing operation shall begin within thirty (30) minutes after the cement has been intermingled with the aggregates.

3.3. PLACEMENT

A. General

1. The handling, depositing, and compacting of concrete shall conform t of these specifications subject to adjustment by the Engineer for weather or placement conditions.

2. Concrete shall not be pumped through aluminum pipe or aluminum alloy pipe.

3. Where construction joints are indicated on the Drawings, the limits of each concrete pour shall be as defined by construction joint locations.

4. If the Contractor prefers construction joint locations other than the locations indicated on the Drawings, he shall predetermine such other joint locations and request the Engineer’s acceptance of the revised joint arrangement as specified hereinafter in Articles 3.12 and 3.13.

5. The location of all construction joints shall be determined prior to fabricating reinforcing steel and shall be clearly labeled on the reinforcing steel shop drawings.

6. All concrete within the established pour limits shall be placed in one continuous operation.

7. Prior to placing concrete for pours that require more than one lift over a relatively large area, the Contractor shall demonstrate that the pour requirements do not exceed his placing ability.

8. Before concrete is placed, forms, reinforcements, water stops, anchor bolts, and embedments shall be rigidly secured in proper position; all dirt, mud, water, and debris shall be removed from the space to be occupied by the concrete; all surfaces which may have become encrusted with dried mortar or concrete from previous placement operation shall be cleaned; and the entire installation shall be acceptable to the Engineer.

B. Bonding to Hardened Concrete

1. The surface of hardened concrete upon which fresh concrete is to be placed shall be rough, clean, and damp.

2. Surface mortar shall be removed to expose the aggregate.

3. The hardened surface shall be cleaned of all foreign substances (including curing compound), washed with clean water, and kept saturated during the twenty-four (24) hour period preceding placement of fresh concrete.

4. All hardened surfaces shall be sand blasted or water blasted to remove surface latency and to expose the coarse aggregate.

C. Conveyance and Distribution

1. Concrete shall be conveyed to the point of final deposit by methods which will prevent the separation or loss of the ingredients.

2. Concrete shall be deposited in its final position without moving it laterally in the forms for a distance in excess of five feet (5’).

D. Depositing Concrete

1. Concrete shall be deposited in approximately horizontal layers of proper depth for effective compaction; however, the depth of a layer shall not exceed twenty inches (20”).

2. Each layer of concrete shall be plastic when covered with the following layer and the forms shall be filled at a rate of vertical rise of not less than two feet (2') per hour.

3. Horizontal and vertical construction joints shall be provided as necessary and as accepted by the Engineer to comply with these requirements.

4. Plastic concrete is defined as concrete which can be re-vibrated at least to the extent that an immersion-type vibrator spud will penetrate the concrete at least one inch (1") by vibration action under its own weight.

5. Concrete shall remain plastic to this extent for at least two and one half (2-1/2) hours after initial contact of cement and water.

6. Concrete which is no longer plastic, but which must be covered by an additional lift, shall be immediately chipped back to well-consolidated concrete, slushed with mortar puddle of two (2) parts sand, one (1) part cement, and water as required to be plastic, and otherwise treated as required by the Engineer to ensure that a cold joint will not occur.

7. If the pour requirements do not exceed the Contractor's placing ability, these measures should not be necessary.

8. Concrete shall be thoroughly settled when top-finished.

9. All latency, debris, and surplus water shall be removed from concrete surfaces at top of forms by screeding, scraping, or other effective means.

10. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has settled, the excess shall be screeded off.

E. Compaction

1. During and immediately after depositing, all concrete shall be thoroughly compacted, worked around reinforcements and embedments, and worked into the corners of the forms.

2. All concrete shall be compacted by means of mechanical vibrating equipment; except concrete slabs six inches (6") or less in thickness may be either vibrated or tamped.

3. Unless otherwise accepted by the Engineer, mechanical vibrators shall be spud-type immersion vibrators.

4. The number and type of vibrators shall be subject to the acceptance of the Engineer.

5. The Contractor shall provide at least one (1) standby vibrator in operable condition at the placement site prior to placing concrete.

F. Hot Weather Concreting

1. Except as modified herein, hot weather concreting shall comply with ACI 305.

2. At air temperatures of ninety degrees Fahrenheit (90˚F) or above, special procedures shall be adopted to keep the concrete as cool as possible during placement and curing.

3. The temperature of the concrete when it is placed in the work shall not exceed ninety degrees Fahrenheit (90˚F).

4. Whenever the air temperature exceeds ninety-five degrees Fahrenheit (95˚F), membrane cured slabs shall be kept wet to promote cooling o the concrete during the curing period.

G. Cold Weather Concreting

1. Except as modified herein, cold weather concreting shall comply with ACI 306.

2. The temperature of concrete at the time of mixing shall be not less than that indicated in the following table for corresponding outdoor temperature (in shade) existing at the time of placement.

3.

Table 03300.3
MINIMUM CONCRETE MIX TEMPERATURES

Outdoor Temperature	Concrete Temperature
Below 30˚ F	70˚ F
Between 30˚ F and 45˚ F	60˚ F
Above 45˚ F	55˚ F

4. When deposited, the temperature of heated concrete shall not be over eighty degrees Fahrenheit (80˚F).

5. When freezing temperatures may be expected during the curing periods, suitable means shall be provided for maintaining the concrete at temperatures of not less than fifty degrees Fahrenheit (50˚F) for five (5) days or seventy degrees Fahrenheit (70˚F) for three (3) days after the concrete is placed.

6. Concrete and adjacent form surfaces shall be kept moist at all times.

7. Sudden cooling of concrete shall not be permitted.

8. The use of calcium chloride will not be permitted.

3.4. QUALITY ASSURANCE TESTING

A. General

1. Field quality assurance testing of slump tests, air content tests, and the preparation of concrete test specimens for compression testing shall be made by the Owner's testing laboratory in accordance with Section 01410.

2. The Contractor shall provide the services of one or more qualified employees, as required, to facilitate in obtaining fresh concrete.

3. The frequency hereinafter specified for each field control test is a minimum.

4. If additional field tests are necessary, in the opinion of the Engineer, such tests shall be made.

5. In accordance with Section 01410, the Contractor may perform Quality Control tests to ensure performance of the concrete supplier. The Owner's Quality Assurance testing however will be the "tests of record" and will be the tests used for approval of the product.

B. Aggregate Gradation

1. Fine and coarse aggregate may be sampled at the batch plant by the Owner's testing laboratory and shall be sampled and tested in accordance with ASTM D 75 and C 136.

C. Slump

1. A slump test shall be made from one (1) of the first three batches mixed each day.

2. An additional slump test shall be made for each additional 50 cubic yards of concrete placed in any one (1) day.

3. Slump shall be determined in accordance with ASTM C 143.

D. Air Content

1. An air content test shall be made from one (1) of the first three (3) batches mixed each day and from each batch of concrete from which concrete compression test cylinders are made.

2. Air content shall be determined in accordance with ASTM C 231.

E. Compression Tests

1. One set of four (4) compression test cylinders shall be made each day concrete is placed.

2. A minimum of one (1) set per fifty (50) cubic yards or fraction thereof shall be made each day concrete is placed.

3. Concrete test cylinders shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C 31.

4. The cylinders will be tested in accordance with ASTM C 39.

5. The Contractor shall provide a secure box with a lock on site for storage of test cylinders.

F. Test Reports

1. The Contractor will be furnished one (1) copy of all test reports made by the laboratory.

3.5. REINFORCEMENT

A. General

1. Reinforcements shall be accurately formed and placed in accordance with ACI 117, “Standard Tolerances for Concrete Construction and Materials.”

2. Unless otherwise indicated on the Drawings or specified herein, the details of fabrication shall conform to the latest version of ACI 318 and ACI 117.

B. Accessories

1. The Contractor shall provide all bar supports, ties, spacers, bolsters, inserts, screeds, and other concrete accessories required to maintain reinforcing in its proper position and permit proper placement of concrete.

2. The Contractor shall be responsible for the design of all bar support systems.

C. Tensile Tests

1. Tensile test shall be performed in accordance with ASTM A 615.

D. Welding

1. Except where indicated on the Drawings, welding of reinforcement for any purpose, and tack welding in particular, is expressly prohibited.

2. Reinforcements upon which unauthorized welding has been done shall be presumed to be damaged and such reinforcing shall be removed and replaced at the Contractor's expense.

3. Replacement materials shall conform to all applicable requirements of these specifications.

4. Welded chairs and supports may be used provided they are clamped or wired to the reinforcement.

5. Where welding is allowed by the Engineer, the procedures shall follow the requirements of AWS D 1.4, "Structural Welding Code – Reinforcing Steel".

E. Shop Drawings and Bar Lists

1. Bar lists and drawings for the fabrication and placing of reinforcements shall be prepared, checked, and submitted to the Engineer for review.

2. Each bar list and placement drawing shall have noted thereon, "ASTM A 615 Grade 60 only", or a similar statement which identifies the grade of reinforcing indicated on that drawings.

F. Concrete Cover

1. Except as otherwise indicated on the Drawings, reinforcement for concrete shall have the concrete protective cover specified in Chapter 7 of ACI 318 or as shown on the Drawings.

G. Placement

1. Reinforcements shall be accurately positioned on supports, spacers, hangers, or other reinforcements and shall be secured in place with wire ties or suitable clips.

2. Bare metal supports shall not be used in contact with forms for exposed surfaces.

3. Pre-formed standees are required for all slabs to support and properly space the top layer of steel and fabricated side form spacers are required for all walls.

H. Splices

1. Unless otherwise required by the specifications or Drawings, splices shall conform to ACI 318 and shall be tension-lapped splices.

2. Splices shall be Class B tension-lapped splices unless a different class is indicated on the Drawings.

3. Splices shall not be used in regions of maximum bending stress.

4. Welded splices shall not be used.

3.6. FORMS

A. General

1. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the Drawings.

2. Forms shall be constructed and maintained in proper position and accurate alignment.

3. Forms shall conform to ACI 347 and the following additional requirements.
   a. Plywood and fiberboard used in forms used on exposed surfaces shall be new when brought to the construction site and shall be properly coated, proteted, and maintained throughout its use.

b. All plywood and fiberboard materials which are damaged, cracked, weathered, or otherwise unsuited, in the Engineer's opinion, for producing smooth, uniformly-textured, formed surfaces shall be rejected as form material.

4. Where concrete is placed against dry or porous surfaces, such surfaces shall be covered with polyethylene film to protect the concrete from loss of water.

5. Unless otherwise accepted by the Engineer, all concrete in contact with sand, gravel, crushed rock, or dry earth shall be placed against polyethylene film.

6. Where concrete is placed against rock, all loose pieces of rock shall be removed; and the exposed surface shall be cleaned with a high pressure hose.

7. Vertical concrete surfaces above extended footings shall be formed.

B. Design

1. Forms shall be substantial and sufficiently tight to prevent leakage of mortar.

2. They shall be properly braced or tied so that they will maintain the desired position, shape, and alignment during and after placing concrete therein.

3. Walers, studs, internal ties, and other form supports shall be of suffiecient size and number and shall be located and spaced so that proper working stresses therein are not exceeded.

4. The design and sagety of all forming systems shall be the responsibility of the Contractor.

C. Form Ties

1. Form ties shall be of the permanently-embedded body type with the removable ends that can be broken off at least three–quarters of an inch (3/4") inside the form face, and shall have sufficient strength, stiffness, and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders.

2. Loop ties or twist ties shall not be used without the written consent of the Engineer.

3. Outer ends of the permanently-embedded portions of form ties which are not provided with threaded ends shall be constructed so that the removable ends can be broken off by twisting, without chipping or spalling, the concrete surface.

4. All ties shall utilize a removable cone at least one inch (1") in length.

5. The type of form ties used shall be acceptable to the Engineer.

6. Form ties in exposed surfaces shall be uniformly spaced and aligned in horizontal and vertical rows.

D. Edges and Corners

1. Chamfer strips shall be placed in forms to bevel all salient edges and corners except edges which are to be buried and edges which are indicated on the drawings with a special treatment.

2. Bevel dimensions shall be three-quarter inch by three-quarter inch (3/4" x 3/4") unless indicated otherwise on the Drawings.

E. Form Removal

1. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads to be imposed thereon.

2. Care shall be taken in the form removal to avoid surface gouging, corner or edge breakage, or other damage to the concrete.

3. In cold weather, wall forms shall not be removed until the end of the protection period in accordance with Article 3.3.G.4.

3.7. EMBEDMENTS

A. Anchor bolts, castings, steel shapes, conduit, sleeves, masonry anchorages, and other materials that are to be embedded in the concrete shall be accurately positioned and securely anchored.

B. Embedments shall not be welded to reinforcement.

C. Embedments shall be clean when they are installed.

D. After Concrete placement, surfaces not in contact with concrete shall be cleaned of all concrete spatter and other foreign substances.

E. All steel embedments shall be galvanized unless indicated otherwise on the Drawings.

F. Any metal embedments that are not made out of steel shall be coated with a coal tar epoxy paint to prevent electrolysis due to dissimilar metals.

3.8. FINISHING FORMED SURFACES

A. General

1. All fins and other surface projections shall be removed from all formed surfaces from which the forms are stripped except exterior surfaces that will be in contact with earth backfill.

2. Projecting ends of all form ties shall be removed and the resulting recesses shall be cleaned, wetted, and filled with patching mortar.

3. All exposed surfaces, except those with form liners or other architectural finishes, shall be rubbed in accordance with the following procedures:
   a. Remove all fins and projections and patch tie and bug holes.
      1) Patches shall match the texture and color of the adjacent concrete.
   b. Wet the concrete surface and apply a grout mix consisting of one (1) part cement and one (1) part fine masonry sand.
   c. Rub surface with a float or stone to fill all air voids and bug holes.
   d. Remove excess grout by rubbing with a rubber float, burlap sack, or other means.

4. All other concrete surfaces which are exposed shall be patched to produce a uniform surface free of projections, bug holes, form marks such as joint displacements, and gouges.

5. Surfaces below grade shall only be patched, including tie holes and all holes larger than one-half inch (1/2”) in diameter.

3.9. FINISHING UNFORMED SURFACES

A. General

1. No surface treatment will be required for buried or permanently submerged concrete not forming an integral part of a structure except that required to obtain the surface elevations or contours and surfaces free of latency.

2. The unformed surfaces of all other concrete shall be screeded and given an initial float finish followed by additional floating and steel troweling where required.

3. Float finished surfaces shall be finished to provide a flat plane in which the profile shall not deviate more than one-eighth inch (1/8”) when measured from a ten foot (10’) straightedge.

B. Screeding

1. Screeding shall provide a concrete surface conforming to the proper elevation and contour with all aggregates completely embedded in adjacent mortar.

2. Surface irregularities in screeded surfaces shall be limited as required to produce finished surfaces within the tolerances specified.

3. If no further finishing is required, surface irregularities shall not exceed one-quarter inch (1/4”) as measured from a ten foot (10’) straightedge.

C. Floating

1. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working.

2. Any piece of coarse aggregate wich may be disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar.

3. Initial floating shall produce a surface of uniform texture and appearance with no unnecessary working of the surface with the float.

4. Initial floating shall be followed by a second floating (“mag float”) at the time of initial set.

5. The second floating shall produce a smoot, uniform, and workmanlike float finish of uniform texture and color.

6. Unless additional finishing is specifically required, the completed finish for all unformed surfaces shall be a float finish as produced by the second floating.

7. Floating shall be performed with hand floats or suitable mechanical compactor floats.

D. Troweling

1. All exposed slabs and horizontal surfaces, unless indicated otherwise on the Drawings or herein, shal be finished with two (2) trowelings and using a steel trowel.

2. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface.

3. Allow a time lapse between successive trowelings to permit concrete to become harder. Each subsequent troweling is to be made perpendicular to the previous pass.

4. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

5. Areas where a slick surface would be dangerous shall be broom finished at the direction of the Engineer after troweling with a steel trowel.

E. Aggregate Exposure

1. All surface mortar shall be removed from surfaces which are to be later covered with mortar, concrete, or grout.

2. The coarse aggregate shall be exposed in all such surfaces to improve bonding.

3. Sand blasting, bush hammering, or water blasting may be employed to remove the mortar as required.

4. If water blasting is employed, the pressure utilized shall be a minimum of 10,000 pounds per square inch and the surface treatment attained acceptable to the Engineer.

5. Aggregate exposure is only required at non-keyed construction joints.

F. Edging

1. Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having a three-quarter inch (3/4”) corner radius.

G. Finish Tolerances

1. Unless noted otherwise herein or in the Drawings, concrete tolerances shall be in accordance with ACI 117.

3.10. CURING

A. Concrete shall be protected from loss of moisture for not less than seven (7) days after the concrete is placed.

B. Concrete with a thickness greater than twenty-four inches (24”) shall be considered “mass concrete” and shall be wet cured and follow the curing methods listed in ACI 207.1R.

C. Curing of concrete shall be by methods which will keep the concrete surfaces adequately wet during the specified curing period.

D. Curing shall be by saturation with water or with membrane curing compound.

E. Troweled surfaces and float finished surfaces, except those which will receive a separate finish, may be cured with either the membrane curing compound specified under Article 2.1.F.2 or with water.

F. Water curing only will be permitted on the surfaces which will receive a separate finish, coating, or additional concrete.

G. If membrane curing is used at least two applications of the compound is required.

H. Any slabs or other areas that are worked on while being cured will require additional applications where the compound is worn off or scuffed.

3.11. REPAIRING DEFECTIVE CONCRETE

A. Defects in formed concrete surfaces shall be repaired to the satisfaction of the Engineer within twenty-our (24) hours, and defective concrete shall be replaced within forty-eight (48) hours after the adjacent forms have been removed.

B. All concrete which is porous, honeycombed, or otherwise defective to a depth in excess of one inch (1”) shall be cut out and removed to sound concrete, with edges square cut to avoid feathering.

C. Cut surfaces shall be coated with epoxy bonding compound before the repair concrete is placed.

D. Concrete repair work shall be performed in a manner that will not interfere with thorough curing of surrounding concrete.

E. Mortar and concrete used in repair work shall be adequately cured and shall be finished to match adjacent surfaces.

F. Repair patching procedures shall be submitted to the Engineer for approval.

G. Areas to be patched during hot weather shall follow the same requirements as the concrete in accordance with Article 3.3.F.

H. Areas to be patched in cold weather shall be heated twenty-four (24) hours prior to patching and shall be protected from freezing in accordance with Article 3.3.G.

I. Curing shall follow the same procedures as the concrete as outlined in Article 3.10.

3.12. CONSTRUCTION JOINTS

A. Construction joints shall be located and constructed as indicated on the Drawings.

B. If additional construction joints are desired by the Contractor, drawings, indicating the locations and details of the proposed joints shall be submitted to the Engineer prior to detailing and fabricating reinforcing steel.

C. Such additional joints shall be installed only where acceptable to the Engineer.

D. All construction joints will be required to be sand blasted, water blasted, or bush hammered to remove all latency and expose the coarse aggregate and to produce a wavy surface with an amplitude of approximately one-quarter inch (1/4”).

E. Joints so designated on the Drawings and any additional construction joints required by the Contractor, if any, which will be subjected to differential hydrostatic pressure, shall be provided with a waterstop.

F. Waterstops shall be clean and free from coatings that would weaken the bond with concrete.

G. Each waterstop shall be continuous throughout the length of the construction joint in which it is installed.

H. Junctions between adjacent waterstop sections shall be heat-bonded as recommended by the manufacturer.

I. Flexible waterstops shall be spliced in strict conformity with the recommendations of the waterstop manufacturer.

J. A sample ninety-degree (90°) corner splice mitered at forty-five degrees (45°) shall be prepared and submitted for the Engineer's acceptance.

K. The sample splice shall be made by the Contractor's field personnel using the procedure intended for use on the work.

L. The sample splice shall be submitted at least two (2) weeks prior to the Contractor's intended first usage of flexible waterstop for this project.

M. All waterstops shall be maintained in proper position until the surrounding concrete has been deposited and compacted.

3.13. EXPANSION JOINTS

A. Expansion joints shall be located and constructed as indicated on the Drawings.

B. Expansion joint filler shall be firmly bonded to the previously poured joint face with a suitable adhesive and the new concrete shall be poured directly against the joint filler.

C. Accessible edges of each expansion joint shall be sealed with the sealer specified under Article 2.1.E applied in accordance with the manufacturer's directions.

D. Polysulfide rubber (Thickol type) sealants shall not be used in contact with bituminous or asphaltic materials.

E. Expansion joints so designated on the Drawings, and any additional expansion joints which will be subjected to differential hydrostatic pressure, shall be provided with a flexible waterstop.

F. Rubber and plastic materials shall be stored in a cool place and shall not be exposed to direct sunlight.

G. Reinforcing steel shall not be continuous through joints.

H. Smooth dowels, one inch (1") diameter by eighteen inches (18") in length, shall extend across the joint with the number being equal to the number of reinforcing bars.

3.14. OPENINGS IN CONCRETE

A. All openings in concrete walls and slabs greater than or equal to eight inches (8") shall be provided with opening reinforcement per the standard details shown on the Drawings. Place and equivalent area of steel bars around each pipe or opening and extend as shown on the details.

B. Waterstops shall be provided around wall openings below grade and floor openings that are exposed to weather or submergence.

3.15. FUTURE BONDING

A. Exposed reinforcements and metal waterstops intended for bonding with future construction, and all other metal embedments indicated on the Drawings, shall be effectively protected from corrosion and mechanical damage.

B. Prior to placing new concrete, all surfaces shall be thoroughly cleaned by wet abrasive blasting, power washing as defined in SSPC-SP/NACE No. 6, Section 4.3, or by dry abrasive blasting followed by sufficient power washing to remove any silica residue .This shall remove any rust, laitance, loose concrete, or foreign materials.

C. For exposed reinforcements and metal waterstops intended for long term exposure prior to future bonding, the bars and embedments shall be coated with epoxy coating in accordance with AASHTO M 84.

D. Reinforcing bar coating shall extend six inches (6”) into the concrete placed under these specifications.

E. Waterstops shall completely coated.

***** END OF SECTION *****

SECTION 03700

GROUTING

PART 1- GENERAL

1.1 WORK INCLUDES

A. Furnishing and installing a temporary bulkhead from both the upstream and downstream ends depending on grouting procedure.

B. Field trial test.

C. Filling annular space between HDPE pipe and existing conduit with grout.

1.2 SUBMITTALS

A. Submit the following to the Engineer at least 21 calendar days prior to any grouting work, except as noted below for initial trial testing:

1. Shop drawings, materials, and installation procedures for filling the pipe with grout, and placing the bulkhead at the cut-off, downstream end of the existing outlet pipe.

2. Trial test mix design for the cement grout. Include product data and Manufacturer's Certificates of Compliance for all materials to be used in the cement grout. Provide statements identifying the reactivity of aggregates and gradations for aggregates. Provide source test analysis for fly ash.

3. First and second stage grouting procedures for filling the outlet pipe with grout including description of proposed grouting equipment and backup equipment, piping, valves, fittings, conduit hangers for second stage grout tubing, and other equipment, proposed field trial test plan, sequencing of operations, and proposed methods to vent air from the outlet pipe.

4. Grouting Schedule. Include schedule for trial test, first stage production grouting, and second stage grouting.

5. Statement of qualifications for Contractor's and relevant Subcontractor's field supervisors, and materials testing agency for field and laboratory testing.

6. Proposed methods and equipment to measure pumping rate, total volume pumped, and pumping pressures.

7. Submit test results from trial test, including 7-day compressive strength testing results to Engineer at least 3 days prior to production grouting.

8. Submit the final proposed concrete grout mix design after evaluating the results of the trial test.

B. Submit the following to the Engineer within one calendar day after completion of first stage production grouting:

1. Volume of pipe grouted.

2. Actual volume of first stage grout used.

3. Delivery tickets for each batch of concrete grout used, with a record of drum revolution counters for each batch delivered to the site. Include reports of all available field testing performed. Strength testing shall be submitted within two days after the information is available

4. Final concrete grout mix design if different from approved trial test mix.

5. Actual volume of second stage grout used shall be submitted to the Engineer within one day of grouting.

C. A copy of all grouting submittals shall be submitted to the State Engineer's Office for review and acceptance prior to grouting.

1.3 QUALITY CONTROL TESTING

A. Concrete grout at the point of discharge from mixers (perform on both initial trial test mix and production grouting at the minimum frequencies shown below):

1. Slump (ASTM C143), Air Content (ASTM C231), Unit Weight and Yield (ASTM C138), and temperature, a minimum of one each per 50 CY or portion thereof.

2. Viscosity by the Flow Cone method (ASTM C939), to check consistency. Minimum of one test or whenever consistency becomes a problem.

3. Concrete grout strength (ASTM C109), to check compressive strength, once per 50 CY or portion thereof. Make five (5) cylinders each time, to be tested at the following schedule: two at 7 days, two at 28 days, and one for spare.

PART 2 PRODUCTS

2.1 TEMPORARY BULKHEAD

A. A temporary bulkhead shall be placed at the upstream end of the conduit to facilitate grouting. An additional temporary bulkhead shall be placed at the downstream end to either contain grout or facilitate grouting if the Contractor chooses to grout from both ends of the conduit.

2.2 CONCRETE GROUT

A. Portland cement shall be ASTM C150, Type II or Type IV portland cement. Fly ash shall be ASTM C 618 Class F. Aggregates shall meet the requirements of ASTM C33. Coarse aggregate shall be 100% finer than 3/8 inch. Water shall be clean and not detrimental to concrete.

B. Mix design:

1. The proportions of the initial trial mix design may require adjustment in the field to provide the required consistency for pumping, to flow freely through the grout supply pipe, and completely fill the outlet pipe.

2. The final mix design for the concrete grout shall be determined in the field based upon the performance of a trial test.

3. Concrete grout shall have a minimum 28-day compressive strength of 1500 pounds per square inch.

4. The consistency of the concrete grout shall suspend the aggregate in the mix and not allow the aggregate to settle out of the mix. The consistency of the mix shall be monitored by the Contractor using a flow cone and methods specified in ASTM C 939. Consistency shall be flowable, with a slump greater than 7 ½ inches but less than 10 inches.

5. The grout mixer shall be a mechanical or venturi-type capable of producing a thoroughly mixed, uniform, highly plastic, flowable grout. A holdover tank equipped with a mechanical agitator shall be used to keep the grout in uniform suspension. The grout may also be mixed

and delivered to the project site in conventional concrete trucks, provided the delivery time from the supplier is not excessive, causing premature hydration of the grout prior to placement. Grout shall be monitored for temperature and consistency. Any grout deemed unsatisfactory by the Engineer shall not be placed. Grout in excess of 90 degrees Fahrenheit shall not be used. Addition of water at the project site shall only be allowed as approved by the concrete grout supplier and the Engineer, and shall not exceed the approved water to cement ratio.

6. A shrinkage-reducing admixture shall be added to the concrete grout, Grace Eclipse Floor, or approved equal. A Superplasticizer shall be added to the concrete grout, Grace Adva 140 or approved equal. A set-retarding admixture may be added if deemed necessary by the Contractor, and shall be added to the trial test batch if it is to be used in the mix, to evaluate it's effect. The proportion of the admixtures required shall be as determined by the Contractor to achieve a workable, non-shrink product. Air-entraining admixtures will not be allowed.
7. Initial trial test concrete grout mix design (per cubic yard of concrete grout):

Portland Cement	300 pounds
Fly Ash	520 pounds
Water (total)	32 gallons (adjust for water in aggregates)
Fine aggregate	2120 pounds
Coarse Aggregate	780 pounds
Superplasticizer	Per manufacturer's recommendations
Shrinkage-reducing admixture	Per manufacturer's recommendations

8. The initial trial test concrete grout mix design submittal may be modified as deemed appropriate by the Contractor, and is subject to approval by the Engineer.

2.3 URETHANE GROUT

A. Second stage grouting shall be done using water activated (hydro active) polyurethane grout, such as Hydro Active Injecto Grout or Hydro Active Pipe Plug Grout manufactured by De Neef Construction Chemicals, Inc. of Houston, TX or approved equal. Grout injection tubes shall be De Neef Injecto Tube or approved equal. Grout injection ports shall be as recommended by the injection tube manufacturer. Placement of the grout injection tubes and injection ports shall be as shown on the Drawings.

PART 3 – EXECUTION

3.1 PREPARATION

A. Perform the trial test in the presence of the Engineer and any appropriate Subcontractors. The trial test batch shall be made for review at least ten (10) calendar days prior to placement of concrete grout in the pipe. Adjustments to the trial test mix may be required to attain the required grout consistency as approved by the Engineer. Perform the required testing of the final mix design, if different than the trial test mix to establish the properties for monitoring the grout during production grouting.

B. Prior to any work inside the pipe and prior to placing the bulkhead, thoroughly clean the pipe. Remove any debris and soil on the pipe walls and the pipe invert. Pressure wash the concrete inside the pipe. Contractor shall protect the pipe after cleaning to prevent soiling, and shall reclean the pipe at their expense in the event it is soiled.

C. Verify that the temporary bulkhead is constructed as shown on the Drawings and has cured a minimum of seven (7) days, and that the inside of the outlet pipe is clean and free of any debris and soil. The inside of the pipe will be inspected by the Engineer immediately prior to any grouting. No production grouting will be performed until the Engineer approves the final placement plan and approval to proceed is granted in writing, by the Engineer.

D. Verify the downstream bulkhead has been backfilled with compacted fill at least two (2) feet above the top of the bulkhead across the entire face, and for a minimum distance of ten (10) feet beyond the downstream toe of the bulkhead. This may be temporary soil backfill or may be permanent fill consisting of the appropriate embankment zone.

E. Verify the secondary grouting tube is in place as shown on the Drawings or as approved in the submittal. Grouting tube ends shall be secured to prevent movement during concrete grout placement and to maintain access for second stage grouting. A single continuous grouting tube shall extend inside existing outlet pipe at least forty (40) feet and loop back to the pipe opening.

F. Construct a bulkhead or other means to contain the fresh grout on the upstream end of the pipe as the grout fills the pipe, to maintain at least one foot of concrete grout above the top of the pipe at the end of the first stage grouting.

G. Continuously observe concrete grouting operations to confirm that air is venting from the outlet pipe and that no air is trapped in the pipe during the grouting operations. This may be done via remote operated camera or by personnel inside the pipe with adequate communication to outside personnel.

3.2 GROUTING PIPE

A. General Requirements:

1. The proposed method of grouting shall be designed to completely fill the pipe to ensure that no air voids remain. A second stage grouting procedure shall be required to fill voids after initial grouting, particularly voids resulting from settling or shrinkage of the grout at the crown of the pipe.

2. Provide the final concrete grout mix submitted and approved by the Engineer based on results of the trial test.

3. Grout outlet pipe in a manner that vents trapped air from the pipe to ensure all air voids are filled with grout. The initial grouting stage shall be performed using a rigid tremie at least 60 feet long, the discharge end of which shall be submerged beyond the advancing grout face at all times. The rigid tremie may be attached to a flexible hose as approved by the Engineer. The purpose of the rigid tremie is to prevent excessive movement of the end of the grout delivery pipe during pump pressure surges, and to assure the end of the grout discharge hose remains submerged beyond the advancing grout face.

4. Grout for each grout stage shall be pumped in one continuous operation to ensure no cold joints are formed, and to avoid segregation or bleeding.

5. Perform second stage grouting a minimum of seven (7) calendar days after completing the first stage grouting to allow for shrinkage to occur in the concrete grout. Perform in accordance with manufacturer's recommended procedures and per the approved submittal.

3.3 ABANDONING EXISTING VENT PIPE AND HYDRAULIC CONDUITS

A. Existing intake structure and hydraulic conduit to remain in place. Drain all hydraulic fluid from the system and dispose of per applicable regulations. Remove and dispose of the hydraulic fluid reservoir and pump. Disconnect the hydraulic conduits from gate structure and cap both ends of conduits with water tight stainless steel end caps to prevent leakage of residual fluid.

DIVISION 4 – MASONRY

NO SECTIONS UNDER THIS DIVISION

DIVISION 5 – METALS

SECTION 05999

MISCELLANEOUS METALS

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the materials, fabrication, and erection requirements for miscellaneous metals.

1.2. SUBMITTALS

A. Submit complete information identified by the following Data Reference Symbols as specified in Section 01340:

1. Shop Drawings: A, C, D, E, H, L, M, and O.

2. Operation and Maintenance Manual: A, C, D, E, F, H, L, M, and O.

1.3. QUALITY ASSURANCE

A. Reference Standards: Conform with requirements of the following standards and codes:

1. ASTM A 36, ASTM A 572: Structural Steel.

2. ASTM A 307: Low-Carbon Steel Externally and Internally Threaded Fasteners.

3. ASTM A 325: High-Strength Bolts for Structural Steel Joints.

4. ASTM B 221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profile, and Tubes.

5. ASTM B 308: Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles

6. AWS D 1.1: Structural Welding Code

7. International Building Code, 2012 Edition

B. Except as otherwise specifically noted on the Drawings or specified herein, all materials furnished and work performed in connection with miscellaneous metals work shall be in conformity with the AISC "Manual of Steel Construction, Fourteenth Edition."

C. Grating and grating treads

1. Grating and grating tread shall comply with the recommendations in "Metal Bar Grating Manual" from the "National Association of Architectural Metal Manual" of the National Association of Architectural Metal Manufacturers (NAAMM).

PART 2 – PRODUCTS

2.1. MATERIALS

A. All materials shall be new and undamaged and shall conform to pertinent AISC and ASTM standard specifications and the following requirements in the Table below.

Table 05999.1

MISCELLANEOUS MATERIALS STANDARDS

Item	Standards
Structural Shapes and Plates	ASTM A 36 steel, galvanized. Minimum yield point of 36,000 psi including appurtenant materials
Structural Bolts	ASTM A 325, Type 1 bolts, nuts, and washers
Miscellaneous Bolts	ASTM A 307 Grade A with lock washers. All galvanized. A304 stainless as indicated on drawings
Anchor Bolts	ASTM A 36 and ASTM A 307, all galvanized A 304 Stainless as indicated on drawings
Expansion Anchors	HILTI or REDHEAD self-drilling type, stainless steel
Concrete Studs	Welded stud type, 1/2 inch by 6 inches, Nelson Stud Welding or acceptable equal
Welding Electrodes	AWS D1.1 (Low Hydrogen Type) Table 4.9 ("Matching Filler Metal Requirements"). Tensile strength range of 70,000 psi minimum
Kickplates, Angles, and Bars	ASTM A 36, Galvanized
Galvanizing	ASTM A 123, ASTM A 153, ASTM A 385

2.2. FABRICATION

A. General

1. Miscellaneous metals shall be fabricated in conformity with the dimensions, arrangements, sizes, and weights or thicknesses indicated on the Drawings or stipulated in the specifications.

2. Framing and connections of all members shall be detailed and fabricated in accordance with AISC standards, specifications, and details unless otherwise indicated on the Drawings or specified herein.

3. All fabricated materials shall conform to the tolerances specified in the AISC Manual and ASTM A6.

4. All members and other parts of fabricated material, as delivered, shall be free of winds, warps, local deformations, unauthorized splices, or unauthorized bends.

5. Holes and other provisions for field connections shall be accurate and shop checked so that proper fit will be provided when the units are assembled in the field.

6. Erection drawings shall be prepared and all separate pieces shall be piece marked to allow accurate field erection.

7. Where required, either by notations on the Drawings or by the necessity of proper identification and fitting of field connections, and the connections shall be match marked.

B. Shapes and Plates

1. Shapes and plates shall be fabricated and assembled in the shop to the greatest extent practicable. Shearing, flame cutting, and chipping shall be done carefully, neatly, and accurately.

2. Holes shall be cut, drilled, or punched at right angles to the surface and shall not be made or enlarged by burning.

3. Holes shall be clean-cut without torn or ragged edges, and burrs resulting from drilling or reaming operations shall be removed with the proper tool.

4. Shapes and plates shall be fabricated to tolerances that will permit field erection within AISC tolerances except as otherwise specified.

5. Contact surfaces at all connections shall be free of loose scale, dirt, burrs, oil and other foreign materials that would prevent solid seating of the arts.

6. Typical shop beam connections shall be all welded.

7. Typical field beam connections shall be bolted with high strength bolts.

8. When a particular connection method (bolting or welding) is specified or detailed for a particular connection or class of connections, such particular method shall take precedence over the typical connections.

9. High strength bolts shall conform to all requirements for A 325 bolts of "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts" as adopted by AISC.

10. High strength bolted connections shall be bearing type connections with threads excluded from the shear planes except where other type connections are required by the Drawings or specifications.

11. Contact surfaces of bearing type connections may by painted.

12. Tightening of high strength bolts shall be done using the "turn-of-nut" method.

13. Any ASTM A 325 bolt which has been tightened more than one-half (1/2) turn beyond snug tight shall not be loosened and retightened.

14. All such bolts shall be discarded and new bolts used in their place.

15. Plates bent at an angle greater than ninety degrees (90°) shall be forged to prevent cracking and reduction in metal thickness.

C. Anchor Bolts

1. Anchor bolts shall be as listed and detailed on the Drawings.

2. Also, each bolt shall be furnished with two (2) nuts and shall be threaded the full length of the projection to permit a nut to be installed on each side of the concrete form or template.

3. All anchor bolts three-quarters inch (3/4") and larger shall be fabricated from ASTM A 36 steel rods and shall have heavy hexagon nuts conforming to ASTM A 307, Grade B.

4. Anchor bolts smaller than three-quarters inch (3/4") shall conform to ASTM A 307, Grade A and shall have hexagon heads and nuts.

5. All anchor bolts, nuts, and washers shall be hot-dip galvanized after fabrication, threads being undercut to provide a tolerance equal to ANSI Class 2A.

D. Iron Castings

1. Iron castings shall be made of tough gray pig iron, free from cracks, swells, holes, and cold shuts, and shall have smooth finish.

2. Before leaving the foundry, all castings shall be thoroughly cleaned and subjected to a hammer test. After testing, all acceptable castings which will not be galvanized shall be hot-dipped in asphalt varnish or given a shop coat of coal tar paint.

E. Embedments

1. Embedded materials shall be accurately fabricated and assembled.

2. Warped or bent sections which do not fit into the concrete forms as required shall be replaced with suitable material.

3. All materials embedded in concrete shall be galvanized after fabrication except steel framing members, baseplates, concrete anchors, and pipe hanger supports.

4. Sleeves through concrete and masonry, except as otherwise noted, shall be fabricated from standard weight steel pipe.

5. Sleeves shall be machine cut or flame cut and ground smooth.

6. Sleeves having a diameter greater than twelve inches (12") shall be made from three-eighths inch (3/8") thick steel plate.

7. Each sleeve shall be provided with anchors welded to the sleeve.

8. The maximum spacing of anchors shall be eighteen inches (18") except that a minimum of three (3) anchors shall be provided for each sleeve.

F. Floor Grating

1. All rectangular floor grating shall be in accordance with the "Metal Bar Grating Manual" from the "National Association of Architectural Metal Manual" of the NAAMM, except as modified herein.

2. Bearing (main load carrying) bars shall be one and one-quarter inches by three-sixteenths inches (1-1/4" x 3/6") heavy duty galvanized steel GW-125 by McNichols or equivalent.

3. Fasten bar grating at a maximum of twenty-four inches (24") off-center.

4. Spacer bars shall be nine-thirty seconds inches (9/32") hexagonal sections

or one-quarter inch (1/4") twisted square sections and shall be spaced on four-inch (4") centers.

5. Round spacer bars shall not be used.

6. Tops of spacer bars shall be flush with the tops of the bearing bars.

7. Ends of spacer bars shall be cut off and ground flush with the outside face of the bearing bars which form the sides of grating panels.

8. Grinding of spacer bar ends may be omitted if a smooth appearance is accomplished without grinding as illustrated by the workmanship on the grating sample.

9. Where openings are indicated in gratings, such as for the passage of pipes, grating sections shall be laid out so that each opening will be centered on a joint between sections.

10. All openings shall be provided with a kickplate of formed three-eighths inch (3/8") steel plate or standard weight steel pipe welded to the bearing bars.

11. Kickplates shall extend the full depth of the grating and project four and one-half inches (4-1/2") above the top of the grating unless otherwise indicated on the Drawings.

12. Kickplates shall be welded to each intersecting bearing bar.

13. Unless indicated otherwise on the Drawings, bands shall be three-sixteenths inches (3/16") thick and the same depth as the bearing bars.

14. Bands shall be welded to the first, last, an every fourth bearing bar of each panel.

    a. "Every fourth bearing bar" shall mean there shall be no more than three (3) bars without welds between bars that are welded.

15. Welds between kickplates, bands, and bearing bars shall be one-eighths inch (1/8") fillet welds at least one inch (1") in length applied on one side of each welded joint.

16. Both ends of all sections of grating shall be banded, except ends so designated on the Drawings, and shall have kickplates in lieu of banding.

17. Grating shall be galvanized after fabrication.

G. Handrailing

1. Handrailing shall be constructed of new material which is smooth and free of mill scale, roll marks, and pitting.

2. Handrailing shall be smooth with all projecting joints and sharp corners ground smooth.

3. Welded joints shall be of the flush type.

4. Members shall be nearly coped and continuously welded at all junctions of posts and rails.

5. Flattening of the rail or post ends at junctions of posts and rails will not be permitted.

6. Fittings or other connectors shall not be used at junctions of posts and rails

7. All welding shall be done neatly and substantially with all fillets dressed to uniform radius, all excess metal removed, and all welds ground smooth and flush.

8. When assembled, all posts shall be vertical and longitudinal members shall be parallel with each other and with the platform or walkway surface.

9. In any section or run of railing, the center lines of all members shall be in true alignment, lying in the same vertical plane.

10. Except as otherwise indicated on the Drawings, the top rails shall run continuously over the posts and the posts shall be continuous through the lower rail.

11. All angles, offsets, and other changes in alignment of railings shall be made with accurately mitered joints.

12. Maximum spacing of posts shall be six feet (6')

13. Minimum height shall be forty-two inches (42")

14. One intermediate rail shall be included.

15. Handrailing shall be removable where indicated on the Drawings.

16. Access openings in handrailing shall be provided with self-closing, spring-loaded gates where indicated on the Drawings.

17. Handrailing shall be galvanized after fabrication.

H. Guardrail

1. Steel guardrail materials shall be fabricated in accordance with the manufacturer's standards for accurate fit and proper alignment.

2. Terminal sections shall be accurately made to fit the guardrail sections without warp or twist. Guardrail sections shall be fabricated and drilled to fit the post spacing indicated on the Drawings.

PART 3 – EXECUTION

3.1. WELDING

A. Except as otherwise specified, all welds, welding, and related operations for steel shall be in conformity with the applicable provisions of the AWS Structural Welding Code, AWS D1.1 as issued by the American Welding Society.

B. Except as otherwise specified, welding shall be performed using only those joint details which have a prequalified status when performed in accordance with the referenced AWS code.

C. All welding procedures shall be submitted to the Engineer for review prior to beginning the work.

D. Low hydrogen electrodes shall be stored and handled during use in a manner that will maintain their low hydrogen characteristics.

E. Welds that are not dimensioned on the Engineer's drawings shall be sized to develop the full strength of the least strength component involved in the connection.

F. All welds shall be properly identified on the detailed shop drawings and shall be subject to acceptance by the Engineer.

3.2. GALVANIZING

A. Metal materials which are specified herein or indicated on the Drawings to be galvanized shall be hot-dip galvanized in accordance with ASTM A 123, ASTM A 153, and ASTM A 385.

B. Materials specified to be galvanized shall be prepared for galvanizing by being properly cleaned, pickled, rinsed, and dried.

C. The cleaned materials shall be immediately galvanized before any rusting can occur.

3.3. ERECTION

A. Metal materials shall be erected in accordance with AISC, the Engineer's Drawings, the erection drawings, and these specifications.

B. Unless specified otherwise, erection tolerances shall be the same as those specified herein before under Article 2.2.

C. All parts shall be assembled accurately as indicated on the Drawings and match marks shall be carefully followed.

D. Any enlargements of holes necessary to make connections in the field shall be done by reaming with twist drills, care being taken not to weaken the adjoining metal.

E. The necessary adjustments shall be made under the direction of the Engineer.

F. All joints shall be assembled and abutting surfaces drawn tightly together; and the framework shall be checked for alignment, plumb, and level in accordance with the specified tolerances.

G. Smooth beveled washers shall be used when the bearing faces of the bolted parts have a slope of 1:20 or greater with respect to a plane normal to the bolt axis.

3.4. FIELD WELDING

A. Field welding shall conform to the requirements specified under Article 3.1 and to these additional requirements.

B. Each welding operator shall be qualified for all welding positions required in a joint that he welds.

C. The entire weld of any structural joint shall be made by one (1) operator.

3.5. TOUCH-UP GALVANIZING

A. Galvanized surfaces scratched or otherwise damage during delivery, unloading, or erection shall be thoroughly cleaned by wire brushing the damaged area to remove all loose, cracked, or bruised galvanizing.

B. Cleaned areas shall then be painted with galvanizing repair paint.

1. Galvanizing repair paint shall be Carboline "Carbo Zinc 11", "Mobil Mobilzinc 7", or Sealube "ZRC".

3.6. ELECTROLYTIC PROTECTION

A. Where aluminum is in contact with dissimilar metals or is to be embedded in concrete or masonry, coat the embedded portion with a coal tar epoxy paint.

***** END OF SECTION *****

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

NO SECTIONS UNDER THIS DIVISION

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

NO SECTIONS UNDER THIS DIVISION

DIVISION 8 – OPENINGS

NO SECTIONS UNDER THIS DIVISION

DIVISION 9 – FINISHES

SECTION 09910

PAINTING AND GALVANIZING

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the materials, equipment, and methods for shop and field painting and tough-up painting.

B. Generally, all equipment and metals supplied for installation shall be finish painted in the shop. All items supplied shall have as a minimum one coat of primer before being shipped to the site.

C. All painted or galvanized metals that are shop applied and are scratched or the finish rubbed off shall be repaired in the field as described herein.

1.2. RELATED SECTIONS

A. Section 05999 – MISCELLANEOUS METALS

1.3. SURFACES TO BE PAINTED OR GALVANIZED

A. All metal items to be supplied shall be painted or galvanized.

1. See Section 05999 for those items to be galvanized.

2. All metals not galvanized shall be painted as described herein.

PART 2 – PRODUCTS

2.1. MATERIALS

A. Primer

1. Carboline "Carbo Zinc 12"

2. Mobil "Mobilzinc 11"

3. Or Equal

B. Primer for Galvanized Metal

1. Carboline "GP 18 White Primer"

2. Mobil "Galva-Kote Primer"

3. Or Equal.

C. Galvanizing Repair Coat Finish

1. Carboline "Carbo Zinc 11"

2. Mobil "Mobilzinc 7"

3. Sealube "ZRC"

4. Or Equal

2.2. DAMAGED GALVANIZED SURFACES

A. Any galvanized surfaces damaged before final acceptance shall be repaired with the paints specified following the manufacturer's recommendations.

PART 3 – EXECUTION

3.1. PREPARATION OF SURFACES

A. All surfaces to be painted shall be dry and free of dirt, dust, oil, grease, rust, loose mill scale, or other objectionable substances that will impair adherence of the paint to the metal.

B. All foreign substances shall be removed with solvents, blasting, or by brushing before painting.

C. Each manufacturer's instructions shall be followed for each kind of paint applied.

D. Different types of paints require specific surface preparation and the manufacturer's recommendations shall be followed.

E. The Contractor shall apply touch-up paint to any damaged surfaces

F. All paint or galvanizing made brittle or otherwise damaged by welding or cutting shall be completely removed and repainted.

3.2. PAINT APPLICATION

A. General

1. Surfaces to be painted shall be at a temperature not less than the minimum surface temperature recommended by the pain manufacturer.

2. In no case shall paint be applied under any of the following conditions:

    a. When the temperature of the surface to be coated is below forty degrees Fahrenheit (40˚).

    b. When the air temperature is below fifty degrees Fahrenheit (50˚) or above one hundred degrees Fahrenheit (100˚).

    c. When insects or windblown dust, dirt, or debris would adhere to the freshly applied paint.

    d. When atmospheric conditions are causing condensation on the surface.

    e. When surfaces are wet or damp.

3. No on-site painting shall be done until construction work is near enough to completion that surrounding or adjacent areas can be cleaned of all dust and other debris before painting, and the paint can be applied without being damaged from further construction.

4. Painting shall not be started except as directed by the Engineer.

5. Shop-primed items shall be primed and painted with coatings which are compatible with the shop primer; from the same coating manufacturer wherever possible.

6. The application of any paint or coating to a surface shall constitute acceptance of that surface by the Contractor.

7. If the surface is not acceptable for painting, he shall notify the Engineer in writing before starting application of the paint or coating.

8. All painting materials shall be applied in accordance with the manufacturer's recommendations by competent and experienced painters.

B. Mixing

1. Paint shall be thoroughly mixed each time any is withdrawn from the container.

C. Tinting

1. Job site tinting of finish coats shall be done only when acceptable to the Engineer.

2. All tinting colors shall be of a type recommended by the manufacturer of the paint being used.

D. Thinning

1. Paint shall not be thinned except as required by the manufacturer of the paint, and then only for first or second coats.

2. In any circumstance, however, the limits of thinning shall be as set by the manufacturer, or, in the absence of such manufacturer's directions, by the Engineer.

3. Thinners shall be as recommended by the paint manufacturer for use with the paint in each instance.

E. Applying

1. Paint shall be brush or roller applied except as otherwise specified or as otherwise acceptable to the Engineer.

2. Application of paint shall continue without interruption to all surfaces between corners, seams, or other surface breaks.

3. No laps will be permitted except at such surface breaks.

4. Each coat of paint shall be inspected by the Engineer before the next coat is applied.

5. Only after inspection is made will credit be given for that coat.

F. Curing

1. All paint in any one paint coat shall be hard and dry through the entire paint film before the next coat is applied.

2. In no case shall the elapsed time between the application of successive coats or paint to any surface be less than that recommended by the paint manufacturer.

G. Defects

1. Paint films which show sags, checks, blisters, tear-drops, or fat edges will not be accepted.

2. Any final coat of paint which shows any of these defects shall be entirely removed from the member or unit involved and the surface repainted.

3. If the defects occur in any of the undercoats, including the shop coat, they shall be repaired to the satisfaction of the Engineer before additional paint coats are applied.

3.3. PROTECTION OF SURFACES

A. Throughout the work the Contractor shall provide and use proper drop cloths, masking tapes, and other protective measures necessary to protect surfaces from accidental spraying, spattering, or spilling of paint.

B. The Contractor shall be responsible for, and shall correct and repair, any damaged condition resulting from his operations or from the operations of those who are responsible to him.

C. Any paint deposited on surfaces which are not being painted at that time shall be immediately removed.

D. In case bituminous paints are spilled or dropped on any material, the spots shall, after surface cleaning, be spot painted with aluminum paint before applying the specified paint.

3.4. REPAIR OF PAINTED SURFACES

A. After erection or installation, touch-up paint shall be furnished and applied to all abraded or damaged areas.

B. Surfaces shall be properly prepared before application of paint.

***** END OF SECTION *****

DIVISION 10 – SPECIALTIES

NO SECTIONS UNDER THIS DIVISION

DIVISION 11 – EQUIPMENT

SECTION 11301

KNIFE GATES

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the installation of knife gates required for the outlet works.

B. The Contractor shall furnish gates and install; complete with operating stem or lifting devices as shown on the Drawings, stem guides, operator and pedestal, thimble, anchor bolts, stem cover, and all other accessories and appurtenances.

1.2. RELATED SECTIONS

A. Section 01340 – SHOP DRAWINGS, SAMPLES, AND OPERATION AND MAINTENANCE MANUALS

B. Manufacturer Drawings and Specifications

1.3. QUALITY ASSURANCE

A. Perform all work as specified herein and in accordance with the latest revisions of the following codes and standards:

1. Federal, State, and Local codes, regulations, and ordinances.

2. American Water Works Association (AWWA)

3. American National Standard Institute (ANSI)

4. American Welding Society (AWS)

5. American Society for Testing and Materials (ASTM)

6. Steel Structures Painting Council (SSPC)

B. In the case of conflict or disagreement between codes, standards, laws, ordinances, rules and regulations or within any document itself, the more stringent condition shall govern.

1.4. SUBMITTALS

A. Submit complete information identified by the following Data Reference Symbols as specified in Section 01340:

1. Shop Drawings: A, C, D, E, H, L, M, and O.

2. Operation and Maintenance Manuals: A, C, D, E, F, H, L, M, and O.

1.5. PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Box, crate, or securely fasten each assembled knife gate to a minimum of two (2) heavy timbers to protect the equipment during shipment, handling, and storage.

B. Protect from exposure to elements and keep items thoroughly dry and clean.

C. Store gates in a horizontal position on a minimum of two (2) equally-spaced, heavy timbers to avoid distortion.

D. Protect painted surface against impact, abrasion, discoloration, and other damage. Repair surfaces which have been damaged.

PART 2 – PRODUCTS

2.1. KNIFE GATES

A. Acceptable Manufacturers

1. DeZURIK

2. Or Equal

B. Design Criteria

1. Gates and all accessories shall conform to AWWA C520

2. Gates are to be manufactured according to the specifications in this section and in Table 11301.2. The number of gates, sizes and details shall be confirmed with the Engineer prior to order.

3. Gates will be mounted vertically to a horizontal, flanged, steel conduit and discharge into a horizontal concrete conduit.

4. Gate operation will use a vertical movement. Gate operation will require a horizontal offset as shown in the Drawings.

5. Gates must be designed with an allowable leakage rate equal to or better than the AWWA C501 standard.

6. Gate must be constructed with the minimum allowable distance from the gate opening centerline to the top of the opening platform.

7. Gates shall be upward opening and have a standard/conventional bottom closure.

8. Gates shall have a forty-five degree (45°) bevel on the upstream edge of the slide to minimize vibration and cavitation.

9. Gates shall have a fully self-contained assembly with yoke and manually actuated, rising stem.

10. Gates shall include seating ring devices around the perimeter of the gate opening.

11. Gates are to be mounted to flanged steel pipe conduit. Conduit is to be encased in concrete.

12. Gates shall have easy access of maintenance and inspection.

C. Materials

1. Materials used in the knife gates are to meet the following parameters and specifications as shown in Table 11301.1 below.

a. In the absence of standards for parts and materials listed below, materials used are to meet the standards as set forth in MSS SP-81-2017.

Table 11301.1
SLIDE GATE MATERIALS: SPECIFICATIONS AND STANDARDS

Part	Material	Standard
• Body	Stainless Steel	ASTM 316
• Stem	Stainless Steel	ASTM 316
• Gate	Stainless Steel	ASTM 316
• Seating Ring	PTFE	
• Packing	PTFE	
• Bonnet	Stainless Steel	ASTM 316
• Bonnet Gasket	Synthetic Fiber	
• Gears	Bronze	ASTM B148 Alloy 9C or 9D, ASTM B584
• Yoke	Cast Iron or Stainless Steel	ASTM A126 Class B, ASTM A48 Class 30, ASTM 316
• Yoke Sleeve	Aluminum Bronze	
• Thrust Bearing	Oil-Impregnated Bronze	

2.2. SHOP PAINTING

A. Grind sharp corners which will be submerged to improve paint adherence.

B. Shop-clean iron and steel surfaces as follows:

1. Submerged or partially submerged surfaces: SSPC-SP-10

2. Other surfaces: SSPC-SP-6

C. Use primer and finish coats by same manufacturer

D. Do not paint stainless steel or bronze items

E. Application

1. Use spray application unless recommended otherwise by manufacturer.

2. Prime iron and steel surfaces as soon as surface preparation is complete. Primer is not required if not recommended by the paint manufacturer.

3. Thickness (minimum dry film):

a. Primer: One coat, 2.0 mils

b. Finish Coat: Two coats, 10.0 mils

PART 3 – EXECUTION

3.1. PROTECTION

1. Cover or otherwise protect the surfaces of gate frames during construction and pouring operations from concrete spillage, paint oil, and other foreign matter.

3.2. INSPECTION

A. Examine each gate for the following:

1. Leakage

2. Binding

3. Stem Alignment

4. Lubrication

3.3. INSTALLATION

A. General

1. Install wall thimbles, frames and gates, and operating mechanism in accordance with the manufacturer's drawings, specifications, and recommendations.

B. Gate Installations

1. Lift the gate and carefully set it over the studs.

2. Place and tighten nuts in the sequence specified by the manufacturer.

3. Shim operators as required to accurately align each operator and stem.

4. Operate each gate for two (2) complete cycles, "close-open-close" after the entire assembly has been installed, adjusted, and properly lubricated.

5. Leakage of water out of the gate shall be monitored and shall meet AWWA Standards per Article 2.1.B.5.

6. Any gate that leaks beyond the standards shall be realigned, readjusted, and the wedges reset to proper tolerances to reduce the leakage.

7. If the gate still does not meet the requirements for leakage, the gate may be rejected or removed and repaired by the manufacturer.

8. Any gate that operates with difficulty shall be realigned, re-shimmed, or removed and replaced if the Contractor is unable to properly adjust.

9. The gate shall operate as designed by the Manufacturer and within the specification limits and torque ranges listed by the Manufacturer or it will not be accepted.

Table 11301.2
SLIDE GATE SCHEDULE

ID #	Description	Opening Size	Elevation	Head	Mounting
SG-R	Right Gate (Looking Downstream)	30" Dia.	8103.0' (Match Existing)	110' (S) 15' (U)	Flanged Steel Conduit
SG-L	Left Gate (Looking Downstream)	30" Dia.	8103.0' (Match Existing)	110' (S) 15' (U)	Flanged Steel Conduit
SG-C	Center Gate	16" Dia.	8103.0' (Match Existing)	110' (S) 15' (U)	Flanged Steel Conduit

3.4. CLEANUP

A. All parts and assemblies shall be cleaned of all dirt and excess grease or oil prior to final acceptance.

***** END OF SECTION *****

DIVISION 12 – FURNISHINGS

NO SECTIONS UNDER THIS DIVISION

DIVISION 13 – SPECIAL CONSTRUCTION

NO SECTIONS UNDER THIS DIVISION

DIVISION 14 – CONVEYING EQUIPMENT

NO SECTIONS UNDER THIS DIVISION

DIVISION 15 – MECHANICAL

SECTION 15063

STAINLESS STEEL PIPE AND FITTINGS

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section covers the requirements for stainless steel piping in non-buried piping systems.

PART 2 – PRODUCTS

2.1. MATERIALS

A. Items containing stainless steel shall meet the following standards and specifications:

Table 15063.1
STAINLESS STEEL MATERIALS: SPECIFICATIONS AND STANDARDS

Part	Material	Standard/Specification
• Pipe	Stainless Steel	ASTM A 312, Type 316, Seamless, Schedule 80
• Fittings • Backing Rings	Stainless Steel	ASTM A 403, Type 316
• Flanges	Stainless Steel	ASTM A 182, Type 316
• Gaskets (Raised Face Flanges)	Stainless Steel	Spiral Wound
• Gaskets (Flat Faced Flanges)	Stainless Steel	PTFE Full Faced
• Hardware (Bolts, nuts and lock washers)	Stainless Steel	Type 316

2.2. FABRICATION

A. Use TIG process for out-position factory welding. Field welds may use MIG welding for horizontal layout welds and TIG welding for out-of-position welds.

B. After fabrication, wire brush welded joints with iron-free tools to remove weld spatter and scale.

C. Passivate welded joints by acid pickling per ASTM A 380, using nitric-hydrofluoric solution.

D. Handle stainless steel piping assemblies with non-marring type straps before and after assemble.

PART 3 – EXECUTION

3.1. INSTALLATION

A. Install piping system to allow for thermal expansion. Ridged pipe supports shall

allow for movement in one direction (i.e. Saddle supports shall have spacer washers to allow linear movement).

B. Use thread lubricant on stainless steel nuts and bolts.

C. All welding shall be done in accordance with AWS D10.18 for stainless steel pipe welding.

D. The Contractor must be able to provide evidence that welds, welding procedures, and welders are qualified and certified to the latest specification of the USA Welding Bureau in welding stainless steel and carbon steel.

***** END OF SECTION *****

DIVISION 16 – ELECTRICAL

NO SECTIONS UNDER THIS DIVISION

COLORADO
Division of Water Resources
Department of Natural Resources

Dam Safety

Mr. Clint Brown, P.E.
Engineering Analytics, Inc.
1600 Specht Point Road, Suite 209
Fort Collins, CO 80525
Via email: cbrown@enganalytics.com

When replying, please refer to:
MOUNTAIN HOME DAM, DAMID 350102
Water Division 3, Water District 35
Construction File No. C-1739B

October 4, 2018

SUBJECT: Approval of Plans and Specifications for Outlet Works Rehabilitation and Waiver of Dam Safety Rule 5.9.6.2.1

Dear Mr. Brown,

Thank you for submitting plans and specifications for the Mountain Home Dam outlet works rehabilitation project (SEO Construction File #C-1739B) for approval by the Office of the State Engineer. We have completed our review of the design and construction documents and have found them to be acceptable for construction. We are transmitting digital copies of the construction drawings and specifications with approval signatures, as digitally signed PDF files. Our acceptance and approval of these documents are effective as of the date of this letter.

Along with our approval and in accordance with State Dam Safety Rule 19, we are waiving Rule 5.9.6.2.1, which requires outlet works to be sized to lower the top five feet of the reservoir in five days, based on your justification that the project will significantly improve drawdown capacity by replacing two inoperable outlet valves and will improve the safety and longevity of the dam by lining the outlet intake conduits.

The construction of this project must be performed under the purview of a professional engineer registered in the State of Colorado. We direct your attention to Rule 9.1 (copy enclosed) of the Rules and Regulations concerning construction observations, coordination, and documentation activities required for this High Hazard Dam. Please keep Mark Perry of our Pueblo office (719-542-3368 x2118) informed of the construction status so he may also meet our obligations under Rule 9.

Please retain the digitally approved plan sheets for your records and reference and for archiving after construction. Those will need to be maintained and provided for distribution and paper document production. At the end of construction, we will need a PDF file of the approved plans, with the approval signatures as well as a new signature on the as-constructed certification. We will accept digital PDF documents meeting all requirements of Rule 10 at that stage of the process for final acceptance. We will not require mylar plan sets or paper final construction report documents. Final acceptance of the construction will be contingent upon

our receipt and acceptance of the "As-Constructed" drawings, as well as the other requirements of Rule 10 (copy enclosed) of the Rules and Regulations.

We look forward to working with you towards successful completion of this project. Please do not hesitate to call me at 303-866-3589 x8262 if you have any questions concerning this matter or any other dam safety related issues.

Sincerely,


for

Kevin G. Rein, P.E.
Director/State Engineer

Enc: Copies of Rule 9 and 10 of the "Rules and Regulations for Dam Safety and Dam Construction"

ec: Craig Cotten, Division Engineer, Division 3
James Heath, Assistant Division Engineer, Division 3
Robert Schultz, WD 35 Water Commissioner
Bill McCormick, Chief, Colorado Dam Safety
Mark Perry, Dam Safety Engineer
Jeremy Franz, Design Review Engineer
Matt Gavin, Dam Safety Engineer
Tracy Kester, Trinchera Irrigation Co., Board President, trinirr@gojade.org
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Jonathan Hernandez, Colorado Water Conservation Board