

CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF THE

SOUTHWEST AQUEDUCT REACH 2 SCHEDULE A - 13400 SOUTH TO 11800 SOUTH SCHEDULE B - 11400 SOUTH JA-2 MAINLINE VALVE VAULT

**Volume 1 of 2
Bid Documents &
Technical Specifications**



JORDAN VALLEY WATER
CONSERVANCY DISTRICT

Jordan Valley Water Conservancy District

For Information Regarding this Project Contact:
Jason Luettinger, P.E.
154 E 14075 S
Draper, Utah 84020
801-495-2224



January 2025

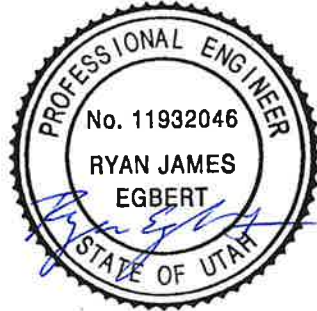
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SEALS PAGE



1/13/2025

SCHEDULE A
[CIVIL/MECHANICAL]



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SCHEDULE B
[CIVIL/MECHANICAL]



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[TRAFFIC CONTROL]

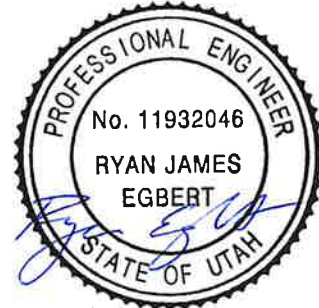


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[ELECTRICAL]



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[CATHODIC PROTECTION]

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**CONTRACT DOCUMENTS FOR
SOUTHWEST AQUEDUCT REACH 2**

PROJECT #: 4321

JANUARY 2025

OWNER

Jordan Valley Water Conservancy District
8215 South 1300 West
West Jordan, Utah
(801) 565-4300
Project Manager: Kevin Rubow, P.E.

ENGINEER

Bowen Collins & Associates
154 East 14075 South
Draper, UT 84020
(801) 495-2224
Project Engineer: Jason Luettinger, P.E.

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VOLUME 2 OF 2 – DRAWINGS

Drawings for Southwest Aqueduct Reach 2 – 13400 S to 11800 S (Bound Separately)

END OF SECTION

NOTICE INVITING BIDS

PROJECT NAME: Southwest Aqueduct Reach 2

DESCRIPTION OF WORK: The Work to be performed under this Contract consists of furnishing all facilities, tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services including fuel, power, water, essential communications, permits, and performing all Work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The Work will provide the next reach of a parallel conveyance facility to the District's Jordan Aqueduct Reach 2 (JA-2) in order to meet future water demands within the District's service area.

The Work of this Contract generally includes the construction of the Southwest Aqueduct Reach 2 (SWA-2) from 13400 South in Riverton City to 11800 South in South Jordan City. The SWA-2 Project includes approximately 10,550 feet of new 66-inch diameter welded steel pipe including two trenchless crossings with casings, air valve structures, major and minor drains, and modifications to the existing 12600 South – JA-2 Vault. The Work also includes construction of an addition to the existing 11400 South JA-2 turnout structure for installation of a new 78-inch isolation valve on the Jordan Aqueduct. Project work also includes cathodic protection and instrumentation at several locations. The Work is primarily located along 3200 West between 13400 South and 11800 South and includes connections to existing SWA-2 at both ends. The Work is primarily located in Riverton, Utah with a portion of work at an existing JWCD property at 11400 South in South Jordan, both in Salt Lake County as indicated on the Drawings.

DISTRICT WEB SITE AND PLANHOLDERS LIST

Prospective bidders must register at the District's web site (www.jvwcd.org) under "Engineering Projects". Prospective bidders are required to check the District's web site for any addenda prior to submitting a responsive bid. The District's web site will be used to publish updated information relative to the project, including a planholders list.

RECEIPT OF BIDS: Sealed bids will be received at the administration office of the Jordan Valley Water Conservancy District, Owner of the Work, located at 8215 South 1300 West, West Jordan, Utah 84088, until **2:00 PM on Thursday, February 27, 2025**, for construction of the "Southwest Aqueduct Reach 2". Electronic bids may also be submitted in adobe .pdf format to ellisad@jvwcd.org. JWCD suggests that electronic bids be submitted 15 minutes prior to the bid opening deadline, to allow for verification of delivery. A public bid opening will be held at the bid due time. Attendance is not required. Bid results will be posted to the District's website within 24 hours of the bid opening.

OBTAINING CONTRACT DOCUMENTS: The Contract Documents are entitled, "Southwest Aqueduct Reach 2". All Contract Documents may be obtained, online at www.jvwcd.org under "Engineering Projects".

NOTICE INVITING BIDS

OPENING OF BIDS: The bids will be publicly opened and read at the time and location identified above.

SITES OF WORK: The beginning point of the pipeline will connect to an existing 66-inch steel pipeline at 13390 South 3200 West with the ending point connecting to an existing 60-inch steel pipeline at 11800 South 3200 West. Work will also be performed at 11400 South 3200 West to construct a JA-2 main-line valve vault on an existing 78-inch diameter pipeline.

PRE-BID MEETING: A **mandatory** pre-bid meeting will be held at **2:30 PM on Tuesday, January 28, 2025**, at the office of the Owner. Prequalified General Contractors must notify the Owner if they are unable to attend the pre-bid meeting, so that alternative pre-bid meeting arrangements can be made.

PREQUALIFIED CONTRACTORS: The Owner authorized use of a prequalification procedure to determine and select General Contractors eligible to bid and construct the Project. Based upon the qualification submittals received in response to the District's Invitation for Contractor Prequalification Submittals, only the following General Contractors are prequalified to bid and construct the Project. Only Prequalified General Contractors shall be allowed to submit Bids on this Contract.

Ames Construction	Sundt
Condie Construction	Vancon, Inc.
COP Construction	Whitaker Construction
Garney Construction	WW Clyde

COMPLETION OF WORK: All work shall be Substantially Complete within 750 calendar days from the date of the Notice to Proceed. Work shall be sequenced and scheduled as listed in Section 01 14 40 – Construction and Schedule Restraints.

AWARD OF CONTRACT: An Award of Contract, if it were awarded, will be made within 60 calendar days of the opening of bids.

NOTICE TO PROCEED: A Notice to Proceed, if it were issued, will be made within 60 calendar days of the Notice of Award.

BID SECURITY: Each bid shall be accompanied by a certified or cashier's check, money order or bid bond in the amount of five percent of the total bid price payable to the Jordan Valley Water Conservancy District as a guarantee that the bidder, if its bid is accepted, will promptly execute the contract, provide evidence of worker's compensation insurance, and furnish a satisfactory faithful performance bond in the amount of 100 percent of the total bid price and a payment bond in the amount of 100 percent of the total bid price.

NOTICE INVITING BIDS

ADDRESS AND MARKING OF BID: The envelope enclosing the bid shall be sealed and addressed to the Jordan Valley Water Conservancy District and delivered or mailed to 8215 South 1300 West, West Jordan, Utah 84088. The envelope shall be plainly marked in the upper left-hand corner with the name and address of the bidder and shall bear the words "Bid for," followed by the title of the Contract Documents for the work and the date and hour of opening of bids. The certified or cashier's check, money order, or bidder's bond shall be enclosed in the same envelope with the bid. Electronic bids shall be submitted to the engineering administrative assistant, ellisad@jvwcd.org as an email attachment with the words "Bid for," followed by the title of the Contract Documents for the work and the date and hour of opening of bids in the subject line of the email.

PROJECT ADMINISTRATION: All questions relative to this project prior to the opening of bids shall be directed to the Engineer for the project. It shall be understood, however, that no interpretations of the specifications will be made by telephone, nor will any "or equal" products be considered for approval prior to award of contract.

ENGINEER

Bowen Collins & Associates
154 East 14075 South
Draper, UT 84020
(801) 495-2224

Project Engineer: Jason Luettinger, P.E.

Email: jluettinger@bowencollins.com

OWNER'S RIGHTS RESERVED: The Owner reserves the right to reject any or all bids, to waive any informality in a bid, and to make awards in the interest of the Owner.

OWNER

Jordan Valley Water Conservancy District
8215 South 1300 West
West Jordan, Utah 84088
(801) 565-4300

Project Manager: Kevin Rubow, P.E.

Email: KevinR@jvwcd.org

JORDAN VALLEY WATER CONSERVANCY DISTRICT

INSTRUCTIONS TO BIDDERS

FORM OF BID: The bid shall be made on the bidding schedule(s) bound herein. The bid shall be enclosed in a sealed envelope bearing the name of the bidder and name of the project. In the event there is more than one bidding schedule, the bidder may bid on any individual schedule or on any combination of schedules.

DELIVERY OF BID: The bid shall be delivered by the time and to the place stipulated in the Notice Inviting Bids. It is the bidder's sole responsibility to see that his bid is received in proper time.

WITHDRAWAL OF BIDS: Bids shall be unconditionally accepted without alteration or correction, excepting that bidder may by means of written request, signed by the bidder or his properly authorized representative withdraw his bid. Such written request must be delivered to the place stipulated in the Notice Inviting Bids for receipt of bids prior to the scheduled closing time for receipt of bids.

OPENING OF BIDS: The bids will be publicly opened and read at the time and place stipulated in the Notice Inviting Bids.

MODIFICATIONS AND ALTERNATIVE BIDS: Unauthorized conditions, limitations, or provisions attached to a bid may render it non-responsive and may cause its rejection. The completed bid forms shall be without interlineations, alterations, or erasures. Alternative bids will not be considered unless called for. Oral, telegraphic, or telephonic bids or modifications will not be considered.

DISCREPANCIES IN BIDS: In the event there is more than one bid item in a bidding schedule, the bidder shall furnish a price for all bid items in the schedule; failure to do so may render the bid non-responsive and subject to rejection. In the event there are unit price bid items in a bidding schedule and the "amount" indicated for a unit price bid item does not equal the product of the unit price and quantity, the unit price shall govern and the "amount" will be corrected accordingly, and the Contractor shall be bound by said Correction. In the event there is more than one bid item in a bidding schedule and the total indicated for the schedule does not agree with the sum of the prices bid on the individual items, the prices bid on the individual items shall govern and the total for the schedule will be corrected accordingly, and the Contractor shall be bound by said correction.

BID SECURITY: Each bid shall be accompanied by a certified or cashier's check or approved bid bond in the amount stated in the Notice Inviting Bids. Said check or bond shall be made payable to the Owner and shall be given as a guarantee that the bidder, if awarded the work, will enter into a contract within 10 calendar days after receipt of the contract from the Owner, and will furnish the necessary insurance certificates, Payment Bond, and Performance Bond; each of said bonds to be in the amount stated in the Notice Inviting Bids. In case the apparent low bidder refuses or fails to enter into such contract or fails to provide the required insurance and insurance certificates, the check or bid bond, as the case may be, shall be forfeited to the Owner. If the bidder elects to furnish a bid

INSTRUCTIONS TO BIDDERS

bond as his bid guarantee, he shall use the bid bond bound herein, or one conforming substantially to it in form.

QUALIFICATIONS OF BIDDERS: To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with its Bid (a) written evidence establishing its qualifications, previous experience, and (b) the following additional information:

1. Section E – Information Required of Bidder.

A Bidder's failure to submit the required information, and/or failure to meet the specific qualification and experience requirements of the Project, will render a Bid non-responsive and disqualify Bidder from receiving an award of the Contract.

BIDDER'S EXAMINATION OF CONTRACT DOCUMENTS AND SITE

It is the responsibility of each Bidder before submitting a Bid to:

1. Examine Contract Documents thoroughly.
2. Visit the site to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the work.
3. Consider federal, state and local laws and regulations that may affect cost, progress, and performance of furnishing of the work.
4. Study and carefully correlate the Bidder's observations with the Contract Documents.
5. Notify the Engineer of all conflicts, errors, or discrepancies in the Contract Documents.

Reference is made to the Supplemental General Conditions for identification of:

1. Those reports of exploration and tests of subsurface conditions at the site, which have been utilized by the Engineer in the preparation of the Contract Documents.
2. Those drawings of physical conditions in or relating to existing surface and subsurface conditions (except underground utilities as defined in Article 1 of the General Conditions) which are at or contiguous to the site and which were utilized by the Engineer in the preparation of the Contract Documents. Copies of such reports and drawings are available for inspection at the office of the Owner.

Information and data reflected in the Contract Documents with respect to underground facilities at/or contiguous to the site are based upon information and data furnished to the

INSTRUCTIONS TO BIDDERS

Owner and the Engineer by the owners of such underground facilities or others, and the Owner does not assume any responsibility for the accuracy or completeness thereof including any damages whatsoever that may be incurred by the Bidder or the Contractor through his reliance thereon unless it is expressly provided otherwise in the Supplemental General Conditions and/or the Technical Specifications.

Before submitting a bid, the bidder shall conduct such examination, investigations, studies and tests as are necessary to satisfy himself as to: the nature and location of the physical conditions (surface, subsurface and underground facilities), the general and local conditions particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, availability of utilities, local weather conditions, the character of equipment and facilities required preliminary to and during the prosecution of the work; any and all other conditions that may in any way affect the cost, progress, performance or furnishing of materials in accordance with the Contract Documents. All such examination, investigation, studies, tests and the like shall be at the Bidder's expense.

Upon reasonable request in advance, the Owner shall provide each Bidder access to the site to conduct such explorations, examination, investigation and tests as each Bidder may determine necessary for the submission of a Bid. The Bidder shall fill all holes, clean and restore the site to its former condition upon the completion of such activities.

The submission of a bid hereunder shall be considered prima facie evidence that the Bidder has made such examination as is set forth in the above paragraph and is knowledgeable as to the location and site conditions surrounding the work and the conditions to be encountered in performing the work and as to the requirements, conditions and terms of the Contract and Contract Documents.

The Owner assumes no responsibility for any understanding or representations made by any of its officers or agents during or prior to the execution of this Contract, for information contained in any reports, subsurface studies, or other information which may be made available for the Contractor's information and which are not included as Contract Documents, for any understanding or representations by the Owner or by others which are not expressly stated in the Contract Documents which liability is not expressly assumed by the Owner or its representatives or Engineer in the Contract Documents. Such information shall be deemed to be for the information of the Contractor and the Contractor shall have the obligation of evaluating any such information as to its accuracy and effect the Owner will not be liable or responsible for any such information or any conclusions that may be drawn there from by the Contractor.

The lands upon which the work is to be performed, right-of-ways and easements for access thereto together with other lands designated for use by the Contractor in performing the work are identified in the Contract Documents. All additional lands and access thereto that are required for temporary construction facilities or storage of materials and equipment are to be provided by the Contractor. Easements for permanent

INSTRUCTIONS TO BIDDERS

structures or permanent changes in existing structures are to be obtained and paid for by the Owner unless otherwise provided in the Contract Documents.

The submission of a Bid shall constitute an incontrovertible representation by the Bidder that the Bidder has complied with every requirement of this Article, and that without exception the Bid is premised upon performing and furnishing the work required by the Contract Documents in compliance with such means, methods, techniques, sequences, or procedures of construction as may be indicated in or required by the Contract Documents; and that such means, methods, techniques, sequences or procedures described in the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing the work.

QUANTITIES OF WORK: The quantities of work or material stated in the Bid Schedule are supplied only to give an indication of the general scope of the work; the Owner does not expressly or by implication agree that the actual amount of work or material will correspond therewith. The Owner reserves the right after award of the Contract to increase or decrease the quantities of any unit price item of the work by an amount up to and including 25 percent of the quantity of any bid item, or to omit portions of such work as may be deemed necessary or expedient by the Engineer or Owner, without a change in the unit price. Such right to revise and omit shall include the right to delete any bid item in its entirety, or to add additional bid items in quantities up to and including an aggregate total amount not to exceed 25 percent of the total amount of the Contract.

The Bidders nor the ultimate Contractor on the Project shall at any time after the submittal of a bid make or have any claim for damages or anticipated profits or loss of profit or otherwise because of any difference between the quantities of work actually done and material furnished and those stated in said unit price items of the Bid.

COMPETENCY OF BIDDERS: In selecting the lowest responsible Bidder, consideration will be given to the general competency of the Bidder for the performance of the work covered by the Bid. To this end, each bid shall be supported by a statement of the bidder's experience as of recent date on the form entitled "Information Required of Bidder," bound herein. No bid for the work will be accepted from a contractor who does not hold an active Contractor's license in good standing applicable to the type of work bid upon at the time of opening bids.

After an award of the contract no substitution of the Project Manager or Project Superintendent will be allowed without the written approval by the Owner.

DISQUALIFICATION OF BIDDERS: More than one bid from an individual, firm partnership, corporation, or association under the same or different names will not be considered. Reasonable grounds for believing that any bidder is interested in more than one bid for the work contemplated will cause the rejection of all bids in which such bidder is interested. If there is reason for believing that collusion exists among the bidders, all

INSTRUCTIONS TO BIDDERS

bids will be rejected.

RETURN OF BID GUARANTEE: Within 10 calendar days after award of the contract, the Owner will return the bid guarantees accompanying such of the bids as are not considered in making the award. All other bid guarantees will be held until a Notice to Proceed has been issued and accepted. They will then be returned to the respective bidders whose bids they accompany.

EVALUATION OF BIDS: In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid or prior to the Notice of Award. In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents. Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

AWARD OF CONTRACT: Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unqualified, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

If Owner awards a contract for the Work, such award shall be to the qualified Bidder submitting the lowest responsive Bid. Any such award will be made by written notice and within 60 calendar days after opening of the bids, unless a different waiting period is expressly allowed in the Notice Inviting Bids. The Owner intends to award a single contract for construction of the Project. Individual schedules will not be awarded separately.

EXECUTION OF CONTRACT: The Bidder to whom the award is made shall secure all insurance and shall furnish all certificates and bonds required by the specifications within ten calendar days after receipt of the Notice of Award from the Owner. The Bidder to whom the award is made shall execute a written contract with the Owner on the form of agreement provided within ten calendar days after receipt of the Agreement from the Owner. Failure or refusal to enter into a contract as herein provided or to conform to any of the stipulated requirements in connection therewith shall be just cause for annulment of the award and forfeiture of the bid guarantee. If the successful bidder refuses or fails to execute the contract, the Owner may award the contract to the second lowest responsible bidder, or reject all bids and re-advertise the project for rebidding. If the second lowest responsible bidder refuses or fails to execute the contract, the Owner may

INSTRUCTIONS TO BIDDERS

award the contract to the third lowest responsible bidder. On the failure or refusal of such second or third lowest bidder to execute the contract, each such bidder's guarantees shall be likewise forfeited to the Owner.

ISSUANCE OF NOTICE TO PROCEED: The Owner intends to execute the Agreement and issue the Notice to Proceed specifying the Project start date within ten calendar days after its receipt of the executed Agreement, Purchase Order Assignment(s), (if applicable), bonds and insurance certificates from the successful bidder. If the Contract Time is expressed as a specific completion date in the Notice Inviting Bids and paragraph 3.1 of the Agreement rather than a specific number of successive days following the start date identified in the Notice to Proceed, then any delay by the Owner beyond the ten days in issuing the Notice to Proceed shall extend the completion date by the number of days of the delay.

LICENSES: Contractor must be licensed as a business qualified to do business within the state of Utah prior to issuance of a Notice of Award. Contractor must hold a current contractor's license with classifications appropriate to the work being contracted.

STATE REGISTRY: The Contractor shall register the project, if awarded, on the State of Utah Construction Registry prior to the commencement of the work.

BID

BID TO: JORDAN VALLEY WATER CONSERVANCY DISTRICT

The undersigned Bidder hereby proposes to furnish all plant machinery, labor, services, materials, equipment, tools, supplies, transportation, utilities, and all other items and facilities necessary to perform all work required under the Bidding Schedule of the Owner's Contract Documents entitled "Southwest Aqueduct Reach 2" drawings and all addenda issued by said Owner prior to opening of the bids.

Addenda, if issued, are only delivered by e-mail to those on Owner's website (jvwcd.org) Plan Holders List.

The undersigned bidder acknowledges receipt of the following addenda:

<u>No.</u>	<u>Date Received</u>	<u>No.</u>	<u>Date Received</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Bidder agrees that, within 10 calendar days after receipt of Notice of Award from Owner, he will execute the Agreement in the required form, of which the Notice Inviting Bids, Instructions to Bidders, Bid, Information Required of Bidder, Technical Specifications, Drawings, and all addenda issued by Owner prior to the opening of bids, are a part, and will secure the required insurance and bonds and furnish the required insurance certificates; and that upon failure to do so within said time, then the bid guarantee furnished by Bidder shall be forfeited to Owner as liquidated damages for such failure; provided, that if Bidder shall execute the Agreement, secure the required insurance and bonds, and furnish the required insurance certificates within said time, his check, if furnished, shall be returned to him within five days thereafter, and the bid bond, if furnished, shall become void. It is further understood that this bid may not be withdrawn for a period of 45 days after the date set for the opening thereof, unless otherwise required by law.

Dated: _____

Bidder: _____

By: _____
(Signature)

Title: _____

Bidder further agrees to complete all work required within the time stipulated in the Contract Documents, and to accept in full payment therefore the price(s) named in the above-mentioned Bidding Schedule(s).

BID

BID SCHEDULE

PART 1 – GENERAL

1.1 CONSTRUCTION CONTRACT

- A. Name of Project: Southwest Aqueduct Reach 2 Project
- B. Owner's Project Number: 4321

1.2 SCHEDULES TO BE ADDED TO THE AGREEMENT

- A. Bid Schedule contains the schedules of prices which will be incorporated into the Agreement (Section F) by reference.

1.3 SCHEDULES OF PRICES

- A. The Contract has been divided into separate Bid Schedules for purposes of award. The Owner reserves the right to award a single Contract based upon the lowest overall project cost, or any combination of the individual bid schedules as described herein.
- B. Schedule A: Generally includes all Work associated with SWA Reach 2 from the connection at 13400 South to an existing 66-inch pipeline and a connection at 11800 South to an existing 60-inch pipeline, including air valve vault and drain structures, modifications to the 12600 South JA Interconnection Vault, restoration and miscellaneous cathodic protection improvement sites.
- C. Schedule B: Generally includes all Work within the JWCD property at 11400 South for construction of a mainline valve vault on the Jordan Aqueduct including installation of a large butterfly valve and appurtenances.
- D. The Contract, if awarded, will be on the basis of materials and equipment specified or described in the bidding documents without consideration of possible substitution of "or equal" items.

BID

Bid Schedule – Unit Prices:

E. BID SCHEDULE A – SOUTHWEST AQUEDUCT REACH 2 PROJECT

Base Bid Items				
Item No.	Classification of Unit Price Work	Quantity Unit	Unit Price	Amount
1A	Mobilization, Demobilization, Temporary Facilities and Administrative Items	1 Lump Sum		\$
2	12600 South Trenchless Crossing – Complete, without 66” SWA-2	1 Lump Sum		\$
3	Jordan Aqueduct Trenchless Crossing – Complete, without 66” SWA-2	1 Lump Sum		\$
4	11800 South Open Cut Crossing – Complete	1 Lump Sum		\$
5	66-inch Southwest Aqueduct Reach 2 – Complete, STA 319+46 to STA 365+50, 3200 West	1 Lump Sum		\$
6	66-inch Southwest Aqueduct Reach 2 – Complete, STA 365+50 to STA 389+20, Cedar Brae Park, 12600 South Crossing, Private Properties and Unimproved Area	1 Lump Sum		\$
7	66-inch Southwest Aqueduct Reach 2 – Complete, STA 389+20 to STA 404+00, 3200 West	1 Lump Sum		\$
8	66-inch Southwest Aqueduct Reach 2 – Complete, STA 404+00 to STA 424+00, 3200 West	1 Lump Sum		\$
9	Trench Stabilization Material, Only as Directed by Engineer	3,000 Cubic Yards	\$	\$
10	Southwest Aqueduct Reach 2 Testing, Disinfection and Connections to Existing SWA – Complete	1 Lump Sum		\$
11	Cathodic Protection – Complete	1 Lump Sum		\$
12	12600 South Vault Improvements – Complete	1 Lump Sum		\$
13	12600 South Vault Improvements, Items Shaded for Schedule Constraints	1 Lump Sum		\$
14	13400 South Vault Improvements – Complete	1 Lump Sum		\$
15	Air Valve/Maintenance Structure	6 Each	\$	\$

BID

Base Bid Items				
Item No.	Classification of Unit Price Work	Quantity Unit	Unit Price	Amount
16	Drain/Maintenance Structure	1 Each	\$	\$
17	JBID Sanitary Sewer Manhole and Sewer Relocation – Complete, Jordan Basin Improvement District Standards	1 Lump Sum		\$
18	12" Waterline Loop Over SWA-2, Riverton City Standards	1 Each	\$	\$
19	10" Pressurized Loop Over SWA-2, Riverton City Standards	1 Each	\$	\$
20	Asphalt Restoration, 3200 West	2,100 Cubic Yards	\$	\$
21	Asphalt Restoration, 11800 South	150 Cubic Yards	\$	\$
22	2" Mill and Overlay, 3200 West	375,000 Sq. Feet	\$	\$
23	Irrigation System Relocation, 12495 South to 12353 South	1 Lump Sum		\$
24	Contractor Excavation and Backfill to Support Utility Relocation of Communication Utility Conflicts north of 12600 South, CenturyLink/Lumen	1 Lump Sum		\$
TOTAL BID SCHEDULE A:			\$	

Bid Adjustment – Southwest Aqueduct Reach 2 Project

The bid adjustment allows the Bidder to adjust their base bid just prior to bid opening without the need to adjust individual bid item amounts. The sum of the extended total shall be increased or (decreased) by this Bid Adjustment amount. Indicate decrease in parenthesis (). For payment purposes, this correction amount will be applied to Bid Items No. 5, 6, 7, and 8 proportionally to the amount bid for those items.

Bid Adjustment _____ \$ _____

Total adjusted BID Schedule A _____ \$ _____

BID

F. BID SCHEDULE B – 11400 SOUTH MAINLINE VALVE VAULT

Base Bid Items				
Item No.	Classification of Unit Price Work	Quantity Unit	Unit Price	Amount
1B	Mobilization, Demobilization, Temporary Facilities, and Administrative Items	1 Lump Sum		\$
25	11400 South Vault Improvements – Complete	1 Lump Sum		\$
TOTAL BID SCHEDULE B:				

G. BID TOTAL – BID SCHEDULES A & B

Bid Total
BID TOTAL– Bid Schedule A <i>Including Bid Adjustment</i> and Bid Schedule B: \$

1. Bidder agrees to accept as full payment for Work proposed with the Bidding Documents, based upon the undersigned’s own estimate of quantities and costs and including sales, consumer, use, other taxes, and overhead and profit.
2. Based upon Bidder’s own estimate of quantities and costs, the Bidder, if awarded the contract, payment shall be made for the items as outlined in Section 01 20 00 – Measurement and Payment.
3. Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.
4. Identify Steel Pipe Supplier, **Circle One:**
 - a. Northwest Pipe Company
 - b. Thompson Pipe Group
 - c. Other, _____ (Name Supplier)

BID

5. Identify Steel Pipe Coating System, **Circle One**:

- a. Straights: Tape Wrap with Cement Mortar Overcoat, and Specials: Epoxy
- b. Straights: Epoxy with Cement Mortar Overcoat, and Specials: Epoxy

Bidder (Company name): _____

By: _____
(Signature)

Dated: _____

Name: _____

Title: _____

ATTACHMENTS TO THIS BID

The following documents are attached to and made a condition of this Bid:

- 1. Required Bid security in the form of Bid Bond.
- 2. Information Required of Bidder.

BID BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____
as Principal, and _____
as Surety, are held and firmly bound unto the Jordan Valley Water Conservancy District
(hereinafter called "Owner") in the sum of _____
dollars, (not less than five percent of the total amount of the bid) for the payment of which
sum, will and truly to be made, we bind ourselves, our heirs, executors, administrators,
successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has submitted a bid to Owner to perform all work required under
the bidding Schedule of the Owner's Contract Documents entitled "Southwest Aqueduct
Reach 2", (hereafter called the "Project").

NOW THEREFORE, if Principal is awarded Contract by Owner for the Construction of the
Project and, within the time and in the manner required under the heading "Instructions
to Bidders" enters into the written contract entitled "Agreement" bound with said Contract
Documents, furnishes the required certificates of insurance, and furnishes the required
Performance Bond and Payment Bond within 10 calendar days after receipt of such
contract from Owner, then this obligation shall be null and void, otherwise it shall remain
in full force and effect. In the event suit is brought upon this bond by Owner and judgment
is recovered, Surety shall pay all costs incurred by Owner in such suit, including a
reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this ___ day of _____, 20__.

—

By: _____
—

President

Its: _____

By: _____

Its: _____

(SEAL)

(SEAL)

INFORMATION REQUIRED OF BIDDER

The Bidder shall furnish the following information. Failure to comply with this requirement may render the Bid non-responsive and subject to rejection. Additional sheets shall be attached as required.

1. Contractor's name: _____

2. Contractor's address: _____

Contractor's Primary Contact: _____

Email address of Contractor's primary contact: _____

Contractor's telephone number: _____

3. Contractor must be qualified and licensed to do business in Utah.

Utah Department of Commerce Information

Business Entity Number: _____

Delinquent Date: _____

4. Contractor license Information:

Contractor's Utah License Number: _____

Expiration Date: _____

Primary Classification: _____

Supplemental Classification held, if any: _____

5. Name and title of officers of Contractor's firm:

6. Number of persons employed full-time by the firm: _____

7. Name of person who inspected site of proposed work for your firm:

Name: _____

Date of Inspection: _____

8. Surety company who will provide the required bonds on this contract:

Agent's Name: _____

Telephone: _____

INFORMATION REQUIRED OF BIDDER

10. Workers Compensation Insurance Policy #: _____

11. Name of Project Manager: As per Pre-Qualification Documents previously submitted. Any substitutions will be considered only after project award.

12. Name of Project Superintendent: As per Pre-Qualification Documents previously submitted. Any substitutions will be considered only after project award.

AGREEMENT

An Agreement made as of the _____ day of _____, 20____, by and between the Jordan Valley Water Conservancy District, a Utah special district (“OWNER”), and _____, a _____ corporation qualified to do business and doing business in the State of Utah (“CONTRACTOR”).

TERMS:

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE I
WORK

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents for the _____. The Work is generally described as follows:

Furnishing all labor, services, materials, equipment, and supplies except for such materials, equipment, and services as may be stipulated in the Contract Documents to be furnished by the OWNER; furnishing and removing all plant machinery, temporary structures, tools, supplies, transportation, utilities, and all other items, facilities and equipment, and to do everything required by this Agreement and the Contract Documents; accepting all responsibility for and paying for all loss and damage arising out of the nature of the Work aforesaid, or from the action of the elements, or from any unforeseen difficulties which may arise during the prosecution of the Work until its acceptance by OWNER, and for all risks of every description connected with the Work; also for all expenses resulting from the suspension or discontinuance of work, except as in the Contract Documents are expressly stipulated to be borne by OWNER.

ARTICLE II
ENGINEER

The Project has been designed by the OWNER. The OWNER will assume all duties and responsibilities and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

[ALTERNATE PARAGRAPH]The Project has been designed by _____, a _____ corporation qualified to do business and doing business in the State of Utah, who is hereinafter called “ENGINEER” and who is to act as OWNER’s representative, assume all duties and responsibilities and have the rights and

authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE III CONTRACT TIME

- 3.1 The Work shall be complete, in accordance with paragraphs 14.08 and 14.09 of the General Conditions, on or before _____.
- 3.2 Liquidated Damages: OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that the OWNER will suffer financial loss if the Work is not completed within the time specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any proof of loss, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER the amount specified in Article 14.07 of the General Conditions and in Article 18.01 of the Supplementary General Conditions for each day that expires after the time specified in paragraph 3.1 for final completion until the Work is substantially complete. And, after Substantial Completion if CONTRACTOR neglects, refuses or fails to complete the remaining Work within forty-five (45) days or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER the amount specified in Article 14.07 of the General Conditions and in Article 18.01 of the Supplemental General Conditions for each day that expires after the forty-five (45) days until readiness for final payment.

ARTICLE IV CONTRACT PRICE

All payments to Contractor shall be made in accordance with the Contract Documents. OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents in current funds those prices stated in the approved Bid Schedule as named in the Notice of Award.

ARTICLE V PAYMENT PROCEDURES

CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

- 5.1 Progress Payments: OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment

as recommended by ENGINEER, on a monthly basis. All progress payments will be on the basis of the progress of the Work measured by the schedule of values established in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Conditions.

- 5.2 Final Payment: Upon final completion and acceptance of the Work in accordance with Article 14 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in Article 14.

ARTICLE VI INTEREST

All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate of twelve percent (12%) per annum.

ARTICLE VII CONTRACTOR'S REPRESENTATION

In order to induce OWNER to enter into the Agreement, CONTRACTOR makes the following representations:

- 7.1 CONTRACTOR has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.
- 7.2 CONTRACTOR has studied carefully all exploration reports and test of subsurface conditions and drawings of physical conditions which are identified in the Supplementary General Conditions, as provided in paragraph 4.02 of the General Conditions, and accepts the Technical Data contained in such reports and drawings upon which CONTRACTOR is entitled to rely.
- 7.3 CONTRACTOR has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests, reports and studies (in addition to or to supplement those referred to in paragraph 7.2 above) which pertain to the subsurface or physical conditions at or contiguous to the site or otherwise may affect the cost, progress, performance or furnishing of the Work as CONTRACTOR considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of paragraph 4.02 of the General Conditions; and no additional examinations, investigations, explorations, tests, reports,

studies or similar information or data are or will be required by CONTRACTOR for such purposes.

- 7.4 CONTRACTOR has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities.
- 7.5 CONTRACTOR has correlated the results of all observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.
- 7.6 CONTRACTOR has given ENGINEER written notice of all conflicts, errors or discrepancies that he had discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

ARTICLE VIII CONTRACT DOCUMENTS

The Contract Documents for the _____, which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work, consist of the following:

- 8.1 This Agreement;
- 8.2 Performance and Payment Bonds;
- 8.3 Notice of Award;
- 8.4 Notice to Proceed;
- 8.5 General Conditions;
- 8.6 Supplemental General Conditions;
- 8.7 Notice Inviting Bids;
- 8.8 Instructions to Bidders;
- 8.9 Information Required of Bidder;
- 8.10 Technical Specifications;
- 8.11 Drawings - Sheets Number One through _____;
- 8.12 Addendum Number One through _____; and,
- 8.13 CONTRACTOR's Bid, including all schedules and explanatory attachments; attached as Exhibit A.

The CONTRACTOR (1) acknowledges that he has received a copy of each document, specified above, (2) acknowledges that he has read and understands each document specified above and (3) agrees to every term, condition and contract obligation set forth in each document specified above.

There are no Contract Documents other than those listed above in this Article 8. The Contract Documents may only be amended, modified or supplemented as provided in paragraphs 3.03 of the General Conditions.

ARTICLE IX
FEDERAL REQUIREMENTS

The CONTRACTOR shall comply with federal regulations as stated in the Supplemental General Conditions, Article 21.

ARTICLE X
MISCELLANEOUS

- 10.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.
- 10.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.
- 10.3 In the event any legal action or other proceeding is brought for the enforcement of this Agreement and/or the Contract Documents, or for damages, because of an alleged dispute, breach, default or misrepresentation in connection with any of the provisions thereof, the successful or prevailing party shall be entitled to recover reasonable attorneys' fees and other costs incurred in the action or proceeding, in addition to any other relief to which it may be entitled.
- 10.4 Any notice to be given hereunder shall be deemed given when sent by registered or certified mail, postage prepaid to the parties at their respective addresses stated below or at any other address when notice of such change of address has been given as provided in this Article 10.4.

[SIGNATURE PAGE FOLLOWS]

“OWNER”:

Jordan Valley Water Conservancy District
8215 South 1300 West
West Jordan, Utah 84088

By: _____
Alan E. Packard
Its General Manager/CEO

“CONTRACTOR”:

Utah License No. _____

By: _____
Its: _____

EXHIBIT A
CONTRACTOR'S BID

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____, as Contractor, and as Surety, are held firmly bound unto the Jordan Valley Water Conservancy District hereinafter called "Owner," in the sum of \$_____ for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has been awarded and is about to enter into the annexed Agreement with Owner to perform all work required under the Bidding Schedule(s) of the Owner's Contract Documents entitled "Southwest Aqueduct Reach 2".

NOW THEREFORE, if Contractor shall perform all the requirements of the Agreement required to be performed on his part, at the times and in the manner specified therein, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

PROVIDED, that any alterations in the work to be done or the materials to be furnished, or changes in the time of completion, which may be made pursuant to the terms of the Agreement, shall not in any way release Contractor or Surety thereunder, nor shall any extensions of the time granted under the provisions of the Agreement release either the Contractor or Surety, and notice of such alterations or extensions of the work, materials or time to complete made under the Agreement is hereby waived by Surety. This Bond is furnished in compliance and in accordance with 14-1-18, Utah Code Ann., as amended, and 63-56-38 Utah Code Ann., as amended.

SIGNED AND SEALED, this _____ day of _____, 20__.

By: _____

By: _____

Its: _____

Its: _____

(SEAL)

(SEAL)

(SEAL AND NOTARIAL ACKNOWLEDGMENT OF SURETY)

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____ as Contractor, and as Surety, are held firmly bound unto the Jordan Valley Water Conservancy District hereinafter called "Owner," in the sum of \$_____ for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has been awarded and is about to enter into the annexed Agreement with Owner to perform all work required under the Bidding Schedule(s) of the Owner's Contract Documents entitled, "Southwest Aqueduct Reach 2".

NOW THEREFORE, if said Contractor, or subcontractor, fails to pay for any materials, equipment, or other supplies, or for rental of same, used in connection with the performance of work contracted to be done, or for amounts due under applicable State law for any work or labor thereon, said Surety will pay for the same in an amount not exceeding the sum specified above, and, in the event suit is brought upon this bond, a reasonable attorney's fee to be fixed by the court. This bond shall inure to the benefit of any persons, companies, or corporations entitled to file claims under applicable State law.

PROVIDED, that any alterations in the work to be done or the materials to be furnished, or changes in the time of completion, which may be made pursuant to the terms of the Agreement, shall not in any way release Contractor or Surety thereunder, nor shall any extensions of time granted under the provisions of said contract release either Contractor or the Surety, and notice of such alterations or extensions of the work, materials or time to complete made under the Agreement is hereby waived by Surety. This bond is furnished in compliance and in accordance with 14-1-18 and 19 Utah Code Ann., as amended, and 63-56-38 Utah Code Ann., as amended.

SIGNED AND SEALED, this _____ day of _____, 20____.

By: _____

By: _____

Its:

Its:

(SEAL)

(SEAL)

(SEAL AND NOTARIAL ACKNOWLEDGMENT OF SURETY)

NOTICE OF AWARD

To: [Insert Contractor's Name and Address]

Re: Southwest Aqueduct Reach 2

You are hereby notified that the OWNER has accepted your bid for the above referenced project in the amount of \$_____.

Furnish the required Contractor's Performance Bond, Payment Bond and Certificates of Insurance within ten calendar days from the date of this notice to you. An acknowledged copy of this Notice of Award, together with all future correspondence regarding this project, shall be sent to the District's Project Manager: Kevin Rubow

When the Agreement is provided, sign and return it within ten calendar days from receipt of the agreement.

Dated this ____ day of _____, 20__.

Shane Swensen, PE
Chief Engineer

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged by:

This _____ day of _____, 20__.

Signature: _____

Printed Name: _____

Title: _____

NOTICE TO PROCEED

To: [Insert Contractor's Name and Address]

Re: Southwest Aqueduct Reach 2

You are hereby notified to commence work in accordance with the Agreement dated _____, and you are to complete the work by, _____.

An acknowledged copy of this Notice to Proceed should be returned to the Owner, Attention: Kevin Rubow, Senior Engineer.

Dated this _____ day of _____.

Travis P. Christensen, P.E.
Engineering Group Leader

ACCEPTANCE OF NOTICE

Receipt of the above Notice to Proceed is hereby acknowledged by:

This _____ day of _____, 20____.

Signature: _____

Printed Name: _____

Title: _____

JORDAN VALLEY WATER CONSERVANCY DISTRICT

PAYMENT APPLICATION AND CERTIFICATE No. ____ **DATE:** _____

SHEET ____ **OF** ____

PERIOD FROM _____ TO _____, 20__

PROJECT: Southwest Aqueduct Reach 2

JVWCD PROJECT NO.: 4321

CONTRACTOR: _____

ADDRESS: _____

ENGINEER:

JVWCD

1. ORIGINAL CONTRACT PRICE:..... \$ _____
2. NET CHANGE ORDERS APPROVED TO DATE: \$ _____
(Attach Summary Sheet)
3. REVISED CONTRACT AMOUNT: \$ _____
(Sum of Lines 1 & 2)
4. TOTAL VALUE OF WORK COMPLETED TO DATE \$ _____
(Attached Payment Breakdown)
5. PERCENT PROJECT COMPLETE: %
(Divide Line 4 by 3 and multiply by 100)
6. LESS AMOUNT RETAINED (5%) \$ _____
7. MATERIALS ON HAND..... \$ _____
(95% of Value, Listing Attached)
8. SUBTOTAL (Sum of Lines 4, Line 6 and Line 7) \$ _____
9. LESS PREVIOUS PAYMENTS \$ _____
10. CURRENT PAYMENT DUE: \$ _____
(Line 8 & 9)

JORDAN VALLEY WATER CONSERVANCY DISTRICT

Payment Application and Certificate No _____

SHEET _____ OF _____

CONTRACTOR'S Certification:

The undersigned CONTRACTOR certifies that: (1) all previous progress payments received from OWNER on account of work done under the Contract referred to herein have been applied to discharge in full all obligations of CONTRACTOR incurred in connection with work covered by prior Applications for Payment numbered 1 through _____ inclusive; and, (2) title to all materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to OWNER at time of payment free and clear of all liens, claims, security interests and encumbrances (except such as covered by bond acceptable to OWNER).

Dated: _____

CONTRACTOR: _____

By: _____

Engineer's Recommendation:

This Application (with accompanying documentation) meets the requirements of the Contract Documents and payment of the amount due this application is recommended.

ENGINEER

Dated: _____

Project Representative

Dated: _____

Project Manager

JORDAN VALLEY WATER CONSERVANCY DISTRICT

CHANGE ORDER

Change Order No. _____

Date: _____

Page ___ of ___

PROJECT NAME: Southwest Aqueduct Reach 2

PROJECT NUMBER: 4321

CONTRACTOR: _____

CONTRACT DATE: _____

The following changes are hereby made to the CONTRACT DOCUMENTS:

- 1)
- 2)
- 3)

Total Change to CONTRACT PRICE: \$

Original CONTRACT PRICE: \$

Current CONTRACT PRICE adjusted by previous CHANGE ORDER(S)..... \$

The new CONTRACT PRICE including this CHANGE ORDER will be \$

The CONTRACT TIME will be increased by _____ calendar days.

The date for Substantial Completion will be _____, 20__.

The Contractor agrees to furnish all labor and materials and perform all work as necessary to complete the change order items for the price named herein, which includes all supervision and miscellaneous costs. This change order constitutes full and mutual accord and satisfaction for all time and all costs related to this change. By acceptance of this change order the Contractor agrees that the change order represents an equitable adjustment to the Contract, and further agrees to waive all right to file a claim arising out of or as a result of this change. This document will become a supplement to the Contract, and all provisions will apply hereto, upon approval by the Owner.

JORDAN VALLEY WATER CONSERVANCY DISTRICT

**CONTRACTOR'S CERTIFICATE
OF
SUBSTANTIAL COMPLETION**

OWNER

ENGINEER

TO: Jordan Valley Water Conservancy District
8215 South 1300 West
West Jordan, Utah 84088-0070

Bowen Collins & Associates
154 East 14075 South
Draper, UT 84020

PROJECT: Southwest Aqueduct Reach 2

ATTENTION: _____

FROM: _____
Firm or Corporation

This is to certify that I, _____ am an authorized official of working in the capacity of _____ and have been properly authorized by said firm or corporation to sign the following statements pertaining to the subject contract:

I know of my own personal knowledge, and do hereby certify, that the work of the contract described above has been substantially performed and all materials used and installed to date are in accordance with, and in conformity to, the contract drawings and specifications. A list of all incomplete work is attached.

The Contractor hereby releases the Owner and its agents from all claims of and liability to the Contractor for anything done or furnished for or relating to the work, as further provided in Article 14.08B of the General Conditions, except demands against the Owner for the remainder of progress payments retained to date, and unresolved written claims prior to this date.

The contract work is now substantially complete, ready for its intended use, and ready for your inspection. You are requested to issue a Certificate of Substantial Completion.

SIGNATURE: _____

DATE: _____

JORDAN VALLEY WATER CONSERVANCY DISTRICT

**CONTRACTOR'S CERTIFICATE
OF
FINAL COMPLETION**

OWNER

ENGINEER

TO: Jordan Valley Water Conservancy District
8215 South 1300 West
West Jordan, Utah 84088-0070

Bowen Collins & Associates
154 East 14075 South
Draper, UT 84020

PROJECT: Southwest Aqueduct Reach 2

ATTENTION: Project Representative: _____

FROM: _____
Firm or Corporation

This is to certify that I, _____ am an authorized official of _____ working in the capacity of _____ and have been properly authorized by said firm or corporation to sign the following statements pertaining to the subject contract:

I know of my own personal knowledge, and do hereby certify, that the work of the contract described above has been performed and all materials used and installed to date are in accordance with, and in conformity to, the contract drawings and specifications.

The Contract work is now complete in all parts and requirements, excepting the attached list of minor deficiencies and the reasons for each being incomplete to date, for which exemption from final payment requirements is requested in conformance to Article 14.09A of the General Conditions of our Contract (if no exemptions requested, write "none") _____. The work is now ready for your final inspection. The following items required from the Contractor prior to application for final payment (such as O & M Manuals, guarantees, record drawings, etc.) are submitted herewith, if any:

JORDAN VALLEY WATER CONSERVANCY DISTRICT

I understand that neither the issuance by the Engineer of a Notice of Completion, nor the acceptance thereof by the Owner, shall operate as a bar or claim against the Contractor under the terms of the guarantee provisions of the Contract Documents.

SIGNATURE: _____

DATE: _____

JORDAN VALLEY WATER CONSERVANCY DISTRICT

CONSENT OF SURETY FOR FINAL PAYMENT

PROJECT NAME: Southwest Aqueduct Reach 2

LOCATION: _____

TYPE OF CONTRACT: _____

AMOUNT OF CONTRACT: _____

In accordance with the provisions of the above-named contract between the Owner and the Contractor, the following named surety:

on the Payment Bond of the following named Contractor:

hereby approves of final payment to the Contractor, and further agrees that said final payment to the Contractor shall not relieve the Surety Company named herein of any of its obligations to the following named Owner (as set forth in said Surety company's bond):

IN WITNESS WHEREOF, the Surety Company has hereunto set its hand and seal this day of _____, 20____.

(Name of Surety Company)

(Signature of Authorized Representative)

(Name of Authorized Representatives)

(Title)

JORDAN VALLEY WATER CONSERVANCY DISTRICT

AFFIDAVIT OF PAYMENT

To All Whom It May Concern:

WHEREAS, the undersigned has been employed by the Jordan Valley Water Conservancy District to furnish labor and materials under a contract dated _____ for the project entitled "Southwest Aqueduct Reach 2", in the County of Salt Lake, State of Utah, of which Jordan Valley Water Conservancy District is the Owner.

NOW, THEREFORE, this _____ day of _____, 20____, the undersigned, as the Contractor for the above-named Contract pursuant to the Conditions of the Contract hereby certifies that, except as listed below, he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or his property might in any way be held responsible.

EXCEPTIONS: (If none, write "None". If required by the Owner, the Contractor shall furnish bond satisfactory to the Owner for each Exception.)

Contractor (Name of sole ownership,
corporation or partnership)

(affix corporate seal here)

(Signature of Authorized Representative)

Title: _____

GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated:

Addenda - Written or graphic instruments issued prior to the opening of Bids which make additions, deletions, or revisions to the Contract Documents.

Agreement - The written contract between the OWNER and the CONTRACTOR for the performance of the WORK pursuant to the Contract Documents. Documents incorporated into the contract by reference become part of the contract and of the Agreement.

Application for Payment - The form furnished by the ENGINEER and completed by the CONTRACTOR to request progress or final payment including supporting documentation to substantiate the amounts for which payment is requested.

Bonds - Performance, and Payment Bonds and other instruments which protect against loss due to inability or refusal of the CONTRACTOR to perform pursuant to the Contract Documents.

Change Order - A document recommended by the ENGINEER, which is signed by the CONTRACTOR and the OWNER and authorizes an addition, deletion, or revision in the WORK, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

Contract Documents - Information and Instructions, forms (including the Schedule of Prices and all required certificates and affidavits), Agreement, Performance Bond, Payment Bond, General Conditions, Supplemental General Conditions, Technical Specifications, Drawings and all Addenda and Change Orders executed pursuant to the provisions of the Contract Documents.

Contract Price - The total monies payable by the OWNER to the CONTRACTOR under the terms and conditions of the Contract Documents.

Contract Time - The number of successive Days stated in the Contract Documents for the completion of the WORK. The Contract Time begins to run on the date specified in the Notice to Proceed.

CONTRACTOR - The person, firm, or corporation with whom the OWNER has executed the Agreement.

Cost Proposal - The offer or proposal of the pipeline installation subcontractor to the CONTRACTOR to provide the work required under these Contract Documents.

Day - A calendar day of 24 hours measured from midnight to the next midnight.

Defective Work - Work that: is unsatisfactory, faulty, or deficient; does not conform to the Contract Documents; does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents; has been damaged prior to the ENGINEERS's recommendation of final payment.

Drawings - The drawings, plans, maps, profiles, diagrams, and other graphic representations which show the character, location, nature, extent, and scope of the WORK.

Effective date of the Agreement - The date indicated in the Agreement on which it was executed, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

ENGINEER - The person, firm, or corporation named as such in the Contract Documents.

Field Order - A written order issued by the ENGINEER which may or may not involve a change in the WORK.

Laws and Regulations; Laws or Regulations - Laws, rules, regulations, ordinances, codes, and/or orders promulgated by a lawfully constituted body authorized to issue such Laws and Regulations.

Notice of Award - The OWNER's written notice to the apparent successful Bidder stating that upon compliance with the conditions precedent enumerated therein by the apparent successful Bidder within the time specified, the OWNER will enter into the Agreement.

Notice to Proceed - The OWNER's written notice to the CONTRACTOR authorizing the CONTRACTOR to proceed with the work and establishing the date of commencement of the Contract Time.

OWNER - The Jordan Valley Water Conservancy District.

Partial Utilization - Placing a portion of the WORK in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion of the WORK.

Project - A unit of total construction of which the WORK to be provided under the Contract Documents, may be the whole, or a part thereof.

Project Representative - The authorized representative of the ENGINEER who is assigned to the site or any part thereof.

Proposer - Any person, firm or corporation submitting a proposal for the work.

Schedule of Prices - The offer or proposal of the CONTRACTOR setting forth the price or prices for the work to be performed.

Shop Drawings - All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for the CONTRACTOR to illustrate some portion of WORK and all illustrations, brochures, standard schedules, performance charts, instruction, and diagrams to illustrate material or equipment for some portion of the WORK.

Specifications - (Same definition as for Technical Specifications hereinafter).

Subcontractor - An individual, firm, or corporation having a direct contract with the CONTRACTOR or with any other Subcontractor for the performance of a part of the WORK at the site.

Substantial Completion - That state of construction when the WORK has progressed to the point where, in the opinion of the ENGINEER as evidenced by the Certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the WORK can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to any work refer to substantial completion thereof.

Supplementary General Conditions - The part of the Contract Documents which make additions, deletions, or revisions to these General Conditions.

Supplier - A manufacturer, fabricator, supplier, distributor, materialman, or vendor.

Technical Data - The factual information contained in reports describing physical conditions, including exploration method, plans, logs, laboratory test methods and factual data. Technical Data does not include conclusions, interpretations, interpolations, extrapolations or opinions contained in reports or reached by the CONTRACTOR.

Technical Specifications - Those portions of the Contact Documents consisting of the written technical descriptions of products and execution of the WORK.

Underground Utilities - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments and any encasements containing such facilities which have been installed under ground to furnish any of the following services or

materials: water, sewage and drainage removal, electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, traffic, or other control systems.

WORK - The entire construction required to be furnished under the Contract Documents. WORK is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

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ARTICLE 2 - PRELIMINARY MATTERS

2.01 DELIVERY OF BONDS/INSURANCE CERTIFICATES

- A. The CONTRACTOR shall deliver to the OWNER the Agreement, Bonds, Insurance Policies and Certificates required by the Contract Documents within ten (10) days after receiving the Notice of Award from the OWNER.

2.02 COPIES OF DOCUMENTS

- A. The OWNER shall furnish the CONTRACTOR 5 copies of the Contract Documents, together with 5 sets of full-scale Drawings. Additional quantities of the Contract Documents will be furnished at reproduction cost.

2.03 STARTING THE PROJECT

- A. The CONTRACTOR shall begin construction of the WORK within 10 days after the commencement date stated in the Notice to Proceed, but shall not commence construction prior to the commencement date.

2.04 BEFORE STARTING CONSTRUCTION

- A. Before undertaking each part of the WORK, the CONTRACTOR shall carefully study and compare the Contract Documents to check and verify pertinent figures and dimensions shown thereon with all applicable field measurements. The CONTRACTOR shall promptly report in writing to the ENGINEER any conflict, error, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from the ENGINEER before proceeding with any work affected thereby.
- B. The CONTRACTOR shall submit to the ENGINEER for review those documents called for in each section of the Technical Specifications.

2.05 PRECONSTRUCTION CONFERENCE

- A. The CONTRACTOR shall attend a preconstruction conference with the OWNER, the ENGINEER and others as appropriate to discuss the construction of the WORK in accordance with the Contract Documents.

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2.06 FINALIZING SCHEDULES

- A. At least 7 days before the CONTRACTOR's submittal of its first Application for Payment, the CONTRACTOR, the ENGINEER, and others as appropriate will meet to finalize the schedules submitted in accordance with the Technical Specifications.

GENERAL CONDITIONS

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 INTENT

- A. The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the WORK. The Contract Documents are complementary, what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.
- B. It is the intent of the Contract Documents to describe the WORK, functionally complete, to be constructed in accordance with the Contract Documents. All work, materials, or equipment that may be reasonably inferred from the Contract Documents as being required to produce the completed work shall be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe work, materials, or equipment such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals, or codes or any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual, or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the OWNER, the CONTRACTOR, or the ENGINEER or any of their consultants, agents, or employees from those set forth in the Contract Documents.
- C. If, during the performance of the WORK, the CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, the CONTRACTOR shall immediately report it to the ENGINEER in writing and before proceeding with the work affected thereby. The ENGINEER shall then make a written interpretation, clarification, or correction from the ENGINEER.

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3.02 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS

- A. In resolving conflicts resulting from conflicts, errors, or discrepancies in any of the Contract Documents, the order of precedence shall be as follows:
 - 1. Change Orders
 - 2. Agreement
 - 3. Addenda
 - 4. Contractor's Bid (Bid Form)
 - 5. Supplemental General Conditions
 - 6. Notice Inviting Bids
 - 7. Instructions to Bidders
 - 8. General Conditions
 - 9. Technical Specifications
 - 10. Referenced Standard Specifications
 - 11. Drawings

- B. With reference to the Drawings the order of precedence is as follows:
 - 1. Figures govern over scaled dimensions
 - 2. Detail drawings govern over general drawings
 - 3. Addenda/change order drawings govern over general drawings
 - 4. Contract Drawings govern over standard drawings

3.03 AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS

- A. The Contract Documents may be amended by a Change Order (pursuant to Article 10) to provide for additions, deletions or revisions in the WORK or to modify terms and conditions.

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3.04 REUSE OF DOCUMENTS

- A. Neither the CONTRACTOR, Subcontractor, Supplier, nor any other person or organization performing any of the WORK under a contract with the OWNER shall have or acquire any title to or ownership rights in any of the Drawings, Technical Specifications, or other documents used on the WORK, and they shall not reuse any of them on the extensions of the Project or any other project without written consent.

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ARTICLE 4 - AVAILABILITY OF LANDS; PHYSICAL CONDITIONS: REFERENCE POINTS

4.01 AVAILABILITY OF LANDS

- A. The OWNER shall furnish the lands, rights-of-way and easements upon which the WORK is to be performed and for access thereto, together with other lands designated for the use of the CONTRACTOR in the Contract Documents. Easements for permanent structures or permanent changes in existing major facilities will be obtained and paid for by the OWNER, unless otherwise provided in the Contract Documents. Nothing contained in the Contract Documents shall be interpreted as giving the CONTRACTOR exclusive occupancy of the lands or rights-of-way provided. The CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment. The CONTRACTOR shall not enter upon nor use any property not under the control of the OWNER until a written temporary construction easement agreement has been executed by the CONTRACTOR and the property owner, and a copy of the easement furnished to the ENGINEER prior to its use. Neither the OWNER nor the ENGINEER shall be liable for any claims or damages resulting from the CONTRACTOR's unauthorized trespass or use of any properties.

4.02 PHYSICAL CONDITIONS - SUBSURFACE AND EXISTING STRUCTURES

- A. Explorations and Reports: The paragraph entitled "Physical Conditions" of the Supplementary General Conditions identifies exploration reports and subsurface conditions tests at the site that have been utilized by the ENGINEER in the preparation of the Contract Documents. The CONTRACTOR may rely upon the accuracy of the Technical Data contained in these reports. The CONTRACTOR is responsible for the interpretation, extrapolation or interpolation of all technical as well as nontechnical data and its reliance on the completeness, opinions and interpretation of the reports.
- B. Existing Structures: The paragraph entitled "Physical Conditions" of the Supplementary General Conditions identifies the drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Utilities referred to in Paragraph 4.04 herein) which are at or contiguous to the site that have been utilized by the ENGINEER in the preparation of the Contract Documents. The CONTRACTOR is responsible for the interpretation, extrapolation or interpolation of all technical as well as nontechnical data and its reliance on the completeness, opinions and interpretation of the reports.

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4.03 DIFFERING SITE CONDITIONS

- A. The CONTRACTOR shall notify the ENGINEER upon encountering any of the following unforeseen conditions, hereinafter called "differing site conditions," during the prosecution of the WORK. The CONTRACTOR's notice to the ENGINEER shall be in writing and delivered before the differing site conditions are disturbed, but in no event later than 14 days after their discovery.
 - 1. Subsurface or latent physical conditions at the site of the WORK differing materially from those indicated, described, or delineated in the Contract Documents including those reports and documents discussed in Paragraph 4.02; and
 - 2. Physical conditions at the site of the WORK of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents including those reports and documents discussed in Paragraph 4.02.
- B. The ENGINEER will review the alleged differing site conditions, determine the necessity of obtaining additional explorations or tests with respect to verifying their existence and extent and advise the OWNER in writing of the ENGINEER's findings and conclusions.
- C. If the OWNER concludes that because of newly discovered conditions a change in the Contract Documents is required, a Change Order will be issued as provided in Article 10 to reflect and document the consequences of the differing site conditions.
- D. In each such case, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to the differing site conditions. If the OWNER and the CONTRACTOR are unable to agree as to the amount or length of the Change Order, a claim may be made as provided in Articles 11 and 12.
- E. The CONTRACTOR's failure to give written notice of differing site conditions within 14 days of their discovery and before they are disturbed shall constitute a waiver of all claims in connection therewith, whether direct or consequential in nature.

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4.04 PHYSICAL CONDITIONS - UNDERGROUND UTILITIES

- A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Utilities at or contiguous to the site are based on information and data furnished to the OWNER or the ENGINEER by the owners of Underground Utilities or by others. Unless it is expressly provided in the Supplementary General Conditions and/or the Section entitled "Protection and Restoration of Existing Facilities" of the Technical Specifications, the OWNER and the ENGINEER shall not be responsible for the accuracy or completeness of any Underground Utilities information or data. The CONTRACTOR's responsibility relating to underground utilities are: review and check all information and data, locate all Underground Utilities shown or indicated in the Contract Documents, coordinate the WORK with the owners of Underground Utilities during construction, the safeguard and protect the of Underground Utilities, and repair any damage to Underground Utilities resulting from the WORK. The cost of all these activities will be considered as having been included in the Contact Price.
- B. Not Shown or Indicated: If an Underground Utility not shown or indicated in the Contract Documents is uncovered or revealed at or contiguous to the site and which the CONTRACTOR could not reasonably have been expected to be aware of, the CONTRACTOR shall give written notice to the OWNER of that utility and the ENGINEER, specifying the location of the utility in question.

4.05 REFERENCE POINTS

- A. The ENGINEER will provide one bench mark, near or on the site of the WORK, and will provide two points near or on the site to establish a base line for use by the ENGINEER for alignment control. Unless otherwise specified in the Technical Specifications, the CONTRACTOR shall furnish all other lines, grades, and bench marks required for proper execution of the WORK.
- B. The CONTRACTOR shall preserve all bench marks, stakes, and other survey marks. In case of their removal or destruction by its own employees or by its subcontractor's employees, the CONTRACTOR shall be responsible for the accurate replacement of reference points by professionally qualified personnel at no additional cost to the OWNER.

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ARTICLE 5 - BONDS AND INSURANCE

5.01 PERFORMANCE AND OTHER BONDS

- A. The CONTRACTOR shall furnish Performance and Payment Bonds, each in the amount set forth in the Supplementary General Conditions as security for the faithful performance and payment of all the CONTRACTOR's obligations under the Contract Documents. All insurance companies, sureties, and bond companies shall have an AM Best rating of A- or better, with a Financial Size Category of XII or better. Sureties shall also be listed on the Department of the Treasury's Circular 570, with an acceptable underwriting limitation limit. The Performance Bond shall remain in effect at least until one year after the date of Notice of Completion, except as otherwise provided by Law or Regulation or by the Contract Documents. After the ENGINEER issues the Notice of Completion, the amount of the Performance Bond may be reduced to 10 percent of the Contract Price, or \$1,000, whichever is greater. The CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary General Conditions.
- B. If the surety on any Bond furnished by the CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the WORK is located, the CONTRACTOR shall within 7 days after written approval by the OWNER of a substitute Bond and Surety substitute the approved Bond and Surety.

5.02 INSURANCE

- A. The CONTRACTOR shall purchase and maintain the insurance required under this paragraph. All insurance companies, sureties, and bond companies shall have an AM Best rating of A- or better, with a Financial Size Category of XII or better. Sureties shall also be listed on the Department of the Treasury's Circular 570, with an acceptable underwriting limitation limit. This insurance shall include the specific coverages set out herein and be written for not less than the limits of liability and coverages provided in the Supplementary General Conditions, or required by law, whichever is greater. The CONTRACTOR's liabilities under the Agreement shall not be deemed limited in any way to the insurance coverage required.
- B. The CONTRACTOR shall furnish the OWNER and ENGINEER with certificates indicating the type, amount, class of operations covered, effective dates and expiration dates of all policies. All insurance policies purchased and maintained (or the certificates or other evidence thereof) shall contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days' prior written

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notice has been given to the OWNER by certified mail. All insurance shall remain in effect until the ENGINEER issues the Notice of Completion and at all times thereafter when the CONTRACTOR may be correcting, removing, or replacing defective work in accordance with Paragraph 13.06 or completing punch list items required by the Notice of Completion. In addition, the insurance required herein (except for Worker's Compensation and Employer's Liability) shall name the OWNER, the ENGINEER, and their officers, agents, and employees as "additional insured" under the policies.

1. Workers' Compensation and Employer's Liability: This insurance shall protect the CONTRACTOR against all claims under applicable state workers' compensation laws. The CONTRACTOR shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a workers' compensation law. This policy shall include an "all states" endorsement. The CONTRACTOR shall require each subcontractor similarly to provide Workers' Compensation Insurance for all of the latter's employees to be engaged in the WORK unless its employees are covered by the protection afforded by the CONTRACTOR's Workers' Compensation Insurance. In the event a class of employees is not protected under the Workers' Compensation Statute, the CONTRACTOR or Subcontractor, as the case may be, shall provide adequate employer's liability insurance for the protection of its employees not protected under the statute.
2. Comprehensive General Liability: This insurance shall be written in comprehensive form and shall protect the CONTRACTOR against all claims arising from injuries to persons other than its employees and damage to property of the OWNER or others arising out of any act or omission of the CONTRACTOR or its agents, employees or subcontractors. The policy shall include the following endorsements: (1) Protective Liability endorsement to insure the contractual liability assumed by the CONTRACTOR under the indemnification provisions in these General Conditions; (2) Broad Form Property Damage endorsement; (3) Personal Injury endorsement to cover personal injury liability for intangible harm. The Comprehensive General Liability coverage shall contain no exclusion relative to blasting, explosion, collapse of building, or damage to underground structures.
3. Comprehensive Automobile Liability: This insurance shall be written in comprehensive form. The policy shall protect the CONTRACTOR against all claims for injuries to employees, members of the public and

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damage to property of others arising from the use of CONTRACTOR's motor vehicles, whether they are owned, non-owned, or hired, and whether used or operated on or off the site. The motor vehicle insurance required under this paragraph shall include: (a) motor vehicle liability coverage; (b) personal injury protection coverage and benefits; and (c) uninsured motor vehicle coverage.

4. Subcontractor's Insurance: The CONTRACTOR shall require each of its subcontractors to procure and to maintain Comprehensive General Liability Insurance and Comprehensive Automobile Liability Insurance of the type and in the amounts specified in the Supplementary General Conditions or insure the activities of its subcontractors in the CONTRACTOR's own policy, in like amount.
5. Builder's Risk: This insurance shall be of the "all risk" type, shall be written in completed value form, and shall protect the CONTRACTOR, the OWNER, and the ENGINEER against damage to buildings, structures, materials and equipment. The amount of this insurance shall not be less than the insurable value of the WORK at completion. Builder's risk insurance shall provide for losses to be payable to the CONTRACTOR, the OWNER, and the ENGINEER as their interests may appear. The policy shall contain a provision that in the event of payment for any loss under the coverage provided, the insurance company shall have no rights of recovery against the CONTRACTOR, the OWNER, and the ENGINEER. The Builder's Risk policy shall insure against all risks of direct physical loss or damage to property from any external cause including flood and earthquake. Allowable exclusions, if any, shall be as specified in the Supplementary General Conditions.

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ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 SUPERVISION AND SUPERINTENDENCE

- A. The CONTRACTOR shall supervise and direct the WORK competently and efficiently, devoting the attention and applying the skills and expertise necessary to perform the WORK in accordance with the Contract Documents. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incidental thereto. The CONTRACTOR shall be responsible to see that the finished WORK complies accurately with the Contract Documents.
- B. The CONTRACTOR shall employ the Superintendent named in "Information Required of Bidder" on the work site at all times during the progress of the WORK. The superintendent shall not be replaced without the OWNER's written consent. The superintendent will be the CONTRACTOR's representative at the site and shall have authority to act on behalf of the CONTRACTOR. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR. The CONTRACTOR shall issue all its communications to the OWNER through the ENGINEER.
- C. The CONTRACTOR's superintendent shall be present at the site of the WORK at all times while work is in progress. Failure to observe this requirement shall be considered suspension of the WORK by the CONTRACTOR until the superintendent is again present at the site.

6.02 LABOR, MATERIALS, AND EQUIPMENT

- A. The CONTRACTOR shall provide skilled, competent and suitably qualified personnel to survey and lay out the WORK and perform construction as required by the Contract Documents. When required in writing by the OWNER or ENGINEER, the CONTRACTOR or any subcontractor shall discharge any person who is, in the opinion of the OWNER or ENGINEER, incompetent, disorderly, or otherwise unsatisfactory and shall not again employ the discharged person on the WORK without the consent of the OWNER or ENGINEER. The CONTRACTOR shall at all times maintain good discipline and order at the site.
- B. Except in connection with the safety or protection of persons the WORK, or property at the site or adjacent thereto, all work at the site shall be performed during regular working hours, and the CONTRACTOR will not permit overtime work or the performance of work on Saturday, Sunday or any legal holiday without the OWNER's written consent given after prior written notice

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to the ENGINEER. Except as otherwise provided in this Paragraph, the CONTRACTOR shall receive no additional compensation for overtime work, i.e., work in excess of 8 hours in any one calendar day or 40 hours in any one calendar week, even though such overtime work may be required under emergency conditions and may be ordered by the ENGINEER in writing. Additional compensation will be paid the CONTRACTOR for overtime work in the event extra work is ordered by the ENGINEER and the Change Order specifically authorizes the use of overtime work, but only to the extent that the CONTRACTOR pays overtime wages on a regular basis being paid by for overtime work of a similar nature in the same locality.

- C. All costs of inspection and testing performed during overtime work approved solely for the convenience of the CONTRACTOR shall be borne by the CONTRACTOR. The OWNER shall have the authority to deduct the costs of all inspection and testing from any partial payments otherwise due to the CONTRACTOR.
- D. Unless otherwise specified in the Contract Documents, the CONTRACTOR shall furnish, erect, maintain and remove the construction plant, and temporary works and assume full responsibility for all materials, equipment, labor, transportation, construction equipment, machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities and all other facilities and incidentals necessary for the furnishing, performance testing, start-up and completion of the WORK.
- E. All materials and equipment incorporated into the WORK shall be of new and good quality, except as otherwise provided in the Contract Documents. If required by the ENGINEER, the CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. The CONTRACTOR shall apply, install, connect, erect, use, clean, and condition all material and equipment in accordance with the instructions of the manufacturer and Supplier except as otherwise provided in the Contract Documents.

6.03 ADJUSTING PROGRESS SCHEDULE

- A. The CONTRACTOR shall submit any adjustments in the progress schedule to the ENGINEER for acceptance in accordance with the provisions for "Contractor Submittals" in the Technical Specifications.

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6.04 SUBSTITUTES OR "OR-EQUAL" ITEMS

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to ENGINEER for review under the circumstances described below:

1. "Or-Equal" Items: If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.04.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment ENGINEER determines that: (i) it is a least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;
 - b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Document.
2. Substitute Items
 - a. If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under paragraph 6.04.A.1, it will be considered a proposed substitute item.
 - b. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or

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equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR.

- c. The procedure for review by ENGINEER will be as set forth in paragraph 6.04.A.2.d, as supplemented in the Technical Specifications and as ENGINEER may decide is appropriate under the circumstances.
 - d. CONTRACTOR shall first make written application to ENGINEER for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not use of the proposed substitute item will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute item, and whether or not incorporation or use of the substitute item is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.
- B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in

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ENGINEER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.04.A.2.

- C. **Engineer's Evaluation:** ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.04.A and 6.04.B. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until ENGINEER's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." ENGINEER will advise CONTRACTOR in writing of any negative determination.
- D. **Special Guarantee:** OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.
- E. **ENGINEER's Cost Reimbursement:** ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.04.A.2 and 6.04.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluation each such proposed substitute.
- F. **CONTRACTOR's EXPENSE:** CONTRACTOR shall provide all data in support of any proposed substitute or "or-equal" at CONTRACTOR's expense.

6.05 CONCERNING SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- A. The CONTRACTOR shall be responsible to the OWNER and the ENGINEER for the acts and omissions of its subcontractors and their employees to the same extent as the CONTRACTOR is responsible for the acts and omissions of its own employees. Nothing contained in this paragraph shall create any contractual relationship between any subcontractor and the OWNER or the ENGINEER nor relieve the CONTRACTOR of any liability or obligation under the Agreement.

6.06 PERMITS

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- A. Unless otherwise provided in the Supplementary General Conditions, the CONTRACTOR shall obtain and pay for all construction permits and licenses from the agencies having jurisdiction, including furnishing the insurance and bonds required by such agencies. The costs incurred by the CONTRACTOR in compliance with this paragraph shall not be made the basis for claims for additional compensation. The OWNER shall assist the CONTRACTOR, when necessary, in obtaining such permits and licenses. The CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the WORK, which are applicable at the time of opening of Bids, including all utility connection charges for utilities required by the WORK.

- B. The CONTRACTOR shall pay all license fees and royalties and assume all costs when any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others when issued in the construction of the WORK or incorporated into the WORK. If a particular invention, design, process, product, or device is specified in the Contract Documents for incorporation into or use in the construction of the WORK and if to the actual knowledge of the OWNER or the ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of these rights shall be disclosed by the OWNER in the Contract Documents. The CONTRACTOR shall indemnify, defend and hold harmless the OWNER and the ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses, and expenses (including attorneys' fees and court costs) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the WORK or resulting from the incorporation in the WORK of any invention, design, process, product, or device not specified in the Contract Documents.

6.07 LAWS AND REGULATIONS

- A. The CONTRACTOR shall observe and comply with all federal, state, and local laws, ordinances, codes, orders, and regulations which in any manner affect those engaged or employed on the WORK, the materials used in the WORK, or the conduct of the WORK. If any discrepancy or inconsistency should be discovered in the Contract Documents in relation to any law, ordinance, code, order, or regulations, the CONTRACTOR shall report the same in writing to the ENGINEER. The CONTRACTOR shall indemnify, defend and hold harmless the OWNER, the ENGINEER and their officers, agents, and employees against all claims and from violation of any law, ordinance, code, order, or regulation, whether by CONTRACTOR or by its employees or subcontractors. Any particular law or regulation specified or

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referred to elsewhere in the Contract Documents shall not in any way limit the obligation of the CONTRACTOR to comply with all other provisions of federal, state, and local laws and regulations. Where an individual State act on occupational safety and health standards has been approved by Federal authority, then the provision of said State act shall control.

6.08 EQUAL OPPORTUNITY

- A. The Contractor agrees to abide by: the provisions of Title VII of the Civil Rights Act of 1964 (42USC § § 2000e et seq.), which prohibits discrimination against any employee or applicant for employment on the basis of race, religion, color, or national origin; Executive Order No. 11246, as amended, which prohibits discrimination on the basis of sex; 45 CFR 90, which prohibits discrimination on the basis of age; Section 504 of the Rehabilitation Act of 1973, (42 USC § 794), which prohibits discrimination on the basis of handicap; Utah Executive Order dated June 30, 1989, which prohibits sexual harassment in the workplace; and the Americans with Disabilities Act (42 USC § § 12111 et seq.), which prohibits discrimination against qualified employees and applicants with a disability.

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6.09 TAXES

- A. The CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by the CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the WORK.

6.10 USE OF PREMISES

- A. The CONTRACTOR shall confine construction equipment, stored materials and equipment, and other operations of workers to (1) the Project site, (2) the land and areas identified for the CONTRACTOR's use in the Contract Documents, and (3) other lands whose use is acquired by Laws and Regulations, rights-of-way, permits, and easements. The CONTRACTOR shall be fully responsible to the owner and occupant of such lands for any damage to the lands or areas contiguous thereto, resulting from the performance of the WORK or otherwise. Should any claim be made against the OWNER or the ENGINEER by owner or occupant of lands because of the performance of the WORK, the CONTRACTOR shall promptly settle the claim by agreement, or resolve the claim through litigation. The CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify, defend, and hold the OWNER and the ENGINEER harmless from and against all claims, damages, losses, and expenses (including, but not limited to, fees of engineers, architects, attorneys, and other professionals and court costs) arising directly, indirectly, or consequentially out of any action, legal or equitable, brought by any owner or occupant of land against the OWNER or the ENGINEER to the extent the claim is based or arises out of the CONTRACTOR's performance of the WORK.

6.11 SAFETY AND PROTECTION

- A. The CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the WORK. The CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 - 1. All employees on the WORK and other persons and organizations who may be affected thereby.
 - 2. All the WORK and materials and equipment to be incorporated therein, whether in storage on or off the site; and

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3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
- B. The CONTRACTOR shall comply with all applicable Laws and Regulations (whether referred to herein or not) of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss and shall erect and maintain all necessary safeguards for such safety and protection. The CONTRACTOR shall notify owners of adjacent property and utilities when prosecution of the WORK may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. Unless the CONTRACTOR otherwise designates in writing a different individual as the responsible individual, the CONTRACTOR's superintendent shall be CONTRACTOR's representative at the site whose duty shall be the prevention of accidents.

6.12 SHOP DRAWINGS AND SAMPLES

- A. After checking and verifying all field measurements and after complying with the applicable procedures specified in the Technical Specifications, the CONTRACTOR shall submit all shop drawings to the ENGINEER for review and approval in accordance with the approved schedule for shop drawings submittals specified in the Technical Specifications.
- B. The CONTRACTOR shall also submit to the ENGINEER for review and approval all samples in accordance with the approved schedule of sample submittals specified in the Technical Specifications.
- C. Before submitting shop drawings or samples, the CONTRACTOR shall determine and verify all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar data with respect thereto and review or coordinate each shop drawing or sample with other shop drawings and samples and with the requirements of the WORK and the Contract Documents.

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6.13 CONTINUING THE WORK

- A. The CONTRACTOR shall carry on the WORK and adhere to the progress schedule during all disputes or disagreements with the OWNER. No work shall be delayed or postponed pending resolution of any dispute or disagreement, except as the CONTRACTOR and the OWNER may otherwise mutually agree in writing.

6.14 INDEMNIFICATION

- A. To the fullest extent permitted by Laws and Regulations, the CONTRACTOR shall indemnify, defend, and hold harmless the OWNER, the ENGINEER, and their officers, agents, and employees, against and from all claims and liability arising under or by reason of the Agreement or any performance of the WORK, but not from the sole negligence or willful misconduct of the OWNER and/or the ENGINEER. Such indemnification by the CONTRACTOR shall include but not be limited to the following:
 - 1. Liability or claims resulting directly or indirectly from the negligence or carelessness of the CONTRACTOR or its agents in the performance of the WORK, or in guarding or maintaining the same, or from any improper materials, implements, or appliances used in its construction, or by or on account of any act or omission of the CONTRACTOR or its agents;
 - 2. Liability or claims arising directly or indirectly from or based on the violation of any law, ordinance, regulation, order, or decree, whether by the CONTRACTOR or its agents;
 - 3. Liability or claims arising directly or indirectly from the use or manufacture by the CONTRACTOR, its agents, or the OWNER in the performance of this Agreement of any copyrighted or uncopyrighted composition, secret process, patented or unpatented invention, article, or appliance, unless otherwise specifically stipulated in this Agreement.
 - 4. Liability or claims arising directly or indirectly from the breach of any warranties, whether express or implied, made to the OWNER or any other parties by the CONTRACTOR or its agents;
 - 5. Liabilities or claims arising directly or indirectly from the willful misconduct of the CONTRACTOR or its agents; and,

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6. Liabilities or claims arising directly or indirectly from any breach of the obligations assumed herein by the CONTRACTOR.
 - B. The CONTRACTOR shall reimburse the OWNER, and the ENGINEER for all costs and expense, (including but not limited to fees and charges of engineers, architects, attorneys, and other professional and court costs) incurred by the OWNER, and the ENGINEER in enforcing the provisions of this Paragraph.
 - C. The indemnification obligation under this Paragraph shall not be limited in any way by any limitation of the amount or type of damages, compensation, or benefits payable by or for the CONTRACTOR or any such subcontractor or other person or organization under workers' compensation acts, disability benefit acts, or other employee benefit acts.

6.15 CONTRACTOR'S DAILY REPORTS

- A. The CONTRACTOR shall complete a daily report indicating manpower, major equipment, subcontractors, weather conditions, etc., involved in the performance of the WORK. The daily report shall be completed on forms prepared by the CONTRACTOR and acceptable to the ENGINEER, and shall be submitted to the ENGINEER at the conclusion of each work day.

6.16 ASSIGNMENT OF CONTRACT

- A. The CONTRACTOR shall not assign, sublet, sell, transfer, or otherwise dispose of the Agreement or any portion thereof, or its right, title, or interest therein, or obligations thereunder, without the written consent of the OWNER except as imposed by law. If the CONTRACTOR violates this provision, the Agreement may be terminated at the option of the OWNER. In such event, the OWNER shall be relieved of all liability and obligations to the CONTRACTOR and to its assignee or transferee, growing out of such termination.

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ARTICLE 7 - OTHER WORK

7.01 RELATED WORK

- A. The OWNER may perform other work related to the Project at the site by the OWNER's own forces, have other work performed by utility owners, or let other direct contracts for the performance of the other work which may contain General Conditions similar to these. If the fact that such other work is to be performed was not noted in the Contract Documents, written notice thereof will be given to the CONTRACTOR prior to commencing any other work.
- B. The CONTRACTOR shall afford each utility owner and other contractor who is a party to a direct contract (or the OWNER, if the OWNER is performing the additional work with the OWNER's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of the other work. The CONTRACTOR shall properly connect and coordinate the WORK with the other work. The CONTRACTOR shall do all cutting, fitting, and patching of the WORK that may be required to make its several parts come together properly and integrate with the other work. The CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and shall only cut or alter their work with the written consent of the ENGINEER and the others whose work will be affected.
- C. If the proper execution or results of any part of the CONTRACTOR's work depends upon the integration of work with the completion of other work by any other contractor or utility owner (or the OWNER), the CONTRACTOR shall inspect and report to the ENGINEER in writing all delays, defects, or deficiencies in the other work that renders it unavailable or unsuitable for proper integration with the CONTRACTOR's work. Except for the results or effects of latent or nonapparent defects and deficiencies in the other work, the CONTRACTOR's failure to report will constitute an acceptance of the other work as fit and proper for integration with the CONTRACTOR's work and as a waiver of any claim for additional time or compensation associated with the integration of the CONTRACTOR's work with the other work.

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7.02 COORDINATION

- A. If the OWNER contracts with others for the performance of other work on the Project at the site, a coordinator will be identified to the extent that the coordinator can be identified at this time, in the Supplementary General Conditions and delegated the authority and responsibility for coordination of the activities among the various contractors. The specific matters over which the coordinator has authority and the extent of the coordinator's authority and responsibility will be itemized in the Supplementary General Conditions or in a notice to the CONTRACTOR at such time as the identity of the coordinator is determined.

GENERAL CONDITIONS

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 COMMUNICATIONS

- A. The OWNER shall issue all its communications to the CONTRACTOR through the ENGINEER.

8.02 PAYMENTS

- A. The OWNER shall make payments to the CONTRACTOR as provided in Paragraphs 14.05 and 14.09.

8.03 LANDS, EASEMENTS, AND SURVEYS

- A. The OWNER's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. The OWNER shall identify and make available to the CONTRACTOR copies of exploration reports and subsurface conditions tests at the site and in existing structures which have been utilized by the ENGINEER in preparing the Drawings and Technical Specifications as set forth in Paragraph 4.02

8.04 CHANGE ORDERS

- A. The OWNER shall execute approved Change Orders for the conditions described in Paragraph 10.01D.

8.05 INSPECTIONS AND TESTS

- A. The OWNER's responsibility with respect to inspection, tests, and approvals is set forth in Paragraph 13.03B.

8.06 SUSPENSION OF WORK

- A. In connection with the OWNER's right to stop work or suspend work, see Paragraphs 13.04 and 15.01. Paragraphs 15.02 and 15.03 deal with the OWNER's right to terminate services of the CONTRACTOR under certain circumstances.

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ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 OWNER'S REPRESENTATIVE

- A. The ENGINEER will be the OWNER's representative during the construction period. The duties, responsibilities and the limitations of authority of the ENGINEER as the OWNER's representative during construction are set forth in a separate agreement with the OWNER and are summarized hereafter.

9.02 VISITS TO SITE

- A. The ENGINEER will make visits to the site during construction to observe and inspect the progress and quality of the WORK and to determine, in general if the WORK is proceeding in accordance with the Contract Documents.

9.03 PROJECT REPRESENTATION

- A. The ENGINEER will furnish a Project Representative to observe and inspect the performance of the WORK. The Project Representative and/or other authorized agents of the Engineer shall serve as the chief Owner/Engineer contact(s) with the Contractor during the construction phase. All submittals shall be delivered to and communications between the Engineer and the Contractor shall be handled by the Project Representative and/or other authorized agents. The Project Representative shall be the chief authorized representative of the Owner and the Engineer at the site of the work in all on-site relations with the Contractor.

9.04 CLARIFICATIONS AND INTERPRETATIONS

- A. The ENGINEER will issue with reasonable promptness written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as the ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents.

9.05 AUTHORIZED VARIATIONS IN WORK

- A. The ENGINEER may authorize minor variation in the WORK as described in the Contract Documents when such variations do not involve an adjustment in the Contract Price or the Contract Time and are consistent with the overall intent of the Contract Documents. These variations shall be accomplished by issuing a Field Order. The issuance of a Field Order requires the CONTRACTOR to perform the work described in the order promptly. If the

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CONTRACTOR believes that a Field Order justifies an increase in the Contract Price or an extension of the Contract Time and parties are unable to agree as the amount or extent thereof, the CONTRACTOR may make a claim therefor as provided in Article 11 or 12.

9.06 REJECTION OF DEFECTIVE WORK

- A. The ENGINEER is authorized to reject work which the ENGINEER believes to be defective and require special inspection or testing of the WORK as provided in Paragraph 13.03G, whether or not the WORK is fabricated, installed, or completed.

9.07 CONTRACTOR SUBMITTALS, CHANGE ORDERS, AND PAYMENTS

- A. The ENGINEER will review for approval all Contractor submittals, including shop drawings, samples, substitutes, and "or equal" items, etc., in accordance with the procedures set forth in the Technical Specifications.
- B. In connection with the ENGINEER's responsibilities as to Change Orders, see Articles 10, 11, and 12.
- C. In connection with the ENGINEER's responsibilities with respect to Applications for Payment, see Article 14.

9.08 DECISIONS ON DISPUTES

- A. All claims, disputes, and other matters concerning the acceptability of the WORK, the interpretation of the requirements of the Contract Documents pertaining to the performance of the WORK, and claims for changes in the Contract Price or Contract Time under Articles 11 and 12 will be referred to the ENGINEER in writing with a request for formal decision in accordance with this paragraph. The ENGINEER will render a decision in writing within 30 days of receipt of the request. Written notice of each claim, dispute, or other matter will be delivered by the CONTRACTOR to the ENGINEER promptly (but in no event later than 30 days) after the occurrence of the event. Written supporting data will be submitted to the ENGINEER with the written claim unless the ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim.
- B. When reviewing the claim or dispute, the ENGINEER will not show partiality to the OWNER or the CONTRACTOR and will incur no liability in connection with any interpretation or decision rendered in good faith. The ENGINEER's rendering of a decision with respect to any claim, dispute, or other matter (except any which have been waived by the making or acceptance of final

GENERAL CONDITIONS

payment as provided in Paragraph 14.12) shall be a condition precedent to the OWNER's or the CONTRACTOR's exercise of their rights or remedies under the Contract Documents or by Law or Regulations with respect to the claim, dispute, or other matter.

9.09 LIMITATION ON ENGINEER'S RESPONSIBILITIES

- A. Neither the ENGINEER's authority to act pursuant to its agreement with the OWNER, nor the description of that authority under this Article 9, nor any other description of the ENGINEER's responsibility in the Contract Documents, nor any decision made by the ENGINEER in good faith either to exercise or not exercise its authority, shall give rise to any duty or responsibility on the part of the ENGINEER to the CONTRACTOR, any Subcontractor, any Supplier, any surety or any other person or organization performing any part of the WORK.
- B. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as reviewed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review, or judgement of the ENGINEER as to the WORK, it is intended that such requirement, direction, review, or judgment will be solely to evaluate the WORK for compliance with the Contract Documents, unless there is a specific statement indicating otherwise. The use of any such term or adjective shall not be effective to assign to the ENGINEER any duty or authority to supervise or direct the performance of the WORK or any duty or authority to undertake responsibility contrary to the provisions of its agreement with the OWNER.
- C. The ENGINEER will not be responsible for the CONTRACTOR's means, methods, techniques, sequences, or procedures of construction not specified in the Contract Documents or the safety precautions and programs incident thereto.
- D. The ENGINEER will not be responsible for the acts or omissions of the CONTRACTOR nor of any subcontractor, supplier, or any other person or organization performing any of the WORK to the extent that such acts or omissions are not reasonably discoverable considering the level of observation and inspection required by the ENGINEER's agreement with the OWNER.

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ARTICLE 10 - CHANGES IN THE WORK

10.01 GENERAL

- A. Without invalidating the Agreement and without notice to any surety, the OWNER may at any time or from time to time, order additions, deletions, or revisions in the WORK; these will be authorized by a written Field Order and/or a Change Order issued by the ENGINEER. Upon receipt of any of these documents, the CONTRACTOR shall promptly proceed with the work involved pursuant to the applicable conditions of the Contract Documents.
- B. If the OWNER and the CONTRACTOR are unable to agree upon the increase or decrease in the Contract Price or an extension or shortening of the Contract Time, if any, that should be allowed as a result of a Field Order, a claim may be made therefor as provided in Articles 11 or 12.
- C. The CONTRACTOR shall not be entitled to an increase in the Contract Price nor an extension of the Contract Time with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented by Change Order, except in the case of an emergency and except in the case of uncovering work provided in the Paragraph 13.03G.
- D. The OWNER and the CONTRACTOR shall execute appropriate Change Orders covering:
 - 1. Changes in the WORK which are ordered by the OWNER pursuant to Paragraph 10.01A;
 - 2. Changes required because of acceptance of defective work under Paragraph 13.06;
 - 3. Changes in the Contract Price or Contract Time which are agreed to by the parties; or
 - 4. Any other changes agreed to by the parties.
- E. If the provisions of any Bond require notice of any change to be given to a surety, the giving of these notices will be the CONTRACTOR's responsibility. The CONTRACTOR shall provide for the amount of each applicable Bond to be adjusted accordingly.

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10.02 ALLOWABLE QUANTITY VARIATIONS

- A. Whenever a unit price and quantity have been established for a bid item in the Contract Documents, the quantity stated may be increased or decreased to a maximum of 25 percent with no change in the unit price. An adjustment in the quantity in excess of 25 percent will be sufficient to justify a change in the unit price. Changes in the quantity of all bid items established in the Contract Documents, regardless of whether the changes are more or less than 25 percent and at the unit price established in the Contract Documents or adjusted otherwise, shall be documented by Change Orders.

- B. In the event a part of the WORK is to be entirely eliminated and no lump sum or unit price is named in the Contract Documents to cover the eliminated work, the price of the eliminated work shall be agreed upon in writing by the OWNER and the CONTRACTOR. If the OWNER and the CONTRACTOR fail to agree upon the price of the eliminated work, the price shall be determined in accordance with the provisions of Article 11.

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ARTICLE 11 - CHANGE OF CONTRACT PRICE

11.01 GENERAL

- A. The Contract Price constitutes the total compensation payable to the CONTRACTOR for performing the WORK. Except as directed by Change Orders, all duties, responsibilities, and obligations assigned to or undertaken by the CONTRACTOR shall be at its expense without change in the Contract Price.
- B. The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price shall be based on written notice delivered by the CONTRACTOR to the ENGINEER promptly (but in no event later than 30 days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered with the claim, unless the ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim, and shall be accompanied by the CONTRACTOR's written statement that the amount claimed covers all known amounts (direct, indirect, and consequential) to which the CONTRACTOR is entitled as a result of the occurrence of the event. If the OWNER and the CONTRACTOR cannot otherwise agree on the amount involved, all claims for adjustment in the Contract Price shall be determined by the ENGINEER in accordance with Paragraph 9.08A. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this Paragraph 11.01B.
- C. The value of any work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:
 - 1. Where the work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved.
 - 2. By mutual acceptance of a lump sum, which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.
 - 3. On the basis of the cost of work (determined as provided in Paragraphs 11.02 and 11.03) plus a CONTRACTOR's fee for overhead and profit (determined as provided in Paragraph 11.04).

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11.02 COST OF WORK (BASED ON TIME AND MATERIALS)

- A. General: The term "cost of work" means the sum of all costs necessarily incurred and paid by the CONTRACTOR for labor, materials, and equipment in the proper performance of work. Except as otherwise may be agreed to in writing by the OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project.
- B. Labor: The cost of labor used in performing work by the CONTRACTOR, a subcontractor, or other forces will be the sum of the following:
1. The actual wages paid plus any employer payments to, or on behalf of workers for fringe benefits including health and welfare, pension, vacation, and similar purposes. The cost of labor may include the rates paid to foremen when determined by the ENGINEER that the services of foremen do not constitute a part of the overhead allowance.
 2. All payments imposed by state and federal laws including, but not limited to, compensation insurance, and social security payments.
 3. The amount paid for subsistence and travel required by collective bargaining agreements, or in accordance with the regular practice of the employer.

At the beginning of the extra work and as later requested by the ENGINEER, the CONTRACTOR shall furnish the ENGINEER proof of labor compensation rates being paid.

- C. Materials: The cost of materials used in performing work will be the cost to the purchaser, whether CONTRACTOR or subcontractor, from the supplier thereof, except as the following are applicable:
1. Trade discounts available to the purchase shall be credited to the OWNER notwithstanding the fact that such discounts may not have been taken by the CONTRACTOR.
 2. For materials secured by other than a direct purchase and direct billing to the purchaser, the cost shall be deemed to be the price paid to the actual supplier as determined by the ENGINEER. Markup except for actual costs incurred in the handling of such materials will not be allowed.

GENERAL CONDITIONS

3. Payment for materials from sources owned wholly or in part by the purchaser shall not exceed the price paid by the purchaser for similar materials from these sources on extra work items or current wholesale price for the materials delivered to the work site, whichever is lower.
 4. If in the opinion of the ENGINEER the cost of material is excessive, or the CONTRACTOR does not furnish satisfactory evidence of the cost of the material, then the cost shall be deemed to be the lowest current wholesale price for the quantity concerned, delivered to the work site less trade discount. The OWNER reserves the right to furnish materials for the extra work and no claim shall be made by the CONTRACTOR for costs and profit on such materials.
- D. Equipment: The CONTRACTOR will be paid for the use of equipment at the rental rate listed for the equipment specified in the Supplementary General Conditions. The rental rate will be used to compute payments for equipment whether the equipment is under the CONTRACTOR's control through direct ownership, leasing, renting, or another method of acquisition. The rental rate to be applied for use of each item of equipment shall be the rate resulting in the least total cost to the Owner for the total period of use. If it is deemed necessary by the CONTRACTOR to use equipment not listed in the Supplementary General Conditions an equitable rental rate for the equipment will be established by the ENGINEER. The CONTRACTOR may furnish cost data which might assist the ENGINEER in the establishing the rental rate.
1. All equipment shall, in the opinion of the ENGINEER, be in good working condition and suitable for the purpose for which the equipment is to be used.
 2. Before construction equipment is used on the extra work, the CONTRACTOR shall plainly stencil or stamp an identifying number thereon at a conspicuous location, and shall furnish to the ENGINEER, in duplicate, a description of the equipment and its identifying number.
 3. Unless otherwise specified, manufacturers' ratings and manufacturer approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least the minimum rating recommended by the manufacturer.
 4. Individual pieces of equipment or tools having a replacement value of \$100 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefore.

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5. Rental time will not be allowed while equipment is inoperative due to breakdowns.
- E. Equipment on the Work: The rental time to be paid for equipment used on the WORK shall be the time the equipment is in productive operation on the extra work being performed and, in addition, shall include the time required to move the equipment to the location of the extra work and return it to the original location or to another location that requires no more moving time than that required to return it to its original location. Moving time will not be paid if the equipment is used on other than the extra work, even though located at the site of the extra work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power. However, no payment will be made for loading and transporting costs when the equipment is used on other than the extra work even though located at the site of the extra work. The following shall be used in computing the rental time of equipment on the WORK.
1. When hourly rates are listed, any part of an hour less than 30 minutes of operation shall be considered to be 1/2-hour of operation, and any part of an hour in excess of 30 minutes will be considered one hour of operation.
 2. When daily rates are listed, any part of a day less than 4 hours operation shall be considered to be 1/2-day of operation. When owner-operated equipment is used to perform extra work to be paid for on a time and materials basis, the CONTRACTOR will be paid for the equipment and operator, as set forth in Paragraph (3), (4), and (5), following.
 3. Payment for the equipment will be made in accordance with the provisions in Paragraph 11.02D, herein.
 4. Payment for the cost of labor and subsistence or travel allowance will be made at the rates paid by the CONTRACTOR to other workers operating similar equipment already on the WORK, or in the absence of such labor, established by collective bargaining agreements for the type of workmen and location of the extra work, whether or not the operator is actually covered by such an agreement. A labor surcharge will be added to the cost of labor described herein in accordance with the provisions of Paragraph 11.02B, herein, which surcharge shall constitute full compensation for payments imposed by state and federal laws and all payments made to on behalf of workers other than actual wages.

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5. To the direct cost of equipment rental and labor, computed as provided herein, will be added the allowances for equipment rental and labor as provided in Paragraph 11.04, herein.

11.03 SPECIAL SERVICES

- A. Special work or services are defined as that work characterized by extraordinary complexity, sophistication, or innovation or a combination of the foregoing attributes which are unique to the construction industry. The following may be considered by the ENGINEER in making estimates for payment for special services:
 1. When the ENGINEER and the CONTRACTOR, by agreement, determine that a special service or work is required which cannot be performed by the forces of the CONTRACTOR or those of any of its subcontractors, the special service or work may be performed by an entity especially skilled in the work to be performed. After validation of invoices and termination of market values by the ENGINEER, invoices for special services or work based upon the current fair market value thereof may be accepted without complete itemization of labor, material, and equipment rental cost.
 2. When the CONTRACTOR is required to perform work necessitating special fabrication or machining process in a fabrication or a machine shop facility away from the job site, the charges for that portion of the work performed at the off-site facility may by agreement, be accepted as a special service and accordingly, the invoices from the work may be accepted without detailed itemization.
 3. All invoices for special services will be adjusted by deducting all trade discounts offered or available, whether the discounts were taken or not. In lieu of the allowances for overhead and profit specified in Paragraph 11.04, herein, an allowance of 5 percent will be added to invoices for special services.
- B. All work performed hereunder shall be subject to all of the provisions of the Contract Documents and the CONTRACTOR's sureties shall be bound with reference hereto as under the original Agreement. Copies of all amendments to surety bonds or supplemental surety bonds shall be submitted to the OWNER for review prior to the performance of any work hereunder.

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11.04 CONTRACTOR'S FEE

- A. WORK ordered on the basis of time and materials will be paid for at the actual necessary cost as determined by the ENGINEER, plus allowances for overhead and profit. For extra work involving a combination of increases and decreases in the WORK the actual necessary cost will be the arithmetic sum of the additive and deductive costs. The allowance for overhead and profit shall include full compensation for superintendence, bond and insurance premiums, taxes, office expenses, and all other items of expense or cost not included in the cost of labor, materials, or equipment provided for under Paragraphs 11.02B, C, and D, herein including extended overhead and home office overhead. The allowance for overhead and profit will be made in accordance with the following schedule:

ACTUAL NECESSARY COST OVERHEAD AND PROFIT ALLOWANCE

Labor	10 percent
Materials	10 percent
Equipment	10 percent

- B. It is understood that labor, materials, and equipment may be furnished by the CONTRACTOR or by the subcontractor, the allowance specified herein shall be applied to the labor, materials, and equipment costs of the subcontractor, to which the CONTRACTOR may add 5 percent of the subcontractor's total cost for the extra work. Regardless of the number of hierarchical tiers of subcontractors, the 5 percent increase above the subcontractor's total cost which includes the allowances for overhead and profit specified herein may be applied one time only for each separate work transaction.

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ARTICLE 12 - CHANGE OF CONTRACT TIME

12.01 GENERAL

- A. The Contract Time may only be changed by a Change Order. Any claim for an extension of the Contract time shall be based on written notice delivered by the CONTRACTOR to the ENGINEER promptly (but in no event later than 30 days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within 30 days after such occurrence (unless the ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR's written statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Time shall be determined by the ENGINEER in accordance with Paragraph 9.08 if the OWNER and the CONTRACTOR cannot otherwise agree. No claim for an adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this Paragraph 12.01A.
- B. The Contract Time will be extended in an amount equal to time lost if the CONTRACTOR makes a claim as provided in Paragraph 12.01A and the ENGINEER determines that the delay was caused by events beyond the control of the CONTRACTOR. Examples of events beyond the control of the CONTRACTOR include acts or neglect by the OWNER or others performing additional work as contemplated by Article 7, or by acts of God or of the public enemy, fire, floods, epidemics, quarantine restrictions, strikes, labor disputes, sabotage, or freight embargoes.
- C. All time limits stated in the Contract Documents are of the essence.
- D. None of the aforesaid time extensions shall entitle the CONTRACTOR to any adjustment in the Contract Price or any damages for delay. Furthermore, the CONTRACTOR hereby indemnifies and holds harmless the OWNER and ENGINEER, their officers, agents and employees from and against all claims, damages, losses and expenses (including lost property and attorney's fees) arising out of or resulting from the temporary suspension of work whether for the OWNER's convenience as defined in Article 15.01 (a) or for whatever other reasons including the stoppage of work by the ENGINEER for the CONTRACTOR's failure to comply with any order issued by the ENGINEER.

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12.02 EXTENSIONS OF THE TIME FOR DELAY DUE TO INCLEMENT WEATHER

- A. "Inclement weather" is any weather condition or conditions resulting immediately therefrom, causing the CONTRACTOR to suspend construction operations or preventing the CONTRACTOR from proceeding with at least 75 percent of the normal labor and equipment force engaged on the WORK.
- B. Should the CONTRACTOR prepare to begin work at the regular starting time at the beginning of any regular work shift on any day on which inclement weather, or its effects on the condition of the WORK prevents work from beginning at the usual starting time and the crew is dismissed as a result thereof, the CONTRACTOR will not be charged for a working day whether or not conditions change thereafter during the day and the major portion of the day could be considered to be suitable for construction operations.
- C. The CONTRACTOR shall base its construction schedule upon the inclusion of the number of days of inclement weather specified in the paragraph entitled "Inclement weather delays" of the Supplementary General Conditions. No extension of the Contract Time due to inclement weather will be considered until after the stated number of days of inclement weather has been reached. However, no reduction in Contract Time will be made if the number of inclement weather days is not reached.

12.03 EXTENSIONS OF TIME FOR OTHER DELAYS

- A. If the CONTRACTOR is delayed in completion of the WORK beyond the time named in the Contract Documents for the completion of the WORK, by acts of God or of the public enemy, fire, floods, epidemics, quarantine restrictions, strikes, labor disputes, industry-wide shortage of raw materials, sabotage or freight embargoes, the CONTRACTOR shall be entitled to an adjustment in the Contract Time. No such adjustment will be made unless the CONTRACTOR shall notify the ENGINEER in writing of the causes of delay within 15 calendar days from the beginning of any such delay. The ENGINEER shall ascertain the facts and the extent of the delay. No adjustment in time shall be made for delays resulting from noncompliance with the Contract, accidents, failure on the part of the CONTRACTOR to carry out the provisions of the Contract including failure to provide materials, equipment or workmanship meeting the requirements of the Contract Documents; the occurrence of such events shall not relieve the CONTRACTOR from the necessity of maintaining the required progress.
- B. In the event that Contract completion is delayed beyond the Contract Time named in the Specifications by reason of shortages of raw materials required for CONTRACTOR-furnished items, the CONTRACTOR shall be entitled to

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an adjustment in the Contract Time in like manner as if the WORK had been suspended for the convenience and benefit of the OWNER; provided, however, that the CONTRACTOR shall furnish documentation acceptable to the OWNER and ENGINEER that he placed or attempted to place firm orders with suppliers at a reasonable time in advance of the required date of delivery of the items in question, that such shortages shall have developed following the date such orders were placed or attempts made to place same, that said shortages are general throughout the affected industry, that said shortages are shortages of raw materials required to manufacture CONTRACTOR-furnished items and not simply failure of CONTRACTOR's suppliers to manufacture, assemble or ship items on time, and that the CONTRACTOR shall, to the degree possible, have made revisions in the sequence of his operations, within the terms of the Contract, to offset the expected delay. The CONTRACTOR shall notify the ENGINEER, in writing, concerning the cause of delay, within 15 calendar days of the beginning of such delay. The validity of any claim by the CONTRACTOR to an adjustment in the Contract Time shall be determined by the OWNER acting through the ENGINEER, and his findings thereon shall be based on the ENGINEER's knowledge and observations of the events involved and documentation submitted by the CONTRACTOR, showing all applicable facts relative to the foregoing provisions. Only the physical shortage of raw materials will be considered under these provisions as a cause for adjustment of time and no consideration will be given to any claim that items could not be obtained at a reasonable, practical, or economical cost or price, unless it is shown to the satisfaction of the OWNER that such items could have been obtained only at exorbitant prices entirely out of line with current rates taking into account the quantities involved and the usual practices in obtaining such quantities.

- C. If the CONTRACTOR is delayed in completion of the WORK by reason of changes made under the provisions of Article 10 or changed conditions as provided under Article 4.03, or by failure of the OWNER to acquire or clear right-of-way as provided under Article 15.01, or by any act of the ENGINEER or of the OWNER, not contemplated by the Contract, an adjustment in the Contract time will be made by the OWNER in like manner as if the WORK had been suspended for the convenience and benefit of the OWNER, except, that if the WORK is increased as a result of changes, the OWNER, at his sole discretion, may grant an adjustment in the number of calendar days for completion of the Contract. In the event of such delay, the CONTRACTOR shall notify the ENGINEER in writing of the causes of delay within 15 calendar days from the beginning of any such delay.

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ARTICLE 13 - WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

13.01 WARRANTY, GUARANTEE AND MAINTENANCE PERIOD

- A. The CONTRACTOR warrants and guarantees to the OWNER and the ENGINEER that all work, equipment, materials and workmanship are in accordance with the Contract Documents and are not defective. Prompt notice of defects discovered by the OWNER or ENGINEER shall be given to the CONTRACTOR. All defective work, whether or not in place, may be rejected, corrected, or accepted as provided in this Article 13.

- B. If within one (1) year after the date of Final Completion, as set by the Engineer's Notice of Completion, or a longer period of time prescribed by Laws or Regulations or by the terms of any applicable special guarantee or specific provisions of the Contract Documents, any work is found to be defective, the OWNER shall notify the CONTRACTOR in writing and the CONTRACTOR shall promptly, without cost to the OWNER and in accordance with the OWNER's written notification, either correct the defective work, or, if it has been rejected by the OWNER, remove it from the site and replace it with non-defective work. In the event the CONTRACTOR does not promptly comply with the notification, or in an emergency where delay would cause serious risk of loss or damage, the OWNER may have the defective work corrected or rejected work removed and replaced. All direct, indirect, and consequential costs of the removal and replacement including but not limited to fees and charges of engineers, architects, attorneys and other professionals will be paid by the CONTRACTOR. This paragraph shall not be construed to limit nor diminish the CONTRACTOR's absolute guarantee to complete the WORK in accordance with the Contract Documents.

13.02 ACCESS TO WORK

- A. The ENGINEER, other representatives of the OWNER, testing agencies, and governmental agencies with jurisdictional interests shall have access to the work at reasonable times for their observation, inspections, and testing. The CONTRACTOR shall provide proper and safe conditions for their access.

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13.03 TESTS AND INSPECTIONS

- A. The CONTRACTOR shall give the ENGINEER timely notice of readiness of the WORK for all required inspections, tests, or approvals.
- B. If Laws or Regulations of any public body other than the OWNER, with jurisdiction over the WORK require any work to be specifically inspected, tested, or approved, the CONTRACTOR shall pay all costs in connection therewith. The CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with the OWNER's or the ENGINEER's acceptance of a Supplier of materials or equipment proposed as a substitution or-equal to be incorporated in the WORK and of materials or equipment submitted for review prior to the CONTRACTOR's purchase for incorporation in the WORK. The cost of all inspections, tests, and approvals with the exception of the above which are required by the Contract Documents shall be paid by the OWNER (unless otherwise specified).
- C. The ENGINEER will make, or have made, such inspections and test as the ENGINEER deems necessary to see that the WORK is being accomplished in accordance with the requirements of the Contract Documents. The Contractor without additional cost to the OWNER, shall provide the labor and equipment necessary to make the WORK available for inspections. Unless otherwise specified in the Supplementary General Conditions or the OWNER-ENGINEER Agreement, all other costs of inspection and testing will be borne by the OWNER. In the event the inspections or tests reveal non-compliance with the requirements of the Contract Documents, the CONTRACTOR shall bear the cost of corrective measures deemed necessary by the ENGINEER, as well as the cost of subsequent re-inspection and retesting. Neither observations by the ENGINEER nor inspections, tests, or approvals by others shall relieve the CONTRACTOR from the CONTRACTOR's obligation to perform the WORK in accordance with the Contract Documents.
- D. All inspections, tests, or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by properly licensed organizations selected by the OWNER.

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- E. If any work (including the work of others) that is to be inspected, tested, or approved is covered without the ENGINEER's written authorization, it must, if requested by the ENGINEER, be uncovered for testing, inspection, and observation. The uncovering shall be at the CONTRACTOR's expense unless the CONTRACTOR timely notified the ENGINEER of the CONTRACTOR's intention to cover the same and the ENGINEER failed to act with reasonable promptness in response to the notice.
- F. In any work is covered contrary to the written request of the ENGINEER, it must, if requested by the ENGINEER, be uncovered for the ENGINEER's observation and replaced at the CONTRACTOR's expense.
- G. If the ENGINEER considers it necessary or advisable that covered work be observed, inspected or tested by the ENGINEER or others, the ENGINEER shall direct the CONTRACTOR to uncover, expose, or otherwise make available for observation, inspection, or testing that portion of the work in question. The CONTRACTOR shall comply with the ENGINEER's direction and furnish all necessary labor, material, and equipment. If found the work is defective, the CONTRACTOR shall bear all direct, indirect and consequential costs of uncovering, exposure, observation, inspection, and testing and of satisfactory reconstruction of the work, including but not limited to fees and charges for engineers, architects, attorneys, and other professionals. However, if the work is not defective, the CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both. The increase in Contract Time and Contract Price shall be the CONTRACTOR's actual time and costs directly attributable to uncovering and exposing the work. If the parties are unable to agree as to the amount or extent of the changes, the CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

13.04 OWNER MAY STOP THE WORK

- A. If the WORK is defective, or the CONTRACTOR fails to perform work in such a way that the completed WORK will conform to the Contract Documents, the OWNER may order the CONTRACTOR to stop the WORK, or any portion thereof, until the cause for the order has been eliminated. This right of the OWNER to stop the WORK shall not give rise to any duty on the part of the OWNER to exercise this right for the benefit of the CONTRACTOR or any other party.

13.05 CORRECTION OR REMOVAL OF DEFECTIVE WORK

- A. When directed by the ENGINEER, the CONTRACTOR shall promptly correct all defective work, whether or not fabricated, installed, or completed, or, if the

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work has been rejected by the ENGINEER, remove it from the site and replace it with non-defective work. The CONTRACTOR shall bear all direct, indirect and consequential costs of correction or removal, including but not limited to fees and charges of engineers, architects, attorneys, and other professionals made necessary thereby.

13.06 ACCEPTANCE OF DEFECTIVE WORK

- A. If, instead of requiring correction or removal and replacement of defective work, the OWNER prefers to accept the work, the OWNER may do so. The CONTRACTOR shall bear all direct, indirect, and consequential costs attributable to the OWNER's evaluation of and determination to accept the defective work. If any acceptance of defective work occurs prior to final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the WORK, and the OWNER shall be entitled to an appropriate decrease in the Contract Price.

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ARTICLE 14 - PAYMENTS TO CONTRACTOR, LIQUIDATED DAMAGES AND COMPLETION

14.01 SCHEDULE OF VALUES (LUMP SUM PRICE BREAKDOWN)

- A. The schedule of values or lump sum price breakdown established as provided in the Technical Specifications shall serve as the basis for progress payments and will be incorporated into the form of Application for Payment included in the Contract Documents.

14.02 UNIT PRICE BID SCHEDULE

- A. Progress payments for unit price work will be based on the number of units completed.

14.03 APPLICATION FOR PROGRESS PAYMENT

- A. Unless otherwise prescribed by the Owner, on the 25th of each month, the CONTRACTOR shall submit to the ENGINEER for review and approval, an Application for Payment completed and signed by the CONTRACTOR covering the WORK completed as of the date of the Application and accompanied by such supporting documentation as required by the Contract Documents.
- B. The Application for Payment shall identify, as a sub-total, the amount of the CONTRACTOR's Total Earnings to Date, plus the Value of Materials at the Site which have not yet been incorporated in the WORK, and less a deductive adjustment for materials installed which were not previously incorporated in the WORK, but for which payment was allowed under the provisions of payment for Materials Stored at the Site but not yet incorporated in the WORK.
- C. The Net Payment Due to the CONTRACTOR shall be the above-mentioned sub-total, from which shall be deducted the retainage amount and the total amount of all previous payments made to the CONTRACTOR.
- D. The OWNER may withhold and retain 5% of each approved progress payment to the CONTRACTOR. The total retention proceeds withheld shall not exceed 5% of the total construction price. All retention proceeds shall be placed by the OWNER in an interest-bearing account. The interest accrued shall be for the benefit of the CONTRACTOR and its subcontractors, and it shall be paid after the WORK has been completed and accepted by the OWNER. CONTRACTOR shall ensure that any interest accrued on the

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retainage is distributed by the CONTRACTOR to its subcontractors on a pro rata basis.

- E. Any retention proceeds withheld, and any accrued interest, shall be released by the OWNER pursuant to an Application for Payment from the CONTRACTOR within 45 days from the later of:
1. the date the OWNER receives the final Application for Payment from the CONTRACTOR;
 2. the date that a certificate of occupancy or final acceptance notice is issued to:
 - (a) the Contractor who obtained the building permit from the building inspector or from a public agency;
 - (b) the OWNER; or
 - (c) the ENGINEER.
 3. the date the CONTRACTOR accepts final payment for the Work; or
 4. the date that a public agency or building inspector having authority to issue its own certificate of occupancy does not issue the certificate but permits partial or complete occupancy of a newly constructed or remodeled building; provided, however, that if only partial occupancy of a building is permitted, any retention proceeds withheld and retained, and any accrued interest, shall be partially released in direct proportion to the value of the part of the building occupied.

Each Application for Payment from the CONTRACTOR shall include documentation of lien releases or waivers.

- F. Notwithstanding any other provision in this Article to the contrary,
1. If the CONTRACTOR is in default or breach of the terms and conditions of the Contract Documents, the OWNER may withhold from payment to the CONTRACTOR for so long as reasonably necessary an amount necessary to cure the breach or default of the CONTRACTOR; or
 2. If the WORK or a portion of the WORK has been substantially completed, the OWNER may retain until completion up to twice the

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fair market value of the WORK of the CONTRACTOR that has not been completed:

- (a) in accordance with the Contract Documents; or
 - (b) in the absence of applicable provisions in the Contract Documents to generally accepted craft standards.
3. If the OWNER refuses payment under subparagraphs (F)(i) or (ii), it shall describe in writing within 45 days of withholding such amounts what portion of the WORK was not completed according to the standards specified in the Contract Documents.
- G. The CONTRACTOR shall distribute retention proceeds as outlined below:
1. Except as provided in Paragraph 14.03.G.2, below, if the CONTRACTOR receives retention proceeds, it shall pay each of its subcontractors from whom retention has been withheld each subcontractor's share of the retention received within ten days from the day that all or any portion of the retention proceeds is received from the OWNER.
 2. Notwithstanding Paragraph 14.03.G.1, above, if a retention payment received by the CONTRACTOR is specifically designated for a particular subcontractor, payment of the retention shall be made to the designated subcontractor.
- H. Except as otherwise provided in the Supplementary General Conditions, the value of materials stored at the site shall be valued at 95 percent of the value of the materials. This amount shall be based upon the value of all acceptable materials and equipment stored at the site or at another location agreed to in writing by the OWNER; provided, each individual item has a value of more than \$5,000 and will become a permanent part of the WORK. The Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that the CONTRACTOR has received the materials and equipment free and clear of all liens, charges, security interests, and encumbrances (which are hereinafter in these General Conditions referred to as "Liens") and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect the OWNER's interest therein, all of which will be satisfactory to the OWNER.

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14.04 CONTRACTOR'S WARRANTY OF TITLE

- A. The CONTRACTOR warrants and guarantees that title to all work, materials, and equipment covered by an Application for Payment, whether incorporated in the WORK or not, will pass to the OWNER no later than the time of final payment free and clear of all liens.

14.05 REVIEW OF APPLICATIONS FOR PROGRESS PAYMENT

- A. The ENGINEER will, within 7 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to the OWNER, or return the Application to the CONTRACTOR indicating in writing the ENGINEER's reasons for refusing to recommend payment. In the later case, the CONTRACTOR may make the necessary corrections and resubmit the Application. Thirty days after presentation of the Application for Payment with the ENGINEER's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.05B) become due and when due will be paid by the OWNER to the CONTRACTOR.
- B. The OWNER may refuse to make payment of the full amount recommended by the ENGINEER to compensate for claims made by the OWNER on account of the CONTRACTOR's performance of the WORK or other items entitling the OWNER to a credit against the amount recommended, but the OWNER must give the CONTRACTOR written notice within 7 days (with a copy to the ENGINEER) stating the reasons for such action.

14.06 PARTIAL UTILIZATION

- A. The OWNER may utilize or place into service any item of equipment or other usable portion of the WORK at any time prior to completion of the WORK. The OWNER shall notify the CONTRACTOR in writing of its intent to exercise this right. The notice will identify the equipment or specific portion or portions of the WORK to be utilized or otherwise placed into service.
- B. It shall be understood by the CONTRACTOR that until such written notification is issued, all responsibility for care and maintenance of all items or portions of the WORK to be partially utilized shall be borne by the CONTRACTOR. Upon the issuance of a notice of partial utilization, the ENGINEER will deliver to the OWNER and the CONTRACTOR a written recommendation as to division of responsibilities between the OWNER and the CONTRACTOR with respect to security, operation, safety, maintenance,

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heat, utilities and insurance. Upon the OWNER's acceptance of these recommendations, the ENGINEER's aforesaid recommendation will be binding on the OWNER and the CONTRACTOR until final payment.

- C. The CONTRACTOR shall retain full responsibility for satisfactory completion of the WORK, regardless of whether a portion thereof has been partially utilized by the OWNER and the CONTRACTOR's one year correction period shall commence only after the date of Final Completion for the WORK.

14.07 LIQUIDATED DAMAGES

- A. The CONTRACTOR shall pay to the OWNER the amount specified in the Supplemental General Conditions, not as a penalty but as liquidated damages, if he fails to complete the WORK or specified parts of the WORK within the time or times agreed upon. The periods for which these damages shall be paid shall be the number of Days from the agreed date or Contract Time as contained in the Agreement, or from the date of termination of any extension of time approved by the OWNER, to the date or dates on which the ENGINEER certifies Substantial Completion of WORK or specified parts of the WORK as provided in Article 14.08, herein. The OWNER may deduct the amount of said damages from any monies due or to become due the CONTRACTOR. After Substantial Completion, if the CONTRACTOR fails to complete the remaining WORK within 45 days or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER the amount stated in the Supplemental General Conditions as liquidated damages for each day that expires after the 45 days until readiness for final payment.
- B. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would sustain; and said amount is agreed to be the amount of damages which the OWNER would sustain. Said damages are not in lieu of but in addition to other actual or consequential damages to which the OWNER may be entitled.
- C. All times specified in the Contract Documents are hereby declared to be of the essence.

14.08 SUBSTANTIAL COMPLETION

- A. When the CONTRACTOR considers the WORK ready for its intended use, and the CONTRACTOR has delivered to the ENGINEER all maintenance and operating instructions, schedules, guarantees, bonds, certificates of

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inspection, marked-up record documents and other documents, all as required by the Contract Documents, the CONTRACTOR may notify the OWNER and the ENGINEER in writing that the WORK is substantially complete and request that the ENGINEER prepare a Certificate of Substantial Completion. Within a reasonable time thereafter, the OWNER, the CONTRACTOR, and the ENGINEER shall make an inspection of the WORK to determine the status of completion. If the ENGINEER does not consider the WORK substantially complete, the ENGINEER will notify the OWNER and CONTRACTOR in writing giving the reasons therefor. If the ENGINEER considers the WORK substantially complete, the ENGINEER will prepare and deliver to the OWNER for its execution the Certificate of Substantial Completion signed by the ENGINEER and CONTRACTOR, which shall fix the date of Substantial Completion.

- B. The Certificate of Substantial Completion shall be a release by the CONTRACTOR of the OWNER and its agents from all claims and liability to the CONTRACTOR for anything done or furnished for, or relating to, the WORK or for any act or neglect of the OWNER or of any person relating to or affecting the WORK, to the date of Substantial Completion, except demands against the OWNER for the remainder of the amounts kept or retained from progress payments and excepting pending, unresolved claims filed in writing prior to the date of Substantial Completion. At the time of delivery of the Certificate of Substantial Completion, the ENGINEER will deliver to the OWNER and the CONTRACTOR, if applicable, a written recommendation as to division of responsibilities between the OWNER and the CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities and insurance. Upon the OWNER's acceptance of these recommendations, the ENGINEER's recommendation will be binding on the OWNER and the CONTRACTOR until final payment.
- C. The OWNER, upon written notice to the CONTRACTOR, shall have the right to exclude the CONTRACTOR from the WORK after the date of Substantial Completion, and complete all or portions of the WORK at the CONTRACTOR's expense.

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14.09 COMPLETION AND FINAL PAYMENT

- A. Upon written certification from the CONTRACTOR that the WORK is complete (if a Certificate of Substantial Completion has been issued this certification must occur within 45 days of that date), the ENGINEER will make a final inspection with the OWNER and the CONTRACTOR. If the OWNER and ENGINEER do not consider the WORK complete, the ENGINEER will notify the OWNER and the CONTRACTOR in writing of all particulars in which this inspection reveals that the WORK is incomplete or defective. The CONTRACTOR shall immediately take the measures necessary to remedy these deficiencies. If the ENGINEER and OWNER consider the WORK complete, the CONTRACTOR may proceed to file its application for final payment pursuant to this Article. At the request of the CONTRACTOR, the ENGINEER may recommend to the OWNER that certain minor deficiencies in the WORK that do not prevent the entire WORK from being used by the OWNER for its intended use, and the completion of which will be unavoidably delayed due to no fault of the CONTRACTOR, be exempted from being completed prerequisite to final payment. These outstanding items of pickup work, or "punch list items", shall be listed on the ENGINEER's Notice of Completion, together with the recommended time limits for their completion, and extended warranty requirements for those items and the value of such items.
- B. After the issuance of the Notice of Completion and after the CONTRACTOR has completed corrections that have not been exempted to the satisfaction of the ENGINEER and delivered to the ENGINEER all required additions and modifications to maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, marked-up record documents and other documents, all as required by the Contract Documents; and after the ENGINEER has indicated that the WORK is acceptable, the CONTRACTOR may make application for final payment following the procedure for progress payments. The final application for payment shall be accompanied by all documentation called for in the Contract Documents and other data and schedules as the OWNER or ENGINEER may reasonably require, including an affidavit of the CONTRACTOR that all labor, services, material, equipment and other indebtedness connected with the WORK for which the OWNER or his property might in any way be responsible, have been paid or otherwise satisfied, and a consent of the payment bond surety to final payment, all in forms approved by the OWNER.

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14.10 FINAL APPLICATION FOR PAYMENT

- A. If, on the basis of the ENGINEER's observation of the WORK during construction and final inspection, and the ENGINEER's review of the final application for payment and accompanying documentation, all as required by the Contract Documents, the ENGINEER is satisfied that the WORK has been completed and the CONTRACTOR has fulfilled all of his obligations under the Contract Documents, the ENGINEER will, within ten days after receipt of the final application for payment, indicate in writing his recommendation of payment and present the application to the OWNER for payment. Thereupon, the ENGINEER will give written notice to the OWNER and the CONTRACTOR that the WORK is acceptable by executing the ENGINEER's Notice of Completion. Otherwise, the ENGINEER will return the application to the CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case the CONTRACTOR shall make the necessary corrections and resubmit the application.
- B. Within 45 calendar days after the ENGINEER's filing of the Notice of Completion, the OWNER will make final payment including all deducted retainage (except as noted below) to the CONTRACTOR. The OWNER's remittance of final payment shall be the OWNER's acceptance of the WORK if formal acceptance of the WORK is not indicated otherwise. The final payment shall be that amount remaining after deducting all prior payments and all amounts to be kept or retained under the provisions of the Contract, including the following items:
1. Liquidated damages, as applicable.
 2. All amounts retained by the OWNER under Paragraph 14.03(F).

14.11 CONTRACTOR'S CONTINUING OBLIGATIONS

- A. The CONTRACTOR's obligation to perform and complete the WORK in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by the ENGINEER, nor the issuance of a Certificate of Substantial Completion or Notice of Completion, nor payment by the OWNER to the CONTRACTOR under the Contract Documents, nor any use or occupancy of the WORK or any part thereof by the OWNER, nor any act of acceptance by the OWNER nor any failure to do so, nor any review of a shop drawing or sample submittal, will constitute an acceptance of work or materials not in accordance with the Contract Documents or a release of the CONTRACTOR's obligation to perform the WORK in accordance with the Contract Documents.

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14.12 FINAL PAYMENT TERMINATES LIABILITY OF OWNER

- A. Final payment is defined as the last progress payment made to the CONTRACTOR for earned funds, less deductions listed in Paragraph 14.10B herein. The acceptance by the CONTRACTOR of the final payment referred to in Paragraph 14.10 herein, shall be a release of the OWNER and its agents from all claims of liability to the CONTRACTOR for anything done or furnished for, or relating to, the work or for any act or neglect of the OWNER or of any person relating to or affecting the work, except demands against the OWNER for the remainder, if any, of the amounts kept or retained under the provisions of Paragraph 14.10 herein; and excepting pending, unresolved claims filed prior to the date of the Certificate of Substantial Completion.

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ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 SUSPENSION OF WORK BY OWNER

- A. The OWNER acting through the ENGINEER may, by written notice to the Contractor, temporarily suspend the WORK, in whole or in part, for a period or periods of time, but not to exceed 90 days, for the convenience and benefit of the OWNER upon the occurrence of any one or more of the following: (1) unsuitable weather; (2) delay in delivery of OWNER- furnished equipment or materials, or such other conditions as are considered unfavorable for prosecution of the work; (3) Shortfall in construction funds; (4) Constraints imposed by public entities, public utilities, property owners or legal proceedings; (5) Failure or delay in acquisition of easements or right-of-way by the OWNER; or (6) Other conditions which, in the opinion of the OWNER, warrant a delay in the WORK. Suspended WORK shall be resumed by the CONTRACTOR within 10 calendar days of receipt from the ENGINEER of written notice to proceed. Whenever the OWNER temporarily suspends work for any conditions enumerated in this Article 15.01 A, the CONTRACTOR shall be entitled to an adjustment in the Contract Time as specified in Article 12.03 C.
- B. The suspension of work shall be effective upon receipt by the Contractor of the written order suspending the work and shall be terminated upon receipt by the Contractor of the written order terminating the suspension.
- C. The CONTRACTOR hereby indemnifies and holds harmless the OWNER and ENGINEER, their officers, agents and employees, from and against all claims, damages, losses and expenses, including lost profits and attorney's fees, arising out of or resulting from the temporary suspension of the WORK, whether for the OWNER's convenience described in this Article or for whatever other reasons, including the stoppage of work by the ENGINEER for the CONTRACTOR's failure to comply with any order issued by the ENGINEER.

15.02 TERMINATION OF AGREEMENT BY OWNER (CONTRACTOR DEFAULT)

- A. In the event of default by the CONTRACTOR, the OWNER may give written notice to the CONTRACTOR of OWNER's intent to terminate the Agreement. The notice shall state the event of default and the time allowed to remedy the default. It shall be considered a default by the CONTRACTOR whenever the CONTRACTOR shall: (1) declare bankruptcy, become insolvent, or assign its assets for the benefit of its creditors; (2) fail to provide materials or workmanship meeting the requirements of the Contract Documents; (3) disregard or violate provisions of the Contract Documents or ENGINEER's

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instructions, (4) fail to prosecute the WORK according to the approved progress schedule; or, (5) fail to provide a qualified superintendent, competent workmen, or materials or equipment meeting the requirements of the Contract Documents. If the CONTRACTOR fails to remedy the conditions constituting default within the time allowed, the OWNER may then issue a Notice of Termination.

- B. In the event the Agreement is terminated in accordance with Paragraph 15.02A, the OWNER may take possession of the WORK and may complete the WORK by whatever method or means the OWNER may select. The cost of completing the WORK shall be deducted from the balance which would have been due the CONTRACTOR had the Agreement not been terminated and the WORK completed in accordance with the Contract Documents. If such cost exceeds the balance which would have been due, the CONTRACTOR shall pay the excess amount to the OWNER. If such cost is less than the balance which would have been due, the CONTRACTOR shall have no claim to the difference.

15.03 TERMINATION OF AGREEMENT BY OWNER (FOR CONVENIENCE)

- A. The OWNER may terminate the Agreement at any time if it is found that reasons beyond the control of either the OWNER or CONTRACTOR make it impossible or against the OWNER's interests to complete the WORK. In such a case, the CONTRACTOR shall have no claims against the OWNER except: (1) for the value of the work, as determined by the engineer, performed by the Contractor up to the date the Agreement is terminated; and, (2) for the cost of materials and equipment on hand, in transit, or on definite commitment, as of the date the Agreement is terminated, which would be needed in the WORK and which meet the requirements of the Contact Documents. The value of work performed and the cost of materials and equipment delivered to the site, as mentioned above, shall be determined by the ENGINEER in accordance with the procedure prescribed from making the final application for payment and final payment under Paragraphs 14.09 and 14.10.

15.04 TERMINATION OF AGREEMENT BY CONTRACTOR

- A. The CONTRACTOR may terminate the Agreement upon 10 days written notice to the OWNER, whenever: (1) the WORK has been suspended under the provisions of Paragraph 15.01, for more than 90 consecutive days through no fault or negligence of the CONTRACTOR, and notice to resume work or to terminate the agreement has not been received from the OWNER within this time period; or, (2) the OWNER should fail to pay the

GENERAL CONDITIONS

CONTRACTOR any monies due him in accordance with the terms or the Contract Documents and within 60 days after presentation to the OWNER by the CONTRACTOR of a request therefor, unless within said 10-day period the OWNER shall have remedied the condition upon which the payment delay was based. In the event of such termination, the CONTRACTOR shall have no claims against the OWNER except for those claims specifically enumerated in Paragraph 15.03, and as determined in Accordance with the requirements of that paragraph.

GENERAL CONDITIONS

ARTICLE 16 - MISCELLANEOUS

16.01 GIVING NOTICE

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

16.02 TITLE TO MATERIALS FOUND ON THE WORK

- A. The OWNER reserves the right to retain title to all soils, stone, sand, gravel, and other materials developed and obtained from excavations and other operations connected with the WORK. Unless otherwise specified in the Contract Documents, neither the CONTRACTOR nor any subcontractor shall have any right, title, or interest in or to any such materials. The CONTRACTOR will be permitted to use in the WORK, without charge, any such materials which meet the requirements of the Contract Documents.

16.03 RIGHT TO AUDIT

- A. If the CONTRACTOR submits a claim to the OWNER for additional compensation, the OWNER shall have the right, as a condition to considering the claim, and as a basis for evaluation of the claim, and until the claim has been settled, to audit the CONTRACTOR's books. This right shall include the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to discover and verify all direct and indirect costs of whatever nature claimed to have been incurred or anticipated to be incurred and for which the claim has been submitted. The right to audit shall include the right to inspect the CONTRACTOR's plants, or such parts thereof, as may be or have been engaged in the performance of the WORK. The CONTRACTOR further agrees that the right to audit encompasses all subcontracts and is binding upon subcontractors. The right to examine and inspect herein provided for shall be exercisable through such representatives as the OWNER deems desirable during the CONTRACTOR's normal business hours at the office of the CONTRACTOR. The CONTRACTOR shall make available to the OWNER for auditing, all relevant accounting records and documents, and other financial data, and upon request, shall submit true copies of requested records to the OWNER.

16.04 ASBESTOS

- A. If the CONTRACTOR during the course of work observes the existence of asbestos in any structure or building, the CONTRACTOR shall promptly notify the OWNER and the ENGINEER. The OWNER shall consult with the ENGINEER regarding removal or encapsulation of the asbestos material and the CONTRACTOR shall not perform any work pertinent to the asbestos material prior to receipt or special instruction from the OWNER through the ENGINEER.

SUPPLEMENTAL GENERAL CONDITIONS

ARTICLE 17 - GENERAL

17.01 GENERAL

1. These Supplemental General Conditions amend or supplement the General Conditions of the Contract and any other provisions of the Contract Documents as indicated herein. All provisions which are not so amended or supplemented remain in full force and effect.
2. The terms used in these Supplemental General Conditions which are defined in the General Conditions of the Contract have the meanings assigned to them in the General Conditions of the Contract herein.

17.02 SUPPLEMENTAL DEFINITIONS

1. ENGINEER

The "Engineer" is

Bowen, Collins & Associates
154 East 14075 South
Draper, UT 84020
Office: (801) 495-2224
Contact: Jason Luettinger, P.E.
Email: jluettinger@bowencollins.com

17.03 TESTING COSTS

Paragraph 13.03 of the General Conditions is amended as follows: the CONTRACTOR shall pay all testing costs as outlined in Specification Section 01 45 16.13, Contractor Quality Control, and the individual specifications sections of the Contract Documents. The Owner reserves the right to have additional tests performed by a testing organization selected by the OWNER and at the OWNER's expense.

ARTICLE 17 - GENERAL

17.04 SUPPLEMENTAL DOCUMENTATION

1. A geotechnical investigation was conducted for the SWA-2 Project. Results of this investigation are provided for the CONTRACTOR's reference in a Geotechnical Report titled:

Geotechnical Investigation Report
JVWCD Southwest Aqueduct Reach 2
Salt Lake County, Utah
Prepared by: RB&G Engineering
Date: June 2024

This report is available in electronic (PDF) format from the Engineer upon request or is available on the Jordan Valley Water Conservancy District's website at www.jvwcd.org.

SUPPLEMENTAL GENERAL CONDITIONS

ARTICLE 18 - AMOUNTS OF LIQUIDATED DAMAGES, BONDS AND INSURANCE

18.01 AMOUNT OF LIQUIDATED DAMAGES

- A. As provided in Article 14.07 of the General Conditions, the Contractor shall pay to the Owner as liquidated damages the amount of \$1,000 for each calendar day's delay beyond the Contract Time for substantial completion, liquidated damages shall apply to each site stipulated in the Contract Documents. The Contractor shall pay to the Owner as liquidated damages the amount of \$200 for each calendar day's delay beyond 45 calendar days from the date of substantial Completion until the Engineer issues the Notice of Final Completion.

18.02 PERFORMANCE AND OTHER BOND AMOUNTS

- A. The CONTRACTOR shall furnish a satisfactory Performance Bond in the amount of 100 percent of the Contract Price and a satisfactory Payment Bond in the amount of 100 percent of the Contract Price.

18.03 INSURANCE AMOUNTS

The limits of liability for the insurance required by Paragraph 5.02 of the General Conditions shall provide for not less than the following amounts or greater where required by Laws and Regulations:

- A. Workers' Compensation under Paragraph 5.02B.1 of the General Conditions:

- 1. State: Utah Statutory

- B. Comprehensive General Liability: (under Paragraph 5.02B.2 of the General Conditions):

- 1. Bodily Injury (including completed operations and products liability):

<u>\$ 500,000</u>	Each Occurrence
<u>\$ 1,000,000</u>	Annual Aggregate

Property Damage:

<u>\$ 500,000</u>	Each Occurrence
<u>\$ 1,000,000</u>	Annual Aggregate
or a combined single limit of	<u>\$1,000,000</u>

SUPPLEMENTAL GENERAL CONDITIONS

2. Property Damage liability insurance including, Explosion, Collapse and Underground coverages, where applicable.

3. Personal Injury, with employment exclusion deleted

\$ 1,000,000 Annual Aggregate

C. Comprehensive Automobile Liability: (Under Paragraph 5.02B.3 of the General Conditions:)

1. Bodily Injury

\$ 500,000 Each Person
\$ 1,000,000 Each Occurrence

2. Property Damage:

\$ 500,000 Each Occurrence

or combined single limit of \$1,000,000

D. Builders Risk: Not required.

18.04 ADDITIONAL INSURED

Following Paragraph 5.02 of the General Conditions, the Contractor shall include the following parties or entities as additional insured:

A. Jordan Valley Water Conservancy District
8215 South 1300 West, West Jordan, Utah 84088

SUPPLEMENTAL GENERAL CONDITIONS

ARTICLE 19 - PHYSICAL CONDITIONS AND WEATHER DELAYS

19.01 INCLEMENT WEATHER DELAYS

- A. The Contractor's construction schedule shall be based upon the inclusion of at least ten (10) day(s) of inclement weather delays. Reference Article 12, paragraph 12.02 of the General Conditions for additional requirements.

SUPPLEMENTAL GENERAL CONDITIONS

ARTICLE 20 - SUBCONTRACT LIMITATIONS

20.01 SUBCONTRACT LIMITATIONS

- A. In addition to the provisions of Paragraph 6.05 of the General Conditions, the CONTRACTOR shall perform not less than 20 percent of the WORK with its own forces (i.e., without subcontracting). The 20 percent requirement shall be understood to refer to the WORK, the value of which totals not less than 20 percent of the Contract Price.

ARTICLE 21 - MISCELLANEOUS

21.01 PATENTS AND COPYRIGHTS

The Contractor shall indemnify and save harmless the Owner, the Engineer, and their officers, agents, and employees, against all claims or liability arising from the use of any patented or copyrighted design, device, material, or process by the Contractor or any of his subcontractors in the performance of the work.

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DIVISION 01
GENERAL REQUIREMENTS

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**SECTION 01 11 00
SUMMARY OF WORK**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Contract comprises the construction of the Southwest Aqueduct Reach 2 (SWA-2). The SWA-2 Project includes approximately 10,550 feet of new 66" diameter welded steel pipe including two trenchless crossings with casings, six air valve structures, one drain vault structure, drains and blow-offs and modifications to the existing 12600 South Jordan Aqueduct vault. The Work also includes construction of a new addition to the existing 11400 South Jordan Aqueduct Double Turnout Structure for installation of a new 78" isolation valve on the Jordan Aqueduct. Project work also includes cathodic protection and instrumentation at several locations. The Work is primarily located along 3200 West between 13400 South and 11800 South and includes connections to existing SWA-2 at both ends, with additional work at 11400 South and miscellaneous sites.
- B. The Work is located mostly in Riverton, Utah with work at the 11400 South JWCD facility site in South Jordan, both in Salt Lake County as indicated on the Drawings.

1.3 CONTRACT METHOD

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

1.4 STREAMLINED SPECIFICATIONS

- A. These specifications are written in streamlined or declarative style, often using incomplete sentences. This imperative language is directed to Contractor unless specifically noted otherwise.
- B. Omissions of such words and phrases as "Contractor shall," "in conformity therewith," "shall be," "as shown on the Drawings," "a," "an," "the," and "all" are intentional in streamlined sections.
1. Omitted words shall be supplied by inference in the same manner as when a note appears on the Drawings.
 2. Omission of such words shall not relieve Contractor from providing the items and work described herein or indicated on the Drawings.

3. Words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

1.5 WORK BY OTHERS

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

1.6 WORK SEQUENCE

- A. Schedule and perform the Work in such a manner as to result in the least possible disruption to the public's use of roadways, driveways, and utilities. Utilities shall include but not be limited to water, sewerage, drainage structures, ditches and canals, gas, electric, cable television, and telephone. Refer to Utility Adjustment and other plan and profile sheets for approximate location of utilities. However, there is no guarantee as to accuracy or completeness. Contractor shall incorporate as-built locations on the reproducible record plans, in red ink, showing proper location on each sheet where these utilities are located.

1.7 CONTRACTOR USE OF PROJECT SITE

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

1.8 OWNER USE OF THE PROJECT SITE

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

1.9 PARTIAL UTILIZATION OF THE WORK BY OWNER

- A. Owner may take partial utilization of the Work upon successful tie in of the new aqueduct segments into the existing Southwest Aqueduct system. . Partial utilization may involve the placing into service of the southwest aqueduct and any project appurtenances that are completed and ready to be placed into service.

1.10 CONTRACTOR'S WORKING HOURS

- A. Perform work within Owner's regular working hours from Monday thru Friday, 8 AM to 5 PM. If Contractor desires to work overtime or work on a Saturday, Sunday, or any legal holiday, obtain prior approval from Owner and Engineer.

1.11 STORAGE

- A. Storage conditions shall be acceptable to Owner for all materials and equipment not incorporated into the Work but included in Applications for Payment. Such storage arrangements and conditions shall be presented in writing for Owner's review and approval and shall afford adequate and satisfactory security and protection. Off-site storage facilities shall be accessible to Engineer. The stored materials shall be insured for full value. Certificates of liability insurance coverage must be submitted to Engineer with the request for payment by Contractor. All arrangements and costs for storage facilities shall be paid by Contractor, unless specifically designated in the Contract Documents to be furnished by Owner.

1.12 NOTICES TO OWNERS OF ADJACENT PROPERTIES AND UTILITIES

- A. Notify Owners of adjacent property and utilities when prosecution of the Work may affect them.
- B. When it is necessary to temporarily deny access by owners or tenants to their property, or when any utility service connection must be interrupted, Give notices sufficiently in advance to enable the affected person(s) to provide for their needs, but notice shall not be less than 7 days. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit any resulting inconvenience.
- C. Utilities and other concerned agencies shall be contacted at least seven days prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.
- D. Review with the various utility companies the construction methods, safety procedures, and Work to be done in the vicinity of utilities. When temporary relocation of utilities is necessary, provide sufficient advance notice to the utility involved.

1.13 LINES AND GRADES

- A. Perform all Work to the lines, grades, and elevations shown on the Drawings.
- B. Basic horizontal and vertical control points will be established or designated as provided in General Conditions paragraphs. Use these points as datum for the Work. Perform any additional survey, layout, or measurement work needed for proper construction of the Work as a part of the Work at no additional cost to Owner.
- C. Employ experienced instrument personnel, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, furnish, without additional charge, competent personnel and such tools,

stakes, and other materials as Engineer may require in establishing or designating control points or in checking survey, layout, and measurement of Work performed.

- D. Keep Engineer informed, a reasonable time in advance, of the times and places at which Work is to be done, so that horizontal and vertical control points may be established, and any checking deemed necessary by Engineer may be done with minimum delay to the Project.
- E. Remove and reconstruct Work, which is improperly located.

1.14 PROJECT MEETINGS

A. Preconstruction Conference

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

B. Progress Meetings

1. Engineer will schedule and hold regular on-Site progress meetings at least weekly and at other times as deemed necessary by Engineer or as required by progress of the

Work. Contractor, Engineer, and all Subcontractors active on the Site must attend each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

2. Engineer will preside at the meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings will be to review the progress of the Work, discuss safety, maintain coordination of efforts, discuss commercial issues, discuss changes in scheduling, and resolve other problems, which may develop. During each meeting, all parties are required to present any issues, which may impact its Work, with a view toward resolving these issues expeditiously.

1.15 AVAILABLE SUPPLEMENTAL DATA

- A. Geotechnical Report: Geotechnical data referenced in these Contract Documents are based upon the report titled "JVWCD Southwest Aqueduct Reach 2", prepared by RB&G Engineering, Inc, dated June 4, 2024. Report is available in Appendix A.
- B. Cost to Cure Exhibits: Cost to cure exhibits for individual res clarify removal and restoration work that JVWCD is compensating individual land owners to complete (Separate to work required under this contract) are included in Appendix B.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 PERMITS

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

1.3 COORDINATION WITH OTHER CONSTRUCTION

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

1.4 SCHEDULE CONSTRAINTS

- A. Be responsibility to coordinate and plan the construction activities to integrate each schedule constraint into performance of the overall Work.
- B. The listing of schedule constraints below does not mean that all constraints or special conditions have been identified. The list is not a substitute for the duty to coordinate and plan for completion, all Work by the Substantial/Contract Completion Dates specified in the Contract Documents.
- C. Special Listing: The following constraints affect the construction schedule.
 - 1. Coordinate shutdown schedules with the Owner a minimum of 30 days in advance of each shutdown. Additional notice requirements are below for specific locations. Note that the shutdown durations and dates indicated below are defined as the duration the contractor will have possession of the shutdown pipelines. JWCD staff are anticipated to be draining each aqueduct approximately three days prior to a contractor's requested shutdown date. JWCD will also be anticipated to be filling the aqueducts for approximately three days following the end date of each shut down duration.
 - 2. **13400 South Interconnection Vault - Southwest Aqueduct Reach 2 (SWA-02)**

- a. Instrumentation Connections: No shutdown of JA-2 or SWA-02 will be permitted for Water Quality equipment piping connections. Freeze sampling lines to enable connections without aqueduct shut downs.
 - b. Mainline SWA-02 connection: No shutdown of SWA-02 will be required to connect the new segment of SWA-02 to the existing segment of SWA-02 at 13400 South. Valves in the existing 13400 South vault will enable isolation for this connection.
- 3. 12600 South Jordan Aqueduct Mainline Valve Vault Modifications -Shutdown of Jordan Aqueduct Reach 2 (JA-2)**
- a. Only one shutdown of the Jordan Aqueduct Reach 2 will be permitted for this project. The allowable shutdown window for JA-2 will vary depending on which bid schedules are ultimately awarded so that shutdown windows can be coordinated to minimize impacts to the Owner’s operations.
 - b. If Schedule B is Awarded (11400 South JA-2 valve vault), then modification work within the 12600 South Vault that requires a JA-2 shut down shall be completed concurrent with the 11400 South mainline valve work also requiring a JA-2 shut down. In this case, Items highlighted blue on Drawing M-04 are to be delayed until after SWA-02 is completed and returned to service, and the JA-2 can then be removed from service. In this case the shutdown of JA-1 for the blue highlighted items in the 12600 South Vault shall be as indicated for 11400 South JA-2 mainline valve vault in paragraph 4. below.
 - c. If schedule B is not awarded, then the allowable Shutdown of JA-2 is as follows for work in the 12600 South Vault:
 - 1) Shutdown window: January 5, 2027 thru March 10, 2027
 - 2) Duration: **14** calendar days maximum shutdown.
 - 3) Notify JWCD 30 days prior to shutdown dates.
 - 4) SWA-02 work under this contract must be complete to enable SWA-02 to be tested and brought into service prior to removing JA-2 from service. SWA-02 shall be in service continuously from the JWTP to 11400 South extent for the duration of the Jordan Aqueduct shut down.
 - d. The Jordan Aqueduct shutdown may not be concurrent with any Southwest Aqueduct shut down.
- 4. 11400 South JA-2 Mainline Valve Vault – Shutdown of Jordan Aqueduct Reach 2 (if Schedule B is Awarded)**
- a. Shutdown window: January 5, 2027 thru March 10, 2027
 - b. Duration: **50** calendar days maximum shutdown of JA-2.
 - c. Notify JWCD 60 days in advance of shutdown dates.
 - d. SWA-02 work under this contract must be complete to enable SWA-02 to be tested and brought into service prior to removing JA-2 from service. SWA-02 shall be in service continuously from the JWTP to 114th South extent for the duration of the Jordan Aqueduct shut down.
 - e. Work at 12600 South mainline valve vault requiring JA-2 shutdown shall be completed current with this 11400 South mainline valve.

5. **11800 South Existing SWA-02 Connection**
 - a. Shutdown period: No restraints on connection to existing Southwest Aqueduct at 11800 South except that JA-1 shall be operational at the time of SWA-02 connection. Give JWCD 30 day notice of this connection date.
 - b. Traffic control
 - 1) Complete 11800 South traffic control closure in the summer months between June 3rd to August 12th to accommodate school schedules to complete the intersection shutdown work outside of the times local schools are in session.
 - 2) Traffic control closure of 11800 South to occur only after UDOT's ongoing Bangerter Highway and 13400 South project closures of 13400 South are complete. Currently 13400 South is closed and the UDOT project is anticipated to have 13400 South re-opened November 1, 2025. For progress updates on the UDOT project's traffic control conditions, contact Daniel Thurgood with Horrocks 801-763-5221, daniel.t@horrocks.com.

6. **Jordan Aqueduct Crossing at 12075 South**
 - a. Limit the trenchless crossing activities under the Jordan Aqueduct to periods of low water demand in the Jordan Aqueduct as defined below. The Jordan Aqueduct is to remain active during trenchless installation of the SWA-02 casing. Work from Station 405 +97 to 406+63 shall be limited to either:
 - 1) October 15, 2025, to March 15, 2026.
 - 2) October 15, 2026 to November 30, 2026.

7. **Riverton Pressurized Irrigation System**
 - a. Shutdown period: October 16th thru March 30th
 - 1) Must maintain service during PI system operation, dates for Riverton City PI system operation are approximately April 1st thru October 15th
 - b. Must maintain existing PI pipeline in service during system operation, specifically at the JA crossing at 3200 West and 12075 South intersection where the bore pit may interfere with existing PI pipeline.

8. **Work in Residential Properties north of 12600 South to Emery Forest Lane**
 - a. Work within the backyards of these homes is to be restricted to a total of 12 consecutive weeks for any individual residential property. Time of restriction begins when the Contractor removes existing fencing, installs temporary security fencing with privacy fabric, and time ends when the excavation has been backfilled and brought up to final grade, permanent fencing restored, and temporary fencing removed. One exception to this is no construction duration restriction is required for the property at 12585 S Sage Glen Drive for the bore pit and air valve work.

9. **Relocation of the Irrigation line between station 377+90 to station 387+80**
 - a. Relocation of the irrigation line and the underlying construction of SWA-02 from station 377+90 to station 387+80 can only be completed during the non-irrigation season from October 15th to April 1st.

10. CenturyLink Relocation

- a. CenturyLink temporary relocation from station 371+50 to station 384+75 is needing to be completed by CenturyLink prior to the installation of the Southwest Aqueduct in this area. CenturyLink relocation completion dates are unknown at this time, but for bidding purposes it is assumed to be October 1st, 2025. Allow for CenturyLink relocation to be performed prior to construction in this area.
- b. Final restoration of the existing communication line is to be scheduled with CenturyLink once the SWA-02 pipeline has been backfilled and the irrigation relocation trenching is underway. Installation of the final communication line will be coordinated with irrigation line and for bidding purposes is estimated to occur between October 15th and April 1st.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 20 00
MEASUREMENT AND PAYMENT**

PART 1 - GENERAL

1.1 GENERAL PROGRESS PAYMENT REQUIREMENTS

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

1.2 APPLICATION FOR PAYMENT

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

1.3 REVIEWS/APPLICATION FOR PAYMENT

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

1.4 PAYMENT FOR SUPPLIES AND MATERIALS

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

1.5 MEASUREMENT AND PAYMENT

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

Payment section. The Owner is not responsible for Contractor's failure to properly coordinate with Subcontractors and Suppliers regarding the breakdown of Work in these Contract Documents.

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

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

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

Partial Payment	Amount	When Paid
1 st	50 percent of bid item lump sum.	With 1 st pay request
2 nd	40 percent of bid item lump sum.	With 1 st pay request following completion of 10 percent of contract
3 rd	10 percent of bid item lump sum (for demobilization).	With 1 st pay request following completion of 90 percent of contract

2. Bid Item No. 2 – 12600 South Trenchless Crossing, Complete

- a. Measurement: Payment for the Trenchless Crossing at 12600 South will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for the 12600 South Trenchless Crossing; including installation of casing pipe and all items for interaction between carrier and casing pipe; potholing of utilities; permits from UDOT and other required entities; clearing and stockpiling of topsoil and landscaping rock, excavation, shoring and

- backfilling of the pit areas; trenchless methods and all required items to complete the work required for the trenchless crossing, Complete.
- c. No Payment for 66-inch Southwest Aqueduct, or restoration of private properties, these items are to be paid under separate bid items.
3. **Bid Item No. 3 – Jordan Aqueduct Trenchless Crossing, Complete**
 - a. Measurement: Payment for the Trenchless Crossing at the Jordan Aqueduct will be made on a Lump Sum basis.
 - b. Payment: Payment will be made on the basis of the Contractor’s lump sum bid for the Jordan Aqueduct Reach 2 (JA-2) trenchless crossing at 3200 West and 12075 South; including installation of casing pipe and all items for interaction between carrier and casing pipe; potholing of the JA-2 and any utilities; relocation of utilities within the work area; monitoring and protection of the JA-2; traffic control and coordination with residents at the crossing; clearing, excavation, shoring and backfill of the pits; trenchless methods and all required items to complete the work required for the trenchless crossing, Complete.
 - c. No Payment for 66-inch Southwest Aqueduct or asphalt restoration, these items are to be paid under separate bid items.
 4. **Bid Item No. 4 – 11800 South Open Cut Crossing, Complete**
 - a. Measurement: Payment for the Open Cut Crossing of 11800 South will be made on a Lump Sum basis.
 - b. Payment: Payment will be made on the basis of the Contractor’s lump sum bid for additional costs of installation required for installing the SWA-2 across the 11800 South intersection; including potholing existing SWA-2 and other utilities; additional supports, and protection required for utilities, excavation and shoring; final backfilling of existing utilities; traffic control and all other Work as shown on the plans, Complete.
 - c. No Payment for 66-inch and 60-inch Southwest Aqueduct and appurtenances; connection to existing SWA-2 or asphalt restoration. These Items are to be paid under separate bid items.
 5. **Bid Item No. 5 – 66-inch Southwest Aqueduct Reach 2, Complete - STA 319+46 to STA 365+50, 3200 West**
 - a. Measurement: Payment for the construction of the 66-inch Southwest Aqueduct Reach 2 will be made on a Lump Sum basis.
 - b. Payment: Payment will be made on the basis of the Contractor’s lump sum bid for the Southwest Aqueduct Reach 2, 66-inch diameter pipe and appurtenances from Station 319+46 at the Temporary Test Head near 13400 South to Station 365+50 at the entrance to the Cedar Brae park; including furnishing and installing all pipe materials, fittings, and appurtenances between the stations shown and within the public rights-of-way, permanent easements, and temporary construction easements provided; potholing existing utilities; site condition and construction progress surveys; asphalt sawcutting and removal; temporary asphalt as necessary; traffic controls; temporary security fencing; excavation including all sheeting, shoring and bracing of excavations as required; rock removal; dewatering; furnishing and installing the pipe and all appurtenances at the strength and wall thickness shown; welding and joint preparation, coating and lining repairs; trench cutoff walls and trench plugs, as necessary; furnishing and installing pipe marking tape and markers; waterway replacement; pipe zone and trench

backfill materials; and balance of all Work required for installation of the 66-inch Southwest Aqueduct as shown on the plans, Complete.

- c. No Payment under this item for asphalt pavement restoration; construction of air valve vaults or the connection to existing SWA-2, cleaning, disinfection and hydrostatic testing of the completed pipeline. These Items are to be paid under separate bid items.

6. Bid Item No. 6 – 66-inch Southwest Aqueduct Reach 2, Complete - STA 365+50 to STA 389+20, Cedar Brae Park, 12600 South Crossing, Private Properties and Unimproved Area

- a. Measurement: Payment for the construction of the 66-inch Southwest Aqueduct Reach 2 will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for the Southwest Aqueduct Reach 2, 66-inch diameter pipe and appurtenances from Station 365+50 at the Cedar Brae Park to the Station 389+20 at Emery Forest Lane; including furnishing and installing all pipe materials, fittings, and appurtenances between the stations shown, including installation of carrier pipe in casing, within the public rights-of-way, permanent easements, and temporary construction easements provided; potholing existing utilities; site condition and construction progress surveys; clearing and grubbing and stock piling topsoil; asphalt sawcutting and removal; temporary asphalt as required; concrete flatwork sawcutting, removal and restoration as indicated on drawings; removal and restoration of existing fencing and gates, including new vinyl access 4 ft gate at private property 3176 W Durham Woods Way; utility service line restoration as required, temporary security fencing with privacy devices; excavation including all sheeting, shoring and bracing of excavations as required; rock removal; dewatering; furnishing and installing the pipe and all appurtenances at the strength and wall thickness shown; welding and joint preparation, coating and lining repairs; trench cutoff walls and trench plugs, as necessary; furnishing and installing pipe marking tape and markers; curb and gutter, sidewalk and parkstrip replacement; pipe zone and trench backfill materials; compaction and grading to final surface elevation for final restoration by others; public involvement with residents as necessary, surface improvement removal and restoration, and balance of all Work required for installation of the 66-inch Southwest Aqueduct as shown on the plans, Complete.
- c. No Payment under this item for utility relocation; cost to cure restoration of private properties; asphalt pavement restoration; construction of air valve vaults; cleaning, disinfection and hydrostatic testing. These Items are to be paid under separate bid items.

7. Bid Item No. 7 – 66-inch Southwest Aqueduct Reach 2, Complete - STA 389+20 to STA 404+00, 3200 West

- a. Measurement: Payment for the construction of the 66-inch Southwest Aqueduct Reach 2 will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for the Southwest Aqueduct Reach 2, 66-inch diameter pipe and appurtenances from Station 389+20 at Emery Forest Ln to Station 404+00; including furnishing and installing all pipe materials, fittings, and appurtenances between the stations shown and within the public rights-of-way, permanent easements, and temporary construction easements provided; site condition and construction progress surveys; asphalt

sawcutting and removal; temporary asphalt as necessary; traffic controls; temporary security fencing; excavation including all sheeting, shoring and bracing of excavations as required; large rock and boulder removal; dewatering; utility service line restoration as required; furnishing and installing the pipe and all appurtenances at the strength and wall thickness shown; welding and joint preparation, coating and lining repairs; trench cutoff walls and trench plugs, as necessary; furnishing and installing pipe marking tape and markers; pipe zone and trench backfill materials; and balance of all Work required for installation of the 66-inch Southwest Aqueduct as shown on the plans, Complete.

- c. No Payment under this item for JBID sewer relocation; asphalt pavement restoration; cleaning, disinfection and hydrostatic testing. These Items are to be paid under separate bid items

8. Bid Item No. 8 – 66-inch Southwest Aqueduct Reach 2, Complete - STA 404+00 to STA 424+00, 3200 West

- a. Measurement: Payment for the construction of the 66-inch Southwest Aqueduct Reach 2 will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for the Southwest Aqueduct Reach 2, 66-inch diameter pipe and appurtenances from Station 404+00 to Station 424+00 at the Temporary Test Head at the south side of 11800 South; including furnishing and installing all pipe materials, fittings, and appurtenances between the stations shown; including installation of carrier pipe in casing at Jordan Aqueduct crossing, within the public rights-of-way, permanent easements, and temporary construction easements provided; potholing existing JA-2 and other utilities; site condition and construction progress surveys; asphalt sawcutting and removal; temporary asphalt as necessary; traffic controls; temporary security fencing; excavation including all sheeting, shoring and bracing of excavations as required; large rock and boulder removal; dewatering; utility service line restoration as required; furnishing and installing the pipe and all appurtenances at the strength and wall thickness shown; welding and joint preparation, coating and lining repairs; trench cutoff walls and trench plugs, as necessary; furnishing and installing pipe marking tape and markers; curb and gutter, waterways, sidewalk and parkstrip replacement; 8-inch drain, including buried valves, blowoff structure and connection to storm drain; pipe zone and trench backfill materials; protection of existing services to residents or relocation as required, coordinate with utility Owner; and balance of all Work required for installation of the 66-inch Southwest Aqueduct as shown on the plans, Complete.
- c. No Payment under this item for asphalt pavement restoration; construction of air valve vaults; and cleaning, disinfection and hydrostatic testing of the completed pipeline. These Items are to be paid under separate bid items.

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

- a. Measurement: Measurement of trench stabilization material will be based upon Unit Price per in place cubic yard measured from the dimensions of the trench prior to installation of the material.
- b. Payment: Payment for trench stabilization material will include stabilization material with geotextile; additional over excavation of the trench; dewatering; furnishing, transporting, and installing trench

stabilization in accordance with the specifications. Trench stabilization must be authorized in advance by the Engineer.

10. Bid Item No. 10 – SWA-2 Testing, Disinfection and Connections to Existing SWA, Complete

- a. Measurement: Payment for the testing, disinfection and final connections of the 66-inch Southwest Aqueduct Reach 2 will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for the successful hydrostatic testing and disinfection of the pipeline, including drains and final connections of the new Southwest Aqueduct Reach 2 to the existing SWA-2, 66-inch diameter pipe and appurtenances; with connections from Station 319+36 to Station 319+46 at 13400 South and from Station 424+00 to Station 424+82 at 11800 South; including furnishing and installing all pipe materials, fittings, and appurtenances between the stations shown and within the public rights-of-way, permanent easements, and temporary construction easements provided; potholing existing SWA and other utilities; site condition and construction progress surveys; asphalt sawcutting and removal; temporary asphalt as necessary; excavation including all sheeting, shoring and bracing of excavations as required; large rock and boulder removal; dewatering; furnishing and installing the pipe and all appurtenances at the strength and wall thickness shown; welding and joint preparation, coating and lining repairs, including repairs to the 11800 South existing SWA-2 previously damaged; trench cutoff walls and trench plugs, as necessary; furnishing and installing pipe marking tape and markers; pipe zone and trench backfill materials; and balance of all Work required for final connections of the 66-inch Southwest Aqueduct as shown on the plans, Complete.
- c. No Payment under this item for asphalt pavement restoration, to be paid under separate bid item.

11. Bid Item No. 11 – Cathodic Protection, Complete

- a. Measurement: Payment for the cathodic protection work will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for furnishing and installing all cathodic protection materials for the SWA-2. Including test stations, wires, connections, terminal boards, post mounts, concrete slabs, labels, and fittings to install a complete system; adding dielectric union to SWA-1 vault; restore the parkstrip or area where test station is installed back to original condition, including all area outside pavement restoration.
- c. No payment for asphalt pavement restoration, these items are to be paid under separate bid items.

12. Bid Item No. 12 – 12600 South Vault Improvements, Complete

- a. Measurement: Payment for the work at the 12600 South JA Mainline Valve and Turnout Structure will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for construction and improvements to the existing Jordan Aqueduct Mainline Valve and Turnout vault structure at the 12600 South site. Including site condition and construction progress surveys; furnishing and installing all materials and piping, including the 24-inch buried pipe from the SWA-2 turnout to existing wall spool piece; including modifications to existing wall spool piece; vault improvements including new hatch, platform access and

ladder modifications; installation of 24-inch pipe, butterfly valves and all fittings and appurtenances for connection to JA-2; 10-inch interconnection pipe and all fittings and appurtenances with new connection to existing 24-inch pipe; all mechanical items, supports and miscellaneous metals; any necessary repairs to existing lining and coatings; relocation of existing power meter, service disconnect and antenna; modifications to existing and new instrumentation for JA and SWA; installation of new electrical and controls, lighting, panels and all work for complete electrical and instrumentation; all earthwork, shoring; protection of existing structures; site grading and surface restoration; shutdown and draining of JA-1, cleaning, testing, and disinfection; and balance of all Work required at the 12600 South Vault site as shown on the plans, Complete.

- c. No payment for asphalt restoration included in this bid item, to be paid under separate item for asphalt restoration.

13. Bid Item No. 13 – 12600 South Vault Improvements, Items Shaded for Schedule Constraints

- a. Measurement: Payment for additional work required by installation of the items identified by blue highlight/shading at the 12600 South JA Mainline Valve and Turnout Structure due to schedule restraints of JA shutdown (Schedule B awarded), will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for the additional work required to install and complete the 12600 South Vault due to schedule restraints of the JA shutdown for Schedule B work. The items identified by shading and all required additional welding and materials and time for adjustments to install these items at a separate time during the shutdown of the Jordan Aqueduct, including modifications to connections, additional materials, fittings, appurtenances or other items for connections; supports, miscellaneous metals; repairs to linings and coatings; or any other items to complete the work during the required time restraints.

14. Bid Item No. 14 – 13400 South Vault Improvements, Complete

- a. Measurement: Payment for the work at the existing 13400 South SWA-2 Mainline Valve Vault will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for construction and improvements to the existing Southwest Aqueduct Mainline Valve vault structure at 3200 West and south side of 13400 South. Including furnishing and installing all materials and piping for modifications to existing and new instrumentation for JA and SWA; installation of new controls and all work for complete system; protection of existing structures; cleaning, testing, and disinfection; and balance of all Work required at the 13400 South Vault site as shown on the plans, Complete.

15. Bid Item No. 15 – Air Valve/Maintenance Structure

- a. Measurement: Payment for Air Valve/Maintenance Structure shall be made on a per Each basis for each structure.
- b. Payment: Payment shall constitute full compensation for site condition and construction progress surveys; excavation and backfill; construction of the structure; furnishing and installing all pipe materials, fabricated outlet and hinged access manway, valves, insulating flanges, bonding for cathodic protection, appurtenances, fittings, air vents and vent pads, and miscellaneous metals; protective coatings; surface restoration of curb and gutter, parkstrips, and sidewalks as indicated; new gravel access to vault at

- Cedar Brae park; and all other work shown and specified to complete each structure.
- c. Asphalt and other surface restoration, testing and disinfection to occur with mainline and to be paid under separate Bid items.
- 16. Bid Item No. 16 – Drain/Maintenance Structure**
- a. Measurement: Payment for Drain/Maintenance Structure shall be made on a lump sum basis.
 - b. Payment: Payment shall constitute full compensation for site condition and construction progress surveys; excavation and backfill; potholing to locate existing tie-in pipe; construction of the structure including the minor drain; furnishing and installing all pipe materials, fabricated outlet and hinged access manway, valves, insulating flanges, bonding for cathodic protection, appurtenances, fittings, air vents, miscellaneous metals; protective coatings; surface restoration of the curb and gutter and sidewalk; additional flatwork and all other work shown and specified.
 - c. Asphalt surface restoration, testing and disinfection to occur with mainline and to be paid under separate Bid items.
- 17. Bid Item No. 17 – Sanitary Sewer Manhole and Sewer Relocation, Complete**
- a. Measurement: Payment for relocation of sewer manhole and sewer shall be made on a lump sum basis.
 - b. Payment: Payment shall constitute full compensation for site conditions and construction progress surveys; coordination with utility owner; permits required by utility owner; traffic controls; sewer bypassing, including plan for approval by utility owner; excavation and backfill; 8-inch diameter sewer pipe, fittings and connections, flowable fill; sewer casing; furnishing and installing new manhole sections and base, grade rings, cover and frame, grout, and other items for complete manhole and pipe installation; including sloping and forming of trough; cleaning, testing and inspection by utility owner; additional surface restoration outside of 3200 West specific to sewer relocation and all other work necessary to furnish and install manhole, casing and sewer in accordance with Jordan Basin Improvement District standards.
- 18. Bid Item No. 18 – 12-inch Waterline Loop Over SWA-2, Riverton City Standards**
- a. Measurement: Payment for looping of 12-inch waterline over the aqueduct will be made on a per Each basis for each loop.
 - b. Payment: Payment shall constitute full compensation for site conditions and construction progress surveys; coordination with utility owner; traffic controls; site preparation, trench excavation and backfill; furnishing and installing new 12-inch diameter water pipe loop over the new SWA -2, including thrust blocking; fittings and appurtenances; service valves, air valve with venting and connections. The Work includes cleaning and testing of the pipeline, surface restoration specific to looping appurtenances and all other work necessary to furnish and install a complete loop in accordance with Riverton City standards.
- 19. Bid Item No. 19 – 10-inch Pressurized Loop Over SWA-2, Riverton City Standards**
- a. Measurement: Payment for looping of 10-inch pressurized irrigation pipeline over the aqueduct will be made on a per Each basis for each loop.
 - b. Payment: Payment shall constitute full compensation for site conditions and construction progress surveys; coordination with utility owner; traffic controls; site preparation, trench excavation and backfill; furnishing and

installing new 10-inch diameter irrigation pipe loop over the new SWA -2, including thrust blocking; fittings and appurtenances; buried service valves, air valve and connections. The Work includes cleaning and testing of the pipeline, surface restoration specific to looping appurtenances and all other work necessary to furnish and install a complete loop in accordance with Riverton City standards.

20. Bid Item No. 20 – Asphalt Restoration, 3200 West

- a. Measurement: Payment for the reconstruction of the asphalt surface will be made on a Cubic Yard basis.
- b. Payment: Payment includes all Work associated with reconstruction of the asphalt road surface, for the width of the trench, limited at 16 feet wide; Work will include, but not be limited to, full depth removal of all existing asphalt pavement; excavation and hauling of unsuitable materials; subgrade preparation and grading; installation of new 8-inch structural road base and total depth of 4-inch minimum asphalt pavement section – to be coordinated with 2-inch Mill and Overlay for final depth, in accordance with Riverton City Standards; grade adjustment and replacement of utility manholes, valve boxes and survey monuments; concrete collars; striping and marking of the new pavement surface; and all other work shown and specified within the pay limits.

21. Bid Item No. 21 – Asphalt Restoration, 11800 South

- a. Measurement: Payment for the reconstruction of the asphalt road surface along 11800 South will be made on a Cubic Yard basis.
- b. Payment: Payment includes all Work associated with reconstruction of the asphalt road surface, extending from the curb and gutter of 11800 South and the extents of the intersection of 3200 West as shown on the plans. Work will include, but not be limited to, full depth removal of all existing asphalt pavement; excavation and hauling of unsuitable materials; subgrade preparation and grading; installation of new 8-inch structural road base and 6-inch asphalt pavement section in accordance with South Jordan and Riverton City Standards; grade adjustment and replacement of utility manholes, valve boxes and survey monuments; concrete collars; striping and marking of the new pavement surface; and all other work shown and specified within the lump sum pay limits.

22. Bid Item No. 22 – 2” Mill and Overlay, 3200 West

- a. Measurement: Measurement for asphalt pavement mill and overlay Work shall be made on a Unit Price basis by the square foot as calculated by the Engineer based on the area of the overlay as measured in the field to the limits indicated on the Plans.
- b. Payment: Payment shall constitute full compensation for furnishing, placing, and compacting asphalt overlay in accordance with Riverton City Standards including, but not limited to asphalt milling and removal; edge grinding; asphalt; tack coat; crack seal; asphalt testing; adjusting all street fixtures not specified elsewhere to final grade; concrete; restriping; and marking of the new pavement.

23. Bid Item No. 23 –Irrigation System Relocation, 12495 South to 12353 South

- a. Measurement: Payment for relocation of the existing irrigation line, structures, services and appurtenances shall be made on a lump sum basis.
- b. Payment: Payment for relocation of irrigation system north of 12600 South in residential backyards shall constitute full compensation for survey and

investigation to locate the existing line and be able to provide the same level of service after relocation; removal and disposal of existing utility materials, including abandonment of the storm drain currently connected to the irrigation system at property 12397 South; furnishing and installing 18" C-900 DR25 pipe materials, appurtenances, and fittings to match existing service; furnishing and installing of new buried valves, service connections, concrete structures and miscellaneous metals; trench backfill and bringing to grade; connections to the existing irrigation system at project boundaries; restoration of any additional surface features disturbed during irrigation relocation that are outside the Southwest Aqueduct construction limits; cleaning and all other work shown and specified to complete the relocation of the irrigation system, complete, and return to original operating conditions.

24. Bid Item No. 24 – Contractor Excavation and Backfill to Support Utility Relocation of Communication Utility Conflicts north of 12600 South, CenturyLink/Lumen

- a. Measurement: Lump Sum Payment for the excavation, backfill and coordination efforts for the temporary and permanent relocation of the existing communications line.
- b. Payment: Payment for coordination with utility company for them to provide relocation of communication conflicts north of 12600 South in residential backyards shall be based upon actual costs of relocations provided by CenturyLink/Lumen as submitted by the Contractor, including allowable markup for administration of Work. Contractor shall be responsible for coordinating and scheduling work with utility company, including temporary and final relocations of the utility and all required service boxes. Contractor is to provide coordination and excavation for installation of the final utility relocation in the same trench with the irrigation line and Contractor is to provide backfill materials and compaction for the communication line in conjunction with the irrigation line and bring excavation back to final grade.
- c. This item does not include a direct payment to CenturyLink for their utility relocation cable/conduit work. JWCD will directly pay CenturyLink for their portion of the relocation work. This bid item is for payment of the excavation, backfill and coordination effort required by the SWA-02 contractor to facilitate CenturyLink's temporary and permanent relocation of the communication utility north of 12600 South.

25. Bid Item No. 25 – 11400 South Vault Improvements, Complete

- a. Measurement: Payment for the construction of the 11400 South Mainline Valve Vault and miscellaneous 11400 South site Improvements will be made on a Lump Sum basis.
- b. Payment: Payment will be made on the basis of the Contractor's lump sum bid for construction of the vault and improvements to the existing Jordan Aqueduct 11400 South site. Including site condition and construction progress surveys; furnishing and installing all materials and piping, construction of the addition to the valve vault, including structural improvements; installation of the 78-inch butterfly valve and all appurtenances; 36-inch butterfly valve and all appurtenances; all mechanical items and miscellaneous metals; any necessary repairs to existing lining and coatings; installation of all electrical and controls, lighting and power service panels; electrical service connection; all earthwork, shoring; protection of existing structures; site grading and surface restoration; connections with existing pipelines; cleaning, testing, and disinfection; drain pipeline, interior

butt-strap welding of Jordan aqueduct joints, drain pipeline and canal lining for drain blowoff, 11400south existing vault modifications, all asphalt, curb gutter, landscape, and surface restoration for the site complete, and balance of all Work required at the 11400 South Vault site as shown on the plans, Complete.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 QUALITY ASSURANCE

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance
 - 1. Deliver and store products, materials, and equipment in accordance with manufacturer's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft.

2. Manage delivery schedules to minimize long-term storage of products at Site and overcrowding of construction spaces. Ensure coordination to minimize holding or storage times for flammable, hazardous, easily damaged, or sensitive materials to deterioration, theft, and other sources of loss.
- B. Transportation and Handling
1. Transport products by methods to avoid damage. Deliver in undamaged condition in manufacturer's unopened containers and packaging.
 2. Furnish equipment and personnel to handle products, materials, and equipment, including those provided by Owner, by methods to prevent soiling and damage.
 3. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.
- C. Storage and Protection
1. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate-controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.
 2. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.
 3. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter.
 4. Storage shall be arranged to provide access for inspection. Periodically inspect to assure products are undamaged and are maintained under required conditions.
 5. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.
- D. Maintenance of Storage
1. Periodically inspect stored products on a scheduled basis. Maintain a log of inspections and make the log available on request.
 2. Comply with manufacturer's product storage requirements and recommendations.
 3. Maintain manufacturer-required environmental conditions continually.
 4. Ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.
 5. For mechanical and electrical equipment, provide a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.
 6. Service products on a regularly scheduled basis. Maintain a log of services and submit as a record document prior to acceptance by Owner in accordance with the Contract Documents.

1.5 PROPOSED SUBSTITUTIONS AND "OR EQUAL" ITEMS

- A. Substitution and "or equal" determination shall be submitted and evaluated per the General Conditions included in the Contract Documents.
- B. When proposing a substitution, make written application to Engineer on the "Substitution Request Form."

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

6. Available maintenance, repair, and replacement service shall be indicated. The manufacturer shall have a local service agency (within 50 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.
 7. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitution, including cost of redesign and claims of other contractors affected by the resulting change.
- H. Without any increase in cost to Owner, be responsible for, and pay all costs in connection with proposed substitutions and costs of inspections and testing of equipment or materials submitted for review prior to purchase thereof for incorporation in the Work, whether or not Engineer accepts the proposed product, equipment, or material. Reimburse Owner for the charges of Engineer and other authorized representatives for evaluating each proposed substitution.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION



SUBSTITUTION REQUEST FORM

To: _____

Project: _____
Date: _____
Owner: _____

Specified Item:

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

Proposed Substitution: _____

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

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

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

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

Submitted by **Contractor:**

Firm: _____

By: _____

Signature: _____

Telephone: _____

Attachments: _____

Comments: _____

Reviewed by **Engineer:**

Accepted as Submitted Accepted as Noted

Not Accepted Received too Late

By: _____

Title: _____

Date: _____

Comments: _____

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

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

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

1.3 DEFINITIONS

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

1.4 CONTRACTOR'S REQUESTS FOR INTERPRETATION (RFI)

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

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

PART 2 - PRODUCTS

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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**SECTION 01 29 73
SCHEDULE OF VALUES**

PART 1 - GENERAL

1.1 GENERAL

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

1.2 DETAILED SCHEDULE OF VALUES

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

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

1.3 CHANGES TO SCHEDULE OF VALUES

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 30
SAFETY

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 SUBMITTALS

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

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

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 GENERAL

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

1.2 RELATED SECTIONS

- A. Section 01 20 00 – Measurement and Payment

1.3 QUALIFICATIONS

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

1.4 SUBMITTAL PROCEDURES

A. Submittal Requirements

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

B. Time of Submittals

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

C. Acceptance

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

1.5 SCHEDULE UPDATES

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

1.6 PROGRESS MEETINGS AND LOOK-AHEAD SCHEDULES

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

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

1.7 CONSTRUCTION SCHEDULE REVISIONS

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

1.8 SCHEDULE RECOVERY

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

1.9 EARLY COMPLETION SCHEDULES

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

Contractor is not entitled to any increase in Contract price for failure to achieve the early completion and waives all claim to same.

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

1.10 BASIS OF SCHEDULE NARRATIVES

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 33 20
SUBMITTAL PROCEDURES**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Whenever submittals are required hereunder, transmit all documents to Engineer in electronic format, via web-based construction management software as specified in Section 00 73 00 – Supplementary Conditions. Contact information for the web-based project management software is as follows:

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

Cell 801-828-7584

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

requirements for submittals as described in the Contract Documents, and include all corrections as required from previous submittals.

E. Submittal Schedule

1. Within 30 days of the Notice to Proceed, submit a complete list of anticipated submittals, which includes Specification and Drawing references.
 - a. Coordinate submittal schedule with any subcontracts, schedule of values, the list of products, and Contractor's construction schedule.
 - b. Prepare schedule in chronological order.
 - c. Update the list with "early start" submittal dates within 15 days of submittal of the Construction Progress Schedule.
 - d. Update submittal dates whenever the schedule is updated and include any additional submittals identified after the initial submittal in the updates.

F. Unsolicited Submittals: Unsolicited submittals may be returned without being reviewed.

G. Changes in Work: Changes in the Work will not be authorized by submittal review actions. No review action, implicit or explicit, will be interpreted to authorize changes in the Work. Changes will only be authorized by separate written direction from Owner, in accordance with the General Conditions.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

A. Product Data:

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

B. Samples

1. Whenever in the Specifications, samples are required, submit not less than 3 samples of each item or material to Engineer for acceptance at no additional cost to Owner.
2. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

3. Submit samples for acceptance, a minimum of 21 days prior to ordering such material for delivery to the jobsite. Submit in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the Work.
4. Transmit a submittal as a single PDF document with list of samples via the web-based project management software.
5. Individually and indelibly label and tag all samples to indicate all specified physical characteristics and Manufacturer's name for identification. Upon receiving acceptance by Engineer, one set of the samples will be stamped, dated, and returned. One set of samples will be retained by Engineer, and one set of samples will remain at the Project site until completion of the Work.
6. Unless indicated otherwise, all colors and textures of specified items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in Contract time or Price, clearly indicate this information in the submittal.

C. Shop Drawings

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

diagrams, controls, connections, anchorage, and supports. Present sufficient level of detail for assessment of compliance with the Contract Documents.

- c. Assign each Submittal a unique number, including the specification section under which it is submitted. Number all submittals sequentially within the applicable specification section. Original submittals will be assigned a numeric submittal number. Resubmittals shall be numbered with a revision number in addition to the original submittal number.

D. Engineer's Action

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

- H. Test and Evaluation Reports: Submit technical data, test reports, calculations, surveys, and certifications based on field tests and inspections by independent inspection and testing agency and by authorities having jurisdiction.
1. Reports of results of inspections and tests will not be considered Contract Documents.
 2. Refer to Section 01 45 00 - Quality Control for additional requirements.

1.5 PRECONSTRUCTION CONFERENCE SUBMITTALS

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

1.6 NEIGHBORHOOD CONSTRUCTION PLAN

- A. Provide for Engineer's review, a Neighborhood Construction Plan detailing the plan of operation for construction between 13400 South and 11800 South along 3200 West. In preparing the plan, consider the public awareness factors listed in Section 01 71 40 - Public Information Program, and include, at minimum, the following:
1. Pertinent elements of permits granted by governmental agencies.
 2. The planned work schedule, hours of operation, and plans for temporary and permanent pavement replacement.
 3. Material hauling routes for trench excavation material, pipe, and backfill material such that materials are not stored in the street right-of-way. Also, construction routes that avoid school zones or other areas of safety consideration.
 4. Plans for detours, access to each occupied property during the period of construction, and emergency vehicle access.
 5. Plans for barricades and neighborhood signage during construction.
 6. Safety measures to be taken to protect persons and private property in the vicinity of construction and including contingency or emergency plans for unplanned events such as excavation cave in or storm runoff.
 7. Identify neighborhood specific dust and noise control measures.
 8. Plans for public notices to adjacent property owners.
 9. Plans for maintaining access to private residences and businesses, including restoration procedures for temporary asphalt patching and the length of time restoration will be maintained.
- B. Submit to Engineer upon receiving accepted permits per Section 01 41 26 - Permits, and at least 14 days prior to work beginning in the Project segments.
- C. Engineer will use the Neighborhood Construction Plan to monitor the construction activities.

1.7 SITE CONDITION SURVEYS

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

1.8 CONSTRUCTION PROGRESS REPORTS

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

1.9 SURVEY DATA

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

1.10 UTILITY INVESTIGATION

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

1.11 QUALITY ASSURANCE/QUALITY CONTROL PLAN

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

1.12 CONTRACTOR DAILY REPORT

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

1.13 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manual

1. Submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the *Operations and Maintenance Manual*, written so that it can be used and understood by the Owner's operation and maintenance staff.
2. Furnish initial submittal of the *Operations and Maintenance Manual* to Engineer upon delivery of the respective equipment.
3. Subdivide the *Operations and Maintenance Manual* first by Specification Section number; second, by equipment item; and last, by "Part." Conform "Parts" to the following (as applicable):
 - a. Part 1 – Equipment Summary:
 - 1) Summary: In a summary table, indicate the equipment name, equipment number, and process area in which the equipment is installed.
 - 2) Form: Furnish an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the Work. Fill in the relevant information on the form and include it in Part 1.
 - b. Part 2 – Operational Procedures:
 - 1) Procedures: Include manufacturer-recommended procedures on the following in Part 2:
 - a) Installation
 - b) Adjustment
 - c) Startup
 - d) Location of controls, special tools, equipment required, or related instrumentation needed for operation
 - e) Operation procedures
 - f) Load changes
 - g) Calibration
 - h) Shutdown
 - i) Troubleshooting
 - j) Disassembly
 - k) Reassembly
 - l) Realignment
 - m) Testing to determine performance efficiency
 - n) Tabulation of proper settings for all pressure relief valves, low and high- pressure switches, and other protection devices
 - o) List of all electrical relay settings including alarm and contact settings
 - p) Lubrication.
 - c. Part 3 – Preventive Maintenance Procedures:
 - 1) Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place.
 - 2) Schedules: Include recommended frequency of preventive maintenance procedures. Cover lubrication schedules, including lubricant SAE grade, type, and temperature ranges.
 - d. Part 4 – Parts List:

- 1) Parts List: Furnish a complete parts list, including a generic description and manufacturer's identification number for each part. Include addresses and telephone numbers of the nearest supplier and parts warehouse.
- 2) Drawings: Include cross-sectional or exploded view drawings with the parts list.
- e. Part 5 – Wiring Diagrams:
 - 1) Diagrams: In this part, include complete internal and connection wiring diagrams for electrical equipment items.
- f. Part 6 – Shop Drawings:
 - 1) Drawings: In this part, include approved shop or fabrication drawings, complete with dimensions.
- g. Part 7 – Safety:
 - 1) Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.
- h. Part 8 – Documentation:
 - 1) Place all equipment warranties, affidavits, and certifications required by the Technical Specifications in this part.
4. Transmit to Engineer, one copy of the *Operations and Maintenance Manual* in digital format. In addition to the digital copy, furnish Engineer with four identical hard copies of the *Operations and Maintenance Manual*. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. Prepare a table of contents indicating all equipment in the manuals. Display the title of each volume on the cover and spine.
5. Submit *Operations and Maintenance Manuals* in final form, not later than the 75 percent of construction completion date. Correct all discrepancies found by Owner or Engineer in the *Operations and Maintenance Manual* within 30 days from the date of written notification.
6. Incomplete or unacceptable *Operations and Maintenance Manuals* at the 75 percent construction completion point constitute sufficient justification to withhold the amount stipulated in paragraph "*Operations and Maintenance Manual Submittals*" of Section 01 77 00 - Project Closeout, from any monies due.

B. Certificates

1. When specified in individual specification sections, submit manufacturers' certificates to Engineer for review as specified.
2. Submit in form of letter or company standard forms, signed by officer of manufacturer.
3. Include the following with each certification
 - a. Project name and location.
 - b. Contractor's name and address.
 - c. Quantity and date or dates of shipment or delivery to which certificate applies.
 - d. Manufacturer's name.
 - e. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - f. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

- C. Record Documents
 - 1. Prepare and maintain one set of record documents at the Project Site per the requirements of Section 01 78 39 - Project Record Documents. Submit to Engineer at close of Project.

1.14 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts: Submit list of spare parts information for all mechanical, electrical, and instrumentation equipment. Include the current list price of each spare part. Limit the spare parts list to those spare parts which each manufacturer recommends be maintained by Owner in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate Owner in ordering. Cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents. In addition to electronic submittal, bind the spare parts lists in standard size, 3-ring, loose-leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size not to exceed 2.5 inches.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 35 53
SECURITY**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 RELATED SECTIONS

- A. Section 01 57 19 – Temporary Environmental Controls

1.4 SUBMITTALS

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

1.5 SECURITY PROGRAM

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

- F. Prohibit firearms for the Project Site.
- G. Prohibit dogs from the Project Site.
- H. Erect and maintain temporary security fencing as required to protect the Work, the Project Site, and existing facilities on the Project Site. The location of all temporary security fencing shall be approved in advance by Engineer.
 - 1. Fence Height: 6 feet
 - 2. Fence Material: Chain linked with privacy screening fabric

1.6 ENTRY CONTROL

- A. Entry control shall not unreasonably limit the personnel of Owner, Engineer, and their operations and maintenance groups from performing assigned duties. Temporary access limitations will be identified to Engineer and the operations and maintenance groups at least 24 hours prior to such limitation.
- B. Restrict entry of unauthorized persons and vehicles into Project Site.
- C. Allow entry only to authorized persons with proper identification.
- D. Maintain a log of workmen and visitors and make log available to Owner on request. This log shall be submitted to Engineer monthly or as necessary.
- E. Require all visitors to sign the visitor log acknowledgment of the project rules included in this Section. A copy of the project rules shall be given to each visitor. Submit copies of these forms to Engineer biweekly.
- F. Contractor has the right to refuse access to the Project Site or require that a person or vehicle be removed from the Project Site if found violating any of the project rules.
- G. Give jobsite security orientation training to all affected employees, including subcontractor employees. Employee participation in the security orientation shall be acknowledged by their respective individual signatures affixed to an orientation roster.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 41 26
PERMITS

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

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

1.2 SUMMARY OF PERMITS TO BE OBTAINED BY CONTRACTOR

- A. Obtain the following permits. Submit copies of these permits to Engineer and maintain copies on-site. Comply with all conditions of the permits.
 - 1. Salt Lake Valley Health Department Bureau of Air Pollution Control Dust Control:
 - a. Dust Permit: The dust permit application requires a description of proposed dust control measures. The permit will include several conditions, including agreement to suspend all or part of the permitted activities if satisfactory control of airborne particulates cannot be obtained, attendance at a dust control class, and possibly posting of a bond to assure performance of permit conditions. Under all circumstances, comply with all mitigation requirements for dust control indemnify Owner against all liability arising out of this responsibility and for any and all Salt Lake Valley Health Department Bureau of Air Pollution imposed fines which may be assessed to the Project for violating the Dust Control Permit.
 - 1) Agency: Bureau of Air Pollution Control, Salt Lake Valley Health Department
 - 2) Contact Person: Joshua Greer - Environmental Health Specialist
 - 3) Telephone No.: (801) 313-6724
 - 4) Fax No.: (801) 313-6676
 - 2. Utah Occupational Safety and Health Administration:
 - a. Construction Permit: Covers worker safety and health for all project features.
 - 3. Utah Department of Transportation, Region II:
 - a. Right-of-Way Encroachment Permit: This permit covers construction of the pipeline across Utah Department of Transportation right-of-way 12600 South.

- 1) Agency: Utah Department of Transportation (UDOT).
- 2) Contact Person: Shane Safford
- 3) Address: 2010 South 2760 West Salt Lake City, Utah 84101-4592
- 4) Telephone No. (801) 975-4809
- 5) E-mail: lsafford@utah.gov
- b. Traffic Control Plan
4. Utah Department of Environmental Quality, Division of Water Quality:
 - a. UPDES General Permit for Construction Dewatering/Hydrostatic Testing of Pipelines: Covers discharge waters associated with dewatering operations and hydrostatic testing of pipelines.
 - 1) Agency: Utah Department of Environmental Quality, Division of Drinking Water
 - 2) Contact Person: Harry Campbell
 - 3) Telephone No.: (801) 538-6923
 - 4) Email: hcampbell@utah.gov
 - b. Notification of Chlorinated Water Discharge: This notification provides 30 days' notice prior to disinfection of pipeline and discharge of pipeline and discharge of chlorinated water.
5. Utah Division of Environmental Protection, Bureau of Water Pollution Control
 - a. Temporary Groundwater Discharge Permit is necessary if groundwater is present.
6. Utah Division of Environmental Protection, General Storm Water Permit for Construction Activities:
 - a. As a condition of contract award, sign a certification of agreement to comply with the terms and conditions of the permit. Permit not required if area of disturbance is less than one acre.
 - b. Agency and Contact Person:
 - 1) Agency: Utah Department of Environmental Quality, Division of Drinking Water
 - 2) Contact Person: Tom Rushing
 - 3) Address: 288 North 1460 West (Cannon Building) 3rd Floor, PO Box 144870, Salt Lake City, Utah 84114-4870
 - 4) Telephone No.: (801) 538-6951
 - 5) Email: trushing@utah.gov
7. Utah State Division of Health:
 - a. Letter of Approval to Construct: Letter and Certificate are required for construction and operations of a water supply system.
8. City of South Jordan
 - a. Excavation / Construction Permit: This permit is for the construction or excavation of all projects within the public right-of-way in South Jordan, Utah. A Traffic Control Plan will be required with this permit.
 - 1) Agency: South Jordan City
 - 2) Contact Person: Andrea Markham
 - 3) Address: 10996 South Redwood Rd., South Jordan, Utah, 84095
 - 4) Telephone No.: (801) 253-5230
 - 5) Email: amarkham@sjc.utah.gov
9. Riverton City
 - a. Right-of-Way Encroachment Permit is required for work within City right-of-way. A Traffic Control Plan will be required with this permit.
 - 1) Agency: Riverton City

- 2) Contact Person: Rose Kenworthy
- 3) Address: 12830 South Redwood Rd., Riverton, Utah, 84065
- 4) Telephone No.: (801) 208-3136
- 5) Email: rkenworthy@rivertoncity.com
- b. A Traffic Control Plan will be required with this permit.
- 10. Riverton City
 - a. Land Disturbance Permit is required to verify that construction will incorporate stormwater controls and comply with the Utah Clean Water Act and the requirements of the Municipal Separate Storm Sewer System (MS4) Permit.
 - 1) Agency: Riverton City
 - 2) Contact Person: Rose Kenworthy
 - 3) Address: 12830 South Redwood Rd., Riverton, Utah, 84065
 - 4) Telephone No.: (801) 208-3136
 - 5) Email: rkenworthy@rivertoncity.com
- 11. Salt Lake County
 - a. Existing Monument Preservation Permit is required to verify compliance with County policies and ordinances regarding existing public survey monuments. It is estimated that approximately 13 existing survey monuments have the potential to be disturbed by Project construction activity.
 - 1) Agency: Salt Lake County
 - 2) Contact Person: Salt Lake County Surveyor
 - 3) Address: 2001 South State Street, Suite N1-400, PO Box 144575, Salt Lake City, UT 84114-4575
 - 4) Telephone No.: (385) 468-8250

1.3 SUMMARY OF PERMITS OBTAINED BY OWNER

- A. The following permits have been or will be obtained by Owner for this Project. Verify and comply with conditions of said permits.
 - 1. Bureau of Reclamation
 - a. Jordan Aqueduct Encroachment Application
 - 1) Agency: Bureau of Reclamation
 - 2) Contact Person: Chris Thompson
 - 3) Telephone No.:
 - 4) Email:
 - b. Standard Form 299
 - 2. Utah Department of Environmental Quality, Division of Drinking Water
 - a. Project Notification Form and Plan Review/Construction Approval
 - 1) Agency: Utah Department of Environmental Quality, Division of Drinking Water
 - 2) Contact Person: Michael Newberry
 - 3) Telephone No.: (385) 515-1464
 - 4) Email: mnewberry@utah.gov
 - 3. Utah Department of Environmental Quality, Division of Drinking Water
 - a. Operating Permit
 - 4. Utah Lake Distributing Company
 - a. Application for Modification to Canal
 - 1) Agency: Utah Lake Distributing Company
 - 2) Contact Person: Brian Andrew (Franson-Noble & Associates)

- 3) Address: 1276 S 820 E, Suite 100, American Fork, Utah, 84003
- 4) Telephone No: (801) 756-0309
- 5. Salt Lake County
 - a. Flood Control Permit: For the use of Right-of-Way, Right-of-Entry, or Installation of Structures.
 - 1) Agency: Salt Lake County
 - 2) Contact Person: Chris Springer
 - 3) Address: 2001 South State Street, Salt Lake City, Utah 84190
 - 4) Telephone No.: (801) 468-2711

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 42 00
KEY PERSONNEL QUALIFICATIONS**

PART 1 - GENERAL

1.1 QUALIFICATIONS

- A. Contractor shall provide and maintain sufficient personnel with previous project experience in the construction of large diameter welded steel pipelines for the personnel specifically completing the Southwest Aqueduct work.
- B. The overall experience of the firm or company is not sufficient to meet this requirement, and the individuals tasked with managing and completing the Southwest Aqueduct shall demonstrate experience on similar projects.
- C. Contractor shall demonstrate that it has sufficient personnel with previous project experience to successfully complete the project. Past Contractor personnel experience shall be provided for each requirement. The Pipeline Owner or Engineer shall be entitled to contact each and every reference listed by the contractor. The Contractor, by submitting this qualification document, expressly agrees that any information concerning the contractors in possession of said entities and references may be made available to the Pipeline Owners and Engineers.
- D. Contractor's superintendent shall be present at the site of the Southwest Aqueduct installation at all times while work is in progress. Failure to observe this requirement will require suspension of the work until the superintendent is again present at the site. Site management by staff not meeting the qualifications of the superintendent will not be permitted.

1.2 CONTRACTOR SUBMITTALS

- A. Provide completed Attachments A and B datasheets for each key personnel submitted for acceptance. Identify key personnel who will be assigned to the project. Contractor's key personnel must be qualified to complete the work. Submit qualifying experience for each member of the team. Substituting non-prequalified Project Managers and/or Project Superintendents during the work is not allowed. Any changes to the Project Managers or Superintendents shall have written confirmation and be qualified to complete the work. Submit the following information and be approved by the Owner.
 - 1. Contractor's Southwest Aqueduct Project Manager:
 - a. shall have at least 8 years construction experience
 - b. shall have been Project Manager on the construction of at least two (2) pressurized welded steel water pipelines \geq 48-inches in diameter or larger with a combined length of 10,000 linear feet. The minimum length of any one pipeline project shall be at least 1,000 feet.
 - 2. Contractor's Southwest Aqueduct Project Superintendent:
 - a. shall have at least 10 years construction experience
 - b. shall have been Project Superintendent on the construction of at least two (2) pressurized welded steel water pipelines \geq 48inches in diameter or larger

with a combined length of 10,000 linear feet. The minimum length of any one pipeline project shall be at least 1,000 feet.

- B. Qualifying experience shall be specifically detailed on the accompanying Attachments A and B. Qualification forms for more than one Project Manager and Project Superintendent may be proposed, if desired, for flexibility in resource assignments; however, each individual proposed must meet the qualifying experience requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

ATTACHMENT A
Project Manager Experience Data Sheet
(submit a separate summary for each alternate Project Manager proposed)
(minimum of two qualifying projects required)
(resume may be submitted as a reference in addition to this table)

Name: _____

Years experienced as Project Manager: _____

Years of prior experience: _____ Positions: _____

Qualifying Project #1: _____

Did this individual serve as a Project Manager on this project? Yes No (circle one)

Length of 48" (or greater), steel, pressurized water pipeline installed: _____

Was this project in an urbanized area? Yes No (circle one)

Year Completed: _____ Total Cost: _____

Owner: _____

Owner's Contact Information: _____

Qualifying Project #2: _____

Did this individual serve as a Project Manager on this project? Yes No (circle one)

Length of 48" (or greater), steel, pressurized water pipeline installed: _____

Was this project in an urbanized area? Yes No (circle one)

Year Completed: _____ Total Cost: _____

Owner: _____

Owner's Contact Information: _____

Qualifying Project #3: _____

Did this individual serve as a Project Manager on this project? Yes No (circle one)

Length of 48" (or greater), steel, pressurized water pipeline installed: _____

Was this project in an urbanized area? Yes No (circle one)

Year Completed: _____ Total Cost: _____

Owner: _____

Owner's Contact Information: _____

(If additional projects are needed to demonstrate Project Manager's qualifications and experience, copy this sheet)

ATTACHMENT B
Project Superintendent Experience Data Sheet

(submit separate summary for each alternate Project Superintendent proposed)
(minimum of two qualifying projects required)
(resume may be submitted as a reference in addition to this table)

Name: _____

Years experienced as Superintendent: _____

Years of construction experience: _____ Positions: _____

Qualifying Project #1: _____

Did this individual serve as a Superintendent on this project? Yes No (circle one)

Length of 48" (or greater), steel, pressurized water pipeline installed: _____

Was this project in an urbanized area? Yes No (circle one)

Year Completed: _____ Total Cost: _____

Owner: _____

Owner's Contact Information: _____

Qualifying Project #2: _____

Did this individual serve as a Superintendent on this project? Yes No (circle one)

Length of 48" (or greater), steel, pressurized water pipeline installed: _____

Was this project in an urbanized area? Yes No (circle one)

Year Completed: _____ Total Cost: _____

Owner: _____

Owner's Contact Information: _____

Qualifying Project #3: _____

Did this individual serve as a Superintendent on this project? Yes No (circle one)

Length of 48" (or greater), steel, pressurized water pipeline installed: _____

Was this project in an urbanized area? Yes No (circle one)

Year Completed: _____ Total Cost: _____

Owner: _____

Owner's Contact Information: _____

(If additional projects are needed to demonstrate Project Superintendent's qualifications and experience, copy this sheet)

SECTION 01 42 13
ABBREVIATIONS OF INSTITUTIONS

PART 1 - GENERAL

1.1 GENERAL

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

1.2 ABBREVIATIONS

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

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

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

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

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

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

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 45 00
QUALITY CONTROL**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

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

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

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

1.4 SITE INVESTIGATION AND CONTROL

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

1.5 INSPECTION OF THE WORK

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

1.6 TIME OF INSPECTION AND TESTS

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

advance of any such inspections shall be reasonable cause for Engineer to order a sufficient delay in scheduled operations to allow time for such inspection. Be responsible for costs of any remedial or corrective work required, and all costs of such delays, including its impact on other portions of the Work.

1.7 SAMPLING AND TESTING

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

1.8 RIGHT OF REJECTION

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

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

1.9 QUALITY CONTROL REQUIREMENTS

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

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

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

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

1.10 TESTING SERVICES

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

3. Quality control testing of all precast concrete.
 4. All other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work.
 5. In addition, the following quality control tests shall be performed by Contractor:
 - a. Holiday testing of pipeline coatings.
 - b. Air testing of field-welded joints for steel pipe or pipe cylinders and fabricated specials.
 - c. All testing and inspection of welding work including, but not limited to, welding procedure qualifications, welder operator qualifications, all work performed by the certified welding inspector, all appropriate nondestructive testing of welds and all repair and retest of weld defects.
- G. Testing Services furnished by Owner: Unless otherwise specified, Owner will provide quality control testing services in connection with the following materials and equipment incorporated in the Work.
1. Concrete and CLSM strength tests.
 2. Moisture-density and relative density tests on embankment, fill, and backfill materials.
 3. In-place field density test on embankments, fills, and backfill.
 4. Vibration testing and monitoring when working near Jordan Aqueduct
 5. Other materials and equipment as specified herein.
 6. Testing, including sampling, shall be performed by Engineer or testing firm's laboratory personnel, in general manner and frequency indicated in the Specifications.
 7. Furnish all sample materials and cooperate in the testing activities, including sampling. Interrupt the Work when necessary to allow testing, including sampling to be performed. There shall be no claim for an increase in Contract Price or Contract Times due to such interruption. When testing activities, including sampling, are performed in the field by the testing firm's laboratory personnel, furnish personnel and facilities to assist in the activities.
 8. The testing firm's laboratory shall perform all laboratory tests within a reasonable time consistent with the specified standards and will furnish a written report of each test. Distribution of the reports shall be as directed by Engineer.
- H. Transmittal of Test Reports: Written reports of tests and engineering data furnished for Engineer's review of materials and equipment proposed to be used in the Work shall be submitted per Section 01 33 20 - Submittal Procedures.
- I. The testing firm retained for material field testing shall furnish an electronic copy of written report of each test. Copies of each test report will be transmitted to Engineer within three Workdays after each test is completed. Consecutively number each report for each type of test.
- J. Testing firm shall furnish an electronic copy of each field and laboratory quality control test to Contractor, Owner and Engineer

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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**SECTION 01 50 10
SITE ACCESS AND STORAGE**

PART 1 - GENERAL

1.1 REFERENCES

- A. U.S. Dept. of Transportation, Federal Highway Administration (FHWA) standards.
MUTCD Manual of Uniform Traffic Control Devices
- B. U.S. Dept. of Labor, Occupational Safety and Health Administration (OSHA) standards.
Subpart G, Part 1926 Safety and Health Standards for Construction

1.2 SUBMITTALS

- A. Provide design and engineering calculations for custom temporary bridges or steel plates to be employed.
- B. Submit hazardous materials storage plan.
- C. Submit the EPA issued number for wastes generated at the site.

1.3 ROADWAY AND TRAFFIC LIMITATIONS

- A. Investigate the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. Comply with the provisions specified in the Traffic Management Plan. Accept responsibility to construct and maintain any haul roads required for construction operations.
- B. Maintain a maximum speed limit of 25 mph while on the Project Site.
- C. Confine all vehicles to the designated construction area. Cross-country travel is prohibited.

1.4 TEMPORARY CROSSINGS

- A. General: Provide continuous, unobstructed, safe, and adequate pedestrian and vehicular access to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, and hospitals. Provide safe and adequate public transportation stops and pedestrian crossings at intervals not exceeding 300 feet. Cooperate with parties involved in the delivery of mail and removal of trash and garbage to maintain existing schedules for such services. Maintain vehicular access to residential driveways to the property line except when required construction precludes such access for reasonable periods of time.
- B. Temporary Bridges: Wherever necessary, provide suitable temporary bridges or steel plates over unfilled excavations, except where written consent of the individuals or authorities concerned to omit such temporary bridges or steel plates has been secured. Any such

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

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

1.5 WORK AND STORAGE AREA

- A. Owner will designate as indicated in the Contract Documents, and arrange for the Contractor's use, a portion of the property at the JWCD Water Treatment Plant near Mountain View Corridor and 3200 West and the complete JWCD property at 12092 South and 3200 West for use during the term of the Contract as a storage and shop area for

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

1.6 PARKING

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 55 26
TRAFFIC CONTROL**

PART 1 – GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. AASHTO Roadside Design Guide, Current Edition.
 2. Manual on Uniform Traffic Control Devices (MUTCD), Current Edition.
 3. Federal Highway Administration. Standard Highway Signs.
 4. ATSSA: American Traffic Safety Services Association. Quality Standards for Work Zone Traffic Control Devices.
 5. NCHRP – Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features.
 6. 2010 ADA Standards for Accessible Design
 7. Utah Department of Transportation (UDOT), Standard Specifications.
 8. Riverton City Standard Specifications and Plans Manual.
 9. South Jordan City Construction Standards and Specifications.
 10. UDOT's "Flagger Training Handbook."

1.2 SUBMITTALS

- A. Administrative Submittals: Copies of permits, licenses, and approvals for construction as required by Laws and Regulations and governing agencies.
- B. Shop Drawings:
1. Approved Traffic Control and Routing Plans: As specified herein.
 2. Message Boards: Proposed locations for placement at each detour or road closure.
- C. Traffic Control Supervisor(s) Qualifications: Qualifications of proposed traffic control supervisor(s) and traffic control plan signatory.

1.3 TRAFFIC CONTROL SUPERVISOR

- A. The traffic control supervisor shall be responsible for initiating, installing, and maintaining all traffic control devices as shown on the Traffic Control and Routing Plans, and as specified in the MUTCD and these specifications, or as directed. The traffic control supervisor shall be an employee of the CONTRACTOR and shall be assigned full time to the Project while work is underway on public roadways. The traffic control supervisor shall work exclusively on traffic control services. The designated traffic control supervisor shall also be available to be contacted by the PROJECT REPRESENTATIVE 24 hours a day for the life of this contract. The persons so designated shall have at least one year of experience directly related to work site traffic control in a supervisory capacity and shall be certified as a work site traffic control supervisor by ATSSA. Submit the name and qualifications of this person for review 7 days in advance of the date set for the preconstruction conference. The traffic control supervisor shall be capable of being onsite within 45 minutes of notification. The traffic control supervisor shall make at least four inspections of all traffic control devices each day as follows:

1. Before beginning work.
 2. At mid-shift.
 3. Half an hour after the end of the shift.
 4. Once during the period of nonworking hours.
- B. The traffic control supervisor shall make a daily record of traffic control activities using a form provided to and approved by the PROJECT REPRESENTATIVE. Submit completed forms within 24 hours.
- C. The traffic control supervisor shall oversee the security of the message boards to be implemented by the CONTRACTOR's field staff. Security measures shall be implemented daily and shall include locking the programming consoles, removing the tires, locking the tires to the message boards, chaining the message boards to a fixed item, and other measures to prevent theft.
- D. Each day the traffic control supervisor shall develop the messages for the message boards, determine the locations of the message boards, coordinate with field labor to locate the message boards, and program the message boards.
- E. The traffic control supervisor shall oversee the flagging operations. For road closures, the traffic control supervisor shall prepare informational handouts showing schedules and maps of the crew locations. The traffic control supervisor shall keep the handouts updated and furnish copies to the flaggers for distribution to drivers approaching closure barricades and drivers waiting to drive through single-lane zones. The traffic control supervisor shall manage the distribution of radios to flaggers and oversee the proper functioning of radios.
- F. Each evening and morning, signs shall be covered and uncovered as needed to inform the public of roadway closures, detours, work zones, and other traffic information. Each evening just before crews leave, all signs not required shall be covered and all signs required shall be uncovered. Each morning before start of construction, all signs not required shall be covered and all signs required shall be uncovered. The traffic control supervisor shall oversee the covering and uncovering of signs each evening and morning.
- G. Traffic control supervisor shall oversee storage of materials and construction equipment along right-of-way, as needed to ensure compliance with the Contract Documents.
- H. Traffic control supervisor shall be responsible for verifying that property owner notifications are made in accordance with Contract requirements.

1.4 FLAGGER

- A. Flaggers must have a current flagging certificate and must present proof of the following certifications upon request by the Department.
1. Acceptable certifications.
 2. UDOT Contractor Certification (Utah Valley State College).
 3. American Traffic Safety Services Association (ATSSA).

1.5 TRAFFIC CONTROL AND ROUTING PLANS

- A. The Traffic Control and Routing Plans shall be prepared and/or certified as to conformance with these Specifications by a Professional Traffic Operation Engineer (PTOE) or an ATSSA certified Work Site Traffic Control Supervisor and shall include the PTOE registration number or ATSSA certification number of the certifying person.
- B. Submit the initial phase Traffic Control and Routing Plans at the preconstruction conference. Submit plans for future phases of construction a minimum of 28 days before start of that construction phase to allow review and resubmittal, if necessary, and public notification. Meet with the PROJECT REPRESENTATIVE and affected agency having jurisdiction to review each of the Traffic Control and Routing Plans for each phase of construction. Do not begin construction on any given phase before receiving written acceptance by Riverton City and/or South Jordan City Traffic Division of the Traffic Control and Routing Plans for that phase.
- C. Failure to submit the Traffic Control and Routing Plans within the specified time frames will not be justification for additional working days. Failure to adequately address comments in any required resubmittal also will not justify additional working days.
- D. Changes to this plan shall be made only by written approval of PROJECT REPRESENTATIVE. Secure approvals for necessary changes so as not to delay progress of the work.
- E. If multiple road closures are desired simultaneously, detours must be coordinated and approved in advance by the PROJECT REPRESENTATIVE and the agency or agencies having jurisdiction. Allow a minimum of 14 working days for the PROJECT REPRESENTATIVE and the agency or agencies having jurisdiction review followed by 14 working days of prior notification of residents. Multiple simultaneous road closures will require additional message boards (at each end of the closure) which shall be provided by CONTRACTOR at no additional cost for duration of simultaneous closures.
- F. Traffic Routing Plan: Show sequences of construction affecting the use of roadways, time required for each phase of the work, provisions for decking over excavations and phasing of operations to provide necessary access, and plans for signing, barricading, and striping to provide passages for pedestrians, bicycles, and vehicles. Include schedule for covering traffic control signs (including detour signs) when not in use and uncovering just prior to use.
- G. The provided Traffic Control Plans in the Contract Documents are guidelines only, and shall not be used in lieu of detailed CONTRACTOR-prepared plans. Detailed Traffic Control Plans shall show the locations of traffic cones, barrier rail, construction zones, flaggers, stored pipe and materials, construction truck access, barricades, detours, signs, message boards, and other traffic control facilities.
- H. On a time and day agreed upon between the CONTRACTOR and PROJECT REPRESENTATIVE, meet weekly with the PROJECT REPRESENTATIVE to describe the following week's construction operations and the traffic control provisions. At each meeting, submit a detailed update of traffic control provisions and construction crew locations. This shall be submitted in hardcopy and electronic form using a Word file. The update shall contain a list of signs and the time and location for covering and uncovering signs. The update shall include the location and wording of message control boards.
- I. Any days lost due to improper traffic control will be charged against the allowable working days.

PART 2 – PRODUCTS

2.1 CERTIFICATIONS

- A. Use devices and systems which meet NCHRP-350 Report crash test requirements as defined in the four categories by the Federal Highway Administration. Some exceptions will be acceptable as stated below.
1. Category 1: Cones, tubular marker, delineators, and drums without lights must be certified by the manufacturer as meeting NCHRP-350 Report requirements.
 2. Category 2: Portable sign stands with signs, Type I, II and III barricades, vertical panels, Category 1 devices with light attachments and devices not expected to cause significant vehicle velocity change. These devices and systems must be certified by FHWA as meeting NCHRP-350 Report test requirements.
 3. Category 3: Portable/Temporary pre-cast concrete barrier manufactured after October 1, 2002 must be certified as meeting NCHRP-350 Report test requirements.
 - a. Manufacture date to be stamped into top of each barrier section using a numeric format (ex: 10/2002) with 2 inch x 2 inch numerals, 1/4 inch deep. See Standard Drawing BA 1A and BA 2.
 - b. Portable/Temporary pre-cast concrete barrier manufactured prior to October 1, 2002 and meeting NCHRP 230 may be used until they are no longer serviceable.
 4. Category 3: Crash Cushions and Truck Mounted Attenuators must be certified by FHWA as meeting NCHRP-350 Report test requirements.
 5. Category 4: Advanced Warning Arrow Panels and portable changeable message signs do not have to meet NCHRP-350 Report test requirements.

2.2 FLAGGER EQUIPMENT AND CLOTHING

- A. Comply with UDOT's "Flagger Training Handbook."
- B. Comply with approved Traffic Control Drawings.
- C. Paddle: Use a combination "STOP" and "SLOW" sign paddle. The paddles shall be a minimum of 18 inches wide with 6 inch series "C" letters and have a rigid fixed handle approximately 5 feet in length, from the bottom of the paddle to ground level. Fabricate the combination sign paddle from sheet metal or other light semirigid material. The background of the "stop" face shall be red with white letters and border. The background of the "SLOW" face shall be orange with black letters and border. Use Type II reflective sheeting for the background, letters, and border on the faces of the Stop/Slow paddles.
- D. Clothing:
1. Flagger vest and hard hat: Orange, red-orange, or fluorescent version of these colors:
 - a. Safety vest with a minimum of 775 inches of background material. Night work requires a minimum of 201 inches of reflective material (100 inches on the front and 100 inches on the back). Reflective material will be white and/or strong yellow-green.
 - b. Hard hat with 10 inches of white or strong yellow-green reflective tape placed around the base of the hard hat and visible to traffic from all directions.

2.3 TRAFFIC CONTROL SIGNING AND DEVICES

- A. Signs, Channelizing Devices, Fences, Barricades:
 - 1. Comply with this section, Article 2.1.
 - 2. Comply with Standard Drawings and specifications of applicable jurisdiction.
 - 3. Comply with Contract Traffic Control and Routing Plans.
 - 4. Do not use rocks, asphalt, or concrete pieces, construction materials, and other debris as weighting devices for barricades. Sand bags will be permitted as long as a low center of gravity is maintained as approved.
 - 5. Use a construction zone attenuator when approach ends of temporary precast barrier are within AASHTO clear zone.
 - a. Use AASHTO Roadside Design Guide to determine proper clear zone distance requirements.
 - b. Install crash cushions as per manufacturer's recommendations.

2.4 ADVANCE WARNING ARROW PANEL

- A. Meet all standards as specified in the MUTCD, Section 6F.53 Arrow Panels. Perform all functions as specified in contract traffic control plan sheets and the MUTCD.

2.5 PORTABLE CHANGEABLE MESSAGE SIGNS

- A. Portable changeable message signs (PCMS) shall conform to the provisions in Section 12-3.12, "Portable Changeable Message Signs," of the UDOT Standard Specifications and these Technical Specifications.

PART 3 – EXECUTION

3.1 LIMITATIONS OF OPERATIONS

- A. Open trench limits for sections located within public streets:
 - 1. Maximum allowable length of open trench at any given time is limited to 500 feet.
 - 2. Use and placement of all signs, channelizing devices, and barrier must comply with applicable city and/or DOT standards and specifications.
 - 3. Maintain one-lane one-way traffic within the open trench section at all times. Provide a traffic routing plans for any detoured traffic. See traffic control details DTR-02 and DTR-03 for traffic control for one-lane one-way through an intersection.
 - 4. On street parking may be temporarily prohibited along within this section. All appropriate and applicable signing must be in place and visible and notification must be provided to all affected residents 48 hours in advance of restriction. The maximum length of the parking restriction shall not exceed 700 feet in length at any given time.
 - 5. Whenever it is necessary to cross, close, or obstruct driveways, sidewalks, or other accesses, whether public or private, notification must be provided to all affected residents 72 hours in advance of restriction. Give notification in writing and include the estimated duration of the closure.
 - 6. No individual driveway is allowed to be closed for longer than 7 days.
 - 7. Access to cul-de-sacs must be maintained at all times.
 - 8. One lane-two way flagging is allowed between 7 AM to 7 PM so long as the flagging setup conforms to TA 10 of the Utah MUTCD.

- B. No Full Closures are allowed within the project limits except as specified below:
1. Full Closure of 3200 West between 13400 South and Lucky Dog Lane is allowed for 14 days. Residential access within this section must be maintained at all times. A marked detour is required as detailed in DTR-04.
 2. Full Closure of Elwood Drive between 3200 West and the west side of the traffic circle is allowed for 14 days. A marked detour is required as detailed in DTR-05.
 3. Full Closure of 3200 West between Emery Forest Lane and Hayden Ridge Way is allowed for 14 days. No detour plan is required.
 4. Full Closure of the 3200 West and the 12075 South intersection is allowed for 14 days. Residential access within this section must be maintained at all times. A marked detour is required as detailed in DTR-06.
 5. Full Closure of the 3200 West and the 11800 South intersection is allowed for 7 days. Residential access within this section must be maintained at all times. A marked detour is required as detailed in DTR-07. Coordinate signal timing adjustments for detours for all impacted traffic signals with the respective agency that maintains each signal. Give maintaining agency a minimum of 72 hours notice for the adjustment of signal phasing to accommodate the approved Traffic Control Plan.
 6. One of the Blue Heeler Way and Lucky Dog Lane intersections can be closed so long as the other is fully open and all residential accesses are maintained.
 7. When the one-lane one-way open trench operation transverses a four-legged cross intersection, one leg of the intersection is allowed to be closed for 7 days so long as a marked detour is provided and right-in/right-out access of the opposing access is maintained. See DTR-03.
- C. Notify the fire department, police/sheriff department, highway patrol, ambulance service, local school district, waste management, postal service, and transit 14 days before closing roadway or portion thereof. Notify said departments or agencies when streets are again passable for vehicles. Coordinate all bus routes and schedules with the Jordan School District. Conduct operations with the least interference to fire equipment access, and at no time prevent such access. Furnish CONTRACTOR's night emergency telephone numbers to the police or sheriff's department. Allow all emergency vehicles immediate passage.
- D. Maintain at least one access to all church properties at all times. On Sundays, all church accesses must be open.
- E. Maintain pedestrian access along at least one side of 3200 West and each cross street at all times. Open sidewalks shall be kept safe from construction activities. Whenever it is necessary to cross, close, or obstruct sidewalks, or other accesses, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary facilities for accommodation of public and private travel. All temporary facilities shall be ADA compliant.
- F. Traffic control shall be conducted in accordance with the approved Traffic Control and Routing Plans and the MUTCD.
- G. PCMS must be in place a minimum of 14 days prior to the beginning of construction and prior to any closure including the start date, time, and duration of closure as shown in the provided detour plans.
- H. Work that interferes with public traffic, either one-lane or two-lane traffic, shall not cause any traffic delays to public traffic between 7 a.m. to 8:30 a.m., and between 4:30 p.m. and 6:00

p.m., nor more than 10-minute delays to public traffic between the hours of 8:30 a.m. to 4:30 p.m. School buses shall not be delayed for more than 2 minutes.

- I. Minimum lane width shall be 10 feet, unless noted otherwise. Where cones are used to separate traffic lane from construction zone, do not use traffic lane for accessing construction zone, and do not store materials or equipment on or near shoulder of traffic lane side of roadway.
- J. If work will interfere with mail delivery, move or provide temporary mailboxes to temporary locations accessible to postal service, and on completion of work in each area, replace them in their original location and in a condition equal to or better than original.
- K. If work will interfere with garbage pickup, move property owner's (resident's) garbage cans to areas accessible for garbage pickup. Garbage cans shall be returned to owner's driveway after pickup.
- L. Coordination: Coordinate traffic routing with that of others working in the same or adjacent areas. Coordinate access for garbage pickup, mail delivery, and school buses.
- M. Each evening prior to crew departure, all work areas shall be swept to ensure all construction debris (including, but not limited to, AC waste, gravel, and dirt) has been removed from the surface of the road. Debris shall be disposed of offsite and shall not be swept into ditches or otherwise outside of the work area.
- N. Barricades and Lights:
 - 1. Provide as shown on all approved Traffic Control Plans and in sufficient quantity to safeguard public and work.
 - 2. Provide as necessary to prevent unauthorized entry to construction areas and affected roads, streets, sidewalks, and alleyways, inside and outside of fenced area, and as required to ensure public safety and the safety of CONTRACTOR's employees, other employer's employees, and others who may be affected by the work.
 - 3. Provide to protect existing facilities and adjacent properties from potential damage.
 - 4. Locate to enable access by facility operators and property owners.
 - 5. Protect streets, roads, highways, and other public thoroughfares that are closed to traffic by effective barricades with acceptable warning signs.
 - 6. Locate barricades at the nearest intersecting public thoroughfare on each side of the blocked section as shown in the provided routing plans.
- O. Signs and Equipment:
 - 1. Traffic control signs and equipment shall be as described herein, the MUTCD and the Standard Highway Signs, shown on Traffic Control Details, and as directed by PROJECT REPRESENTATIVE.
 - 2. CONTRACTOR shall maintain existing traffic control signs during construction.
 - 3. Message Boards: Provide four PCMS conforming to the provisions of Section 2.5 of these specifications for use as directed by PROJECT REPRESENTATIVE. CONTRACTOR shall be responsible for moving and programming message boards as required throughout the Project.
 - 4. Portable TOW-AWAY-NO STOPPING Signs: Place where approved by police department of the agency having jurisdiction and the OWNER.
 - 5. Traffic Cones: Provide to delineate traffic lanes to guide and separate traffic

movements. Provide at obstructions, such as material piles and equipment, as directed by PROJECT REPRESENTATIVE.

6. Use to alert general public of construction hazards, which would include surface irregularities, unramped walkways, grade changes, and trenches or excavations in roadways and in other public access areas.
7. All portable and night use signs shall use “diamond” grade reflective lettering.
8. Detour signs shall be covered when not in use and uncovered just prior to use. Detour signs shall be covered with wood or metal. The use of easily displaced material such as plastic bags, burlap sacks, duct tape, etc. is not acceptable.

END OF SECTION

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 EXPLOSIVES AND BLASTING

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

1.2 DUST ABATEMENT

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

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

1.3 RUBBISH CONTROL

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

1.4 SANITATION

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

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

1.5 CHEMICALS

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

1.6 CULTURAL RESOURCES

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

1.7 AIR QUALITY

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

1.8 NOISE

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

J.

1.9 CONTROL OF SURFACE WATER

- A. Be advised that portions of the Work site are subject to flooding from surface waters. Work located outside major drainage ways may still be subject to minor channelized flows and overland sheet flow during some rainfall events.
- B. Be responsible for protecting the Work and temporary facilities from damage due to flooding, runoff, surface water flows, and related subsurface flows until final Project closeout. Provide protection for all aspects of the Work whether temporary or permanent. Provide all materials and equipment required to protect the Work. No additional payment will be made by Owner for providing protective measures or for any damage resulting from said flows. All damage from said flows shall be completely replaced in accordance with the Contract Documents at no additional cost to Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 58 13
TEMPORARY PROJECT SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide four project identification signs, complete, in accordance with the Contract Documents.
- B. Provide a publicly accessible bulletin board with required safety and labor law posters.

PART 2 - PRODUCTS

2.1 PROJECT IDENTIFICATION SIGNS

- A. Construct each sign of 3/4-inch painted, exterior grade plywood with 4 inch by 4 inch supports and 2 inch by 4 inch cross bracing capable of withstanding 15 psf wind loads.
- B. Each sign face shall be 4 feet vertical by 8 feet horizontal.
- C. Design sign for professional appearance
- D. Colors and text fonts
 - 1. Face
 - a. White
 - 2. Lettering
 - a. Black, block letter style
- E. Sign Content: The content and appearance of the project sign shall be as direct by the Owner. Content shall include Project Title, Owner, Contractor, Engineer, schedule dates, company Logos, and contact information. An Approximate facsimile of a sign is included at the end of this Section, however additional information may be required on each sign. Submit a dimensioned drawing to illustrate proposed sign content to Engineer for approval prior to construction.

PART 3 - EXECUTION

3.1 PROJECT IDENTIFICATION SIGN LOCATIONS

- A. Locate signs on the Project Site as directed by Engineer, but shall generally be located at each major work site of the project.
- B. Set the sign 4 feet above the ground, measured from grade to the lower edge of the plywood sheet.
- C. If the sign is located outside of an Owner-acquired right-of-way or easement, secure written permission from the property owner where the sign will be located and submit to Engineer.

3.2 REMOVAL

- A. Remove the project identification signs upon Substantial Completion of the Work.



END OF SECTION

**SECTION 01 71 00
MOBILIZATION**

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 PAYMENT FOR MOBILIZATION

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

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

3.2 SUBMITTAL REQUIREMENTS

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

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

3.3 MOBILIZATION PLAN

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

END OF SECTION

**SECTION 01 71 30
SITE CONDITIONS SURVEYS**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

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

- D. As a minimum, note preconstruction and postconstruction conditions and perform digital video surveys of the following:
 - 1. Areas used to access the Site or haul materials and equipment to the Site.
 - 2. The access road, both original and relocated locations and ultimately to the Site.
 - 3. All Work areas, including, but not limited to, access corridors, disposal areas, and staging areas.
 - 4. Any work completed by other contractors at the Site that will be impacted or otherwise affected by Work of this Project.
- E. Supplement digital video surveys with still photographs and spot elevation surveys as required to document the original condition and location of existing features and facilities.
- F. Provide digital video records.
- G. Conduct mapping to document the post-construction topography of the following Sites.
 - 1. See Table 1 in section 01 71 50 – Protection and Restoration of Existing Facilities for list of Private Properties impacted.

END OF SECTION

**SECTION 01 71 40
PUBLIC INFORMATION PROGRAM**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section outlines requirements for the Contractor in keeping the public informed and educated about all aspects of the Project related to public involvement, community relations, information dissemination, reporting construction progress, answering questions from the public and being sensitive to the public's concerns during construction.

1.2 DEFINITIONS

- A. Public Information Manager (PIM). PIM is a full time professional provided by the Owner, responsible for managing public information activities for the Project as outlined herein.
- B. Contractor Point of Contact (POC). The POC is a full time professional provided by the Contractor, responsible for coordinating directly with the PIM on the progress of the project and any upcoming outreach needs.
- C. Public Involvement Team (PI Team). PI Team is a combination of the Owner provided and Contractor provided persons working together to provide information about the project.
- D. KEY STAKEHOLDERS. The key stakeholders are defined as individuals, groups, organizations, and businesses that will either be affected by the Project or have an interest in the Project. The key stakeholders identified for the Project are:
 - 1. Adjacent property owners and tenants
 - 2. Nearby businesses and shopping centers
 - 3. The traveling public
 - 4. Partners: Riverton City, South Jordan City, Salt Lake County and Jordan Valley Water Conservancy District, canal companies.
 - 5. Elected officials from non-partner entities such as the Council of Governments for Salt Lake County and smaller communities where JVVCD provides water services.
 - 6. Utility services (i.e. mail carriers, sanitation, etc.)
 - 7. Schools near the work zone
 - 8. Churches near the work zone
 - 9. EMS services
 - 10. Bureau of Reclamation (BOR), owner of the Jordan Aqueduct

1.3 ADMINISTRATIVE REQUIREMENTS

- A. The primary objectives of the public information program are to maintain a high level of communication with the public prior to and throughout the pipeline construction process. This project will be disruptive to many, and it is important that the Project gain and maintain public support throughout construction. Public support will best be achieved if the public is informed in a timely manner; if they have the opportunity to be heard and they receive responses to questions and concerns; if they know where to look or whom to call for information; and if they receive frequent information updates.

- B. The construction period is anticipated to last approximately 24 months. In some areas, specific restrictions will limit when and how long construction can occur, see section 01 14 00 – Construction and Schedule Restraints, such as summer months near a school location or a three-month window of time along a busy intersection. Paving will occur only during certain times of the year. Keeping these guidelines in mind, there must be a coordinated communication effort between team members and the public.

1.4 PUBLIC INFORMATION EFFORTS TO DATE

- A. Preliminary communication planning has been underway since the spring of 2024. JWCD has hired a Public Involvement (PI) Team as part of the project and identified the primary goals of the project and the communication efforts needed to achieve those goals. Notifications were sent to more than 5,000 households located within 1,000 feet on either side of the pipeline corridor and a project website and hotline number have been created. JWCD representatives have presented the project to Riverton City and South Jordan City Council members. Printed information materials are being developed for distribution.

1.5 PUBLIC INFORMATION GOALS

- A. Focus on achieving the following public information goals throughout the Project:
 1. Coordinate with the PI team to communicate with affected property owners in a way that helps them cope with construction and that leads to positive associations for JWCD and its partners.
 2. Help to build a positive reputation for JWCD by being responsive to the public's needs during construction.

1.6 COMMUNICATIONS STRATEGIES

- A. Communications strategies that will be implemented on the Project include:
 1. Direct Communications: Communications with those most affected by SWA will be proactive. Active listening to issues and concerns and problem solving will be employed with the key stakeholders throughout the project.
 2. Coordination with Partners: Routine coordination with the communications staff from Riverton City and South Jordan City will be established to keep them informed with current information prior to other key stakeholders receiving the information.
 3. Feedback: Contractor will coordinate with the PI team about key stakeholder concerns and will devise the best plan moving forward for each issue as they arise.

1.7 PUBLIC INFORMATION ROLES

- A. Owner provides oversight and management of all communication activities. Owner's PIM also manages all media relations associated with JWCD Projects and serves as the spokesperson.
- B. Contractor provides a full-time professional, POC, with experience in large infrastructure projects or experience with the same scope as this project requires. This person will be in close coordination with the PI team and provides day-to-day communication activities specific to the project and is located on-site.

1.8 STAFF REQUIREMENTS

- A. Contractor Point of Contact (POC). Contractor is to provide a full time POC responsible for managing and communicating all schedule updates and onsite conditions to the PIM for the duration of the project. The POC will proactively coordinate with the PIM, who acts as a facilitator to resolve problems and is an advocate for the community. The POC is to be one of the Contractor's key personnel, and is to be available at all times during construction activities. The POC shall have the responsibility to effect direction of the Work if the Work is in conflict with public information. The POC is to have access to all project details, which may be relevant to the public, public agencies, emergency services providers, businesses, and other affected key stakeholders. The POC's responsibilities include:
1. Be available by telephone, call or text, with a minimum of a 30-minute response time on every working day and available upon Owner's request at other than normal working hours.
 2. Maintain daily communications with the PIM and attend regular meetings with Riverton and South Jordan Cities.
 3. Attend meetings as required by Owner's PIM with Riverton and South Jordan Cities' neighborhood coordinators and representatives to provide project updates and Q&A.
 4. Participate in onsite walk throughs or impromptu in-person meetings with the PIM and key stakeholders to address concerns or issues. Work through issues and work on a solution that best aligns with the project goals.
 5. Provide information about project activities, upcoming impacts and schedule updates to PIM.
 6. Provide a weekly summary of activities and meeting minutes to Owner's PI team.
 7. Attend and actively participate in the weekly construction meeting.
 8. Review and approve all communication messaging, written content and graphics, and coordinate edits through the PIM or PI team before distribution.
 9. Follow up all inquiries and complaints with either a return phone call, text or a meeting, as warranted.
 10. Provide updates to the PIM and PI team on project activities that affect public outreach, including the description of the work to be done, work locations, traffic restrictions, traffic detours, work times, days of the week and duration of the impacts.
 11. Monitor the placement of all construction signage to comply with guidelines established by the Owner.
 12. Do not correspond or speak with the news media regarding the Project or Project activities but forward such inquiries to the PIM and/or the PI team.

1.9 PUBLIC NOTIFICATION PROCESS

- A. General construction notification must be made by the Contractor to property owners, residents, and other impacted key stakeholders about construction work in the timeframe identified in Table 1. The notification process will be further defined by Owner as follows:
1. The construction partnering workshop at the beginning of the project will review the minimum advance notification that is required prior to any disruptive work being done along the corridor.
 2. Notifications will be required for road closures and detours, access issues for homeowners, utility disruptions, tree removals, paving and excessive noise during construction as well as other items as defined in the Pre-Construction Conference.
 3. Advanced notification is required for extended construction hours.

Table 1.

Advance Notification Minimum Requirements

Type	Advance Notice	Signage	City Public Information	Residents	Schools, Fire & Police	Businesses	Transportation Related
Construction Schedule	Weekly	N/A	Weekly or Daily	Weekly	Weekly	Weekly	Weekly
Street Closure	2 weeks	VMS* 2 weeks	2 weeks	2 weeks	2 weeks	2 weeks	2 weeks
Utility Disruption	48 hrs.	N/A	48 hrs.	48 hrs.	not in session	48 hrs.	48 hrs
Excessive Noise	72 hrs.	N/A	72 hrs.	72 hrs.	72 hrs.	72 hrs.	72 hrs.
Extended Work Schedule	48 hrs.	VMS* 48 hrs.	48 hrs.	48 hrs.	48 hrs.	48 hrs.	48 hrs.
Work Affecting Private Property	1 week	N/A	1 week	1 week	1 week	1 week	1 week
Access Denied to Private Property	1 week	N/A	1 week	1 week	1 week	1 week	1 week
Access Denied to Private Road	1 week	N/A	1 week	1 week	1 week	1 week	1 week

* VMS is a variable message sign.

- B. Advance notification by the Owner’s PIM shall utilize the following methods:
1. City Public Information: Phone, email, and meetings
 2. Residents: In person and/or flyers and meetings
 3. Schools: In person and/or flyer, fax, emails, and meetings
 4. Businesses: In person and/or flyer, fax, emails, and meetings
 5. Transportation Related Agencies: Phone and fax UTA, Emergency Services (VECC) UDOT, UTMA, mail, and delivery services.

1.10 PUBLIC INFORMATION MATERIALS

- A. The PIM and PI team will develop and distribute public information materials that have been approved by the project team, including the POC.
- B. All printed materials will be delivered by the PI team, unless otherwise discussed and agreed upon by the project team, including the PIM.

1.11 PROJECT COMMUNICATIONS AND BRANDING

- A. The PI team has established communication channels that are project branded and will serve as the public's way of contacting a project representative directly for the duration of the project. These communication channels include:
 - 1. Hotline: 435-254-2700
 - 2. Email: info@SWA-Reach2.com
 - 3. Website: swa-reach2.com
- B. The contractor should direct key stakeholders to the established communication channels out in the field and virtually, and should not give out personal information, including phone numbers and emails, for members of the project team.
- C. The PI team has created project branded materials that the contractor will use these for all project related documents.
 - 1. Project logo
 - 2. Project branded color palette
 - 3. Project branded templates (i.e. Powerpoint presentations, agendas for third party meetings, etc)
- D. The Contractor will include the project Hotline number on all Project signage.
- E. The PIM and/or PI team shall be available to answer the project Hotline at all times that construction activities are taking place on-site, and during all working hours Monday through Friday.

1.12 EVALUATION PROCESS

- A. Owner's PIM and PI team will monitor all activities associated with the role of the Contractor's POC. This will involve a quarterly evaluation of communication and coordination efforts.
- B. The Contractor's performance will be evaluated based upon the following tasks.
 - 1. Establish daily contact with the project construction manager for updates on construction activities.
 - 2. Timely in coordinating and addressing key stakeholder issues for the duration of the project.
 - 3. Easily accessible for coordination in both in-person and virtual communication needs.
 - 4. Provide advance notification within the given timeframes shown in Table 1. Any update to the schedule or impacts are immediately communicated to the PI team.
 - 5. Monitor the placement of all construction signage along the pipeline corridor to comply with guidelines established by the project manager.
 - 6. Attend and actively participate in the weekly meetings with the project contractors and maintenance of traffic for status updates. Provide summary to PIM.
 - 7. Attend key stakeholder meetings, both onsite and virtual, when requested by the PI team.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 71 50
PROTECTION AND RESTORATION OF EXISTING FACILITIES

PART 1 - GENERAL

- A. Protect all existing utilities and improvements not designated for removal and restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, in accordance with the Contract Documents.
- B. Call Blue Stakes before commencing any digging for location of underground utility lines and cable locations. The number is 811 or (801) 208-2100.
- C. Provide temporary 6-foot chain link fencing panels for protection of all open excavations and trenches within public streets, residential areas, and all other locations except for unimproved open areas where excavations and/or pipeline trenches that can be safely sloped in accordance with current OSHA standards to provide safe access without the use of shoring devices. Temporary fencing panels shall fully enclose open excavations and trenches and shall remain in place during all non-working hours.
- D. Provide temporary 6-foot chain link fencing with privacy fabric for protection of all open excavations and trenches within private properties. Temporary fencing shall fully enclose the open excavations and enclose the private property so that no unauthorized access can occur. It shall be installed to prevent pets or children access to the construction area and shall remain in place during all hours until excavation and trenches are backfilled to final grade and ready for final restoration.
- E. Provide temporary caps over all large diameter pipe during non-working hours to prevent unauthorized access.
- F. Cost to Cure method will be applied to properties that will be highly impacted for the construction of the project. Cost to Cure work has been performed by JVVCD, including an appraisal for estimating restoration requirements that will be paid directly to the property owner to perform final restoration of the property. This work will be independently performed once this project is complete within the residential property and the Contractor has restored the property to the requirements of the project. Further clarification between contractor responsibilities under this contract and resident cost to cure responsibilities is found in Exhibits in Appendix B.

1.2 RIGHTS-OF-WAY

- A. Do not perform any work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure. Do not enter upon the rights-of-way involved until notified by Engineer that Owner has secured authority therefore from the proper party.
- B. After authority has been obtained, give said party due notice of intention to begin work, if required by said party, and remove, shore, support or otherwise protect such pipeline, transmission line, ditch, fence, or structure or replace same.

- C. When two or more contracts are being executed at one time on the same or adjacent land in such manner that work on one contract may interfere with that on another, Owner will determine the sequence and order of the Work. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by Owner to Contractor so desiring, to the extent, amount, in the manner, and at the times permitted and in full conformance with the conditions of the Contract Documents.
- D. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage, except as provided for temporary suspension of the Work in the General Conditions of the Contract.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

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

1.4 RESTORATION OF PAVEMENT

- A. General: Replace all paved areas cut or damaged during construction with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing a permit. The pavement restoration requirement to match existing sections applies to all components of existing sections, including sub-base, base and pavement. Conform temporary and permanent pavement to the requirements of the affected jurisdictional agency. Neatly saw cut pavements, which are subject to partial removal, in straight lines.
- B. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, place temporary surfacing promptly after backfilling and maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.
- C. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, saw cut back and trim the edge to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement. Refer to plans for minimum dimension of T-patch replacement width over disturbed pipeline trenches in paved areas.
- D. Pavement Crown: In areas where pipeline trenching impacts an existing crown of asphalt, survey, and submit to Engineer documentation showing the pre-construction location of the

crown prior to trenching. Replace the crown of asphalt to its pre-construction location to the satisfaction of the governing agency and Engineer.

- E. Restoration of Sidewalks or Private Driveways: Wherever sidewalks or private roads have been removed for purposes of construction, place suitable temporary sidewalks or roadways promptly after backfilling and maintain them in satisfactory condition for the period fixed by the authorities having jurisdiction over the affected portions before proceeding with the final restoration. If no such period of time is so fixed, maintain said temporary sidewalks or roadways until the final restoration thereof has been made.
- F. Restoration of Curb and Gutter: Wherever curb and gutter, including driveway and sidewalk approaches, have been removed for purposes of construction, replace these improvements following construction to the specific dimension and requirements of the authority having jurisdiction. Replace improvements, including required ADA access details to the latest version of the authoritative standard regardless of their preconstruction condition.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

- A. General. Protect underground utilities and other improvements, which may be impaired during construction operations, regardless of whether the utilities are indicated on the Drawings. Take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.
- B. Except for utilities specifically located on the Drawings, be responsible for exploratory excavations (potholing) as deemed necessary to determine the exact locations and depths of utilities, which may interfere with the Work. Perform all such exploratory excavations as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the Work's progress. When such exploratory excavations show the utility locations as shown on the Drawings to be in error, so notify Engineer. Refer to plans for minimum advance distance that potholing must be performed prior to pipeline trenching work.
- C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.
- D. Utilities to be Moved: In case it becomes necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of Contractor, be notified by Owner to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, notify Engineer a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.
- E. Utilities to be Removed: Where the proper completion of the Work requires temporary or permanent removal and/or relocation of an existing utility or other improvement which is indicated, remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to Engineer and the owner of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition as found prior to removal.

- F. **Owner's Right of Access:** Owner and owners of public utilities and franchises reserve right to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work of this Contract.
- G. **Underground Utilities Indicated:** Existing utility lines that are indicated or the locations of which are made known prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced unless otherwise repaired by the owner of the damaged utility. If the owner of the damaged facility performs its own repairs, reimburse said owner for the costs of repair.
- H. **Underground Utilities Not Indicated:** In the event of damage to existing utility lines that are not indicated or the locations of which are not made known prior to excavation, make a verbal report of such damage immediately to Engineer and a written report thereof promptly thereafter. Notify the utility owner of the damage. If directed by Engineer, repairs shall be made under the provisions for changes and extra work contained in the General Conditions.
- I. **Damages.** Costs of locating and/or repairing damage not due to failure to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the Work which was interrupted or idled by removal or relocation of such utility facilities, and which was necessarily idled during such Work will be paid for as extra Work in accordance with the provisions of the General Conditions.
- J. **Approval of Repairs:** All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other work.
- K. **Fire Hydrants:** Keep all fire hydrants and water control valves free from obstruction and available for use at all times.
- L. **Maintaining in Service:** Unless indicated otherwise, all oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Engineer are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. Be responsible for and repair all damage due to construction operations. The provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.
- M. **Utility Service Laterals:** Not all utility service laterals are shown on the plans. Anticipate that there are no less service laterals than there are homes where project trenches are located in the vicinity of a street between a home and the utility main. Protect in place or remove and replace to the satisfaction of the utility owner, all utility service laterals encountered during construction. Duration of utility service outages and public notification procedures shall conform to the standards of the controlling agency and these Contract documents.

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

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

1.7 LAWN AREAS – OUTSIDE OF PRIVATE RESIDENTIAL PROPERTIES WITH COST TO CURE AGREEMENTS

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

1.8 UNIMPROVED AREAS

- A. Remove and stockpile topsoil prior to construction in accordance with Division 01 specifications. Replace topsoil prior to restoration of unimproved areas.
- B. Unimproved areas, including unclassified open spaces, fields, and unimproved rights-of-way, damaged during construction shall be repaired to match pre-construction conditions to the satisfaction of the landowner and Owner. At a minimum, unimproved areas shall be smoothed and finished graded with topsoil to match preconstruction topography, and reseeded using a native seed mix acceptable to the landowner and Owner.

- C. All slopes greater than 2H : 1V shall be protected with erosion control matting prior to reseeding.

1.9 OTHER SURFACE IMPROVEMENTS

- A. Conduct a pre-construction survey of all properties that will be impacted by construction operations. All improvements that have the potential to be impacted by construction, including but not limited to fencing, landscaping, boulders, retaining walls, irrigation systems, concrete improvements, and other public and/or private improvements, shall be protected in place, or if necessary, removed and replaced with like kind or better quality following construction.
- B. Work that will impact residential and commercial properties shall be subject to the notification and coordination requirements of Section 01 71 40 – Public Information Program.
- C. Residential and commercial properties which will be directly impacted by construction because of work within the existing JWCD easement are included in the Table below and in the Cost to Cure exhibits in Appendix B. These properties are identified by a Property ID number which also appears on the Drawings. As part of the work, Contractor is responsible for bringing the surface back to the pre-construction elevation including all grading and restoring top soil to final grade. Contractor shall restore all fences that were removed for construction to the nearest fence post and match existing fence type as best as possible. It is understood that fencing styles may require an “or equal” based on age and availability. Gates are to be installed at each property for JWCD access from the BOR easement only. Contract commitments specific to individual properties are included in the Table below and cost to cure exhibits in Appendix B.
- D. Final Restorations not identified in the Table below are only to be performed after consultation and agreement with JWCD.

<u>Property ID</u>	<u>Address</u>	<u>Owner</u>	<u>Right-of-Way Contract Commitments Made for Construction of the Project (Contractor Responsibility)</u>	<u>Cost to Cure Items Already Paid to the Property Owner</u>
R01	3200 W Thorngrove Circle – Cedar Brae Park	Riverton City	Replace: 60 ft vinyl fence (shared with neighbor 3191 W), sandbox (1,350 Sq. ft), 20 ft sidewalk, 75 ft curb and gutter, sod and sprinkler system (7,500 Sq. ft)	None
R02	3191 W 12600 S	Wash-Tech	Replace: 60 ft vinyl fence (shared with Cedar Brae Park), 370 ft vinyl fence, 120 ft chain link fence with double gate, 325 ft curb and gutter, 6,300 Sq. ft asphalt pavement replacement, 10 landscaping rocks, rock/gravel restoration (2,000 Sq. ft), site restoration (10,500 Sq. ft)	None
R03	12585 S 3240 W	Wahlin	Protect in place: Shed (south side of property), Tree (north side of property)	Sod & removal of sprinkler system (1,460 Sq. ft)

<u>Property ID</u>	<u>Address</u>	<u>Owner</u>	<u>Right-of-Way Contract Commitments Made for Construction of the Project (Contractor Responsibility)</u>	<u>Cost to Cure Items Already Paid to the Property Owner</u>
			Replace: 20 ft vinyl fence, 130 ft chain link fence with privacy and 4-ft man gate, 20 ft vinyl fence (shared with neighbor 12555 S), 20 ft modular block retaining wall, 130 ft railroad tie retaining wall	Gravel/fabric (1,100 Sq. ft) Hedgerow (3 lump sum)
R04	12555 S 3240 W	McCann-Welch	Replace: 20 ft vinyl fence (shared with neighbor 12585 S), 150 ft vinyl fence with 4-ft man gate, 20 ft vinyl fence (shared with neighbor 12535 S)	Sod & removal of sprinkler system (2,320 Sq. ft) Top soil (840 Sq. ft)
R05	12535 S 3240 W	Jensen	Replace: 20 ft vinyl fence (shared with neighbor 12555 S), 175 ft chain link fence with 4-ft man gate, 21 ft vinyl fence (shared with neighbor 12515 S) Remove: 3 Trees	Sod & removal of sprinkler system (2,045 Sq. ft) Top soil (1,380 Sq. ft) Post & rail Fence (20 ft)
R06	12515 S 3240 W	Harrison	Protect in place: Structure and rock wall (south side of property), Tree (north side of property) Replace: 21 ft vinyl fence (shared with neighbor 12535 S), 147 ft vinyl fence with 4-ft man gate and solar lighting, 22 ft vinyl fence (shared with neighbor 12495 S) Remove: 3 Trees	Sod & removal of sprinkler system (1,065 Sq. ft) Top soil (1,180 Sq. ft) Landscape rock & fabric (450 Sq. ft) Concrete curbing (125 ft) Stepping stones (7 each)
R07	12495 S 3240 W	Minor	Protect in place: Rock wall Replace: 22 ft vinyl fence (shared with neighbor 12515 S), 100 ft chain link fence with 4-ft man gate, 20 ft masonry block wall (shared with neighbor 12475 S), irrigation service/standpipe, site restoration (1,004 Sq. ft)	Sod & removal of sprinkler system (1,148 Sq. ft)
R08	12475 S 3240 W	Ellis	Protect in place: Structure (north side of property) Replace: 20 ft masonry block wall (shared with neighbor 12495 S), 110 ft chain link fence with 4-ft man gate, 20 ft chain link fence (shared with neighbor 12459 S), 155 ft welded steel pole fence, site restoration (356 Sq. ft) Remove: Concrete flatwork (555 Sq. ft)	Top soil (165 Sq. ft) Gravel/fabric (1,401 Sq. ft) Concrete flatwork (555 Sq. ft)

<u>Property ID</u>	<u>Address</u>	<u>Owner</u>	<u>Right-of-Way Contract Commitments Made for Construction of the Project (Contractor Responsibility)</u>	<u>Cost to Cure Items Already Paid to the Property Owner</u>
R09	12459 S 3240 W	Sorenson	Protect in place: Large Structure (southern edge of property) Replace: 20 ft chain link fence (shared with neighbor 12475 S), 110 ft chain link fence with 4-ft man gate, 20 ft vinyl fence (shared with neighbor 12445 S), 110 ft railroad tie retaining, site restoration (690 Sq. ft) Remove: 1 Tree, concrete flatwork (580 Sq. ft)	Sod & removal of sprinkler system (810 Sq. ft) Concrete flatwork (580 Sq. ft)
R10	12445 S 3240 W	Wheeler	Replace: 20 ft vinyl fence (shared with neighbor 12459 S), 110 ft vinyl fence with 4-ft man gate, 20 ft vinyl fence (shared with neighbor 12405 S), irrigation service/standpipe, site restoration (860 Sq. ft)	Top Soil patch for garden & removal of sprinkler/irrigation system (1,310 Sq. ft) Concrete curbing (43 ft)
R11	12405 S 3240 W	Johnson	Replace: 20 ft vinyl fence (shared with neighbor 12445 S), 110 ft chain link fence with privacy and 4-ft man gate, 20 ft chain link fence with privacy (shared with neighbor 12397 S), 105 ft welded steel pole fence, site restoration (1,650 Sq. ft) Remove: Concrete flatwork (521 Sq. ft),	Concrete flatwork (521 Sq. ft)
R12	12397 S 3240 W and 12391 S Sage Glen Dr	Butt	Replace: 20 ft chain link fence with privacy (shared with neighbor 12405 S), 110 ft chain link fence with privacy and 4-ft man gate, 80 ft vinyl fence with 2 gate panels, irrigation service/standpipe, buried irrigation butterfly valve and irrigation box, site restoration (975 Sq. ft) Remove: Storm drain box	Sod & removal of sprinkler system (1,930 Sq. ft)
R13	12383 S Sage Glen Dr	Steiner	Replace: 140 ft vinyl fence with 2-gate panel system with removable post and 4-ft man gate, 50 ft vinyl fence (shared with neighbor 12377 S), site restoration (450 Sq. ft) Remove: 85 ft chain link fence with 4-ft man gate, 1 Tree, concrete flatwork (630 Sq. ft)	Sod & removal of sprinkler system (2,620 Sq. ft) Gravel/fabric (890 Sq. ft) Bark mulch bed (55 Sq. ft) Concrete flatwork (630 Sq. ft)
R14	12377 S Sage Glen Dr	Phillips	Replace: 50 ft vinyl fence (shared with neighbor 12383 S), 105 ft chain link fence with 4-ft man gate, 50 ft vinyl fence (shared with neighbor 12353 S), site restoration (1,270 Sq. ft) Remove: 3 Trees	Sod & removal of sprinkler system (2,020 Sq. ft) Bark mulch bed (1,565 Sq. ft) Hedgerow

<u>Property ID</u>	<u>Address</u>	<u>Owner</u>	<u>Right-of-Way Contract Commitments Made for Construction of the Project (Contractor Responsibility)</u>	<u>Cost to Cure Items Already Paid to the Property Owner</u>
				(3 lump sum) Rock edging (72 ft) Concrete curbing (240 ft)
R15	12353 S Sage Glen Dr	Bennion	Replace: 50 ft vinyl fence (shared with neighbor 12377 S), 105 ft vinyl fence with 4-ft man gate, 50 ft vinyl fence (shared with neighbor 12337 S), site restoration (1,360 Sq. ft) Remove: 65 ft chain link fence with 4-ft man gate (along JA easement), 2 Trees, concrete flatwork (1,825 Sq. ft)	Sod & removal of sprinkler system (1,680 Sq. ft) Concrete flatwork (1,825 Sq. ft) Concrete stairs (1 lump sum)
R16	12337 S Sage Glen Dr	Jeppsen	Protect in place: Larger Shed and sidewalk (south edge of property near easement), trees and plants (north side of property near easement), vinyl fence (east side of property) Replace: 50 ft vinyl fence (shared with neighbor 12353 S), 50 ft vinyl fence (8 ft tall) with 4-ft man gate Remove: Concrete flatwork (1,635 Sq. ft)	Sod & removal of sprinkler system (2,410 Sq. ft) Gravel/fabric (940 Sq. ft) Concrete curbing (90 ft) Concrete flatwork (1,635 Sq. ft)
R17	3176 W Durham Woods Way	Wallace	Install 4-ft man gate in vinyl fence	None
R18	12600 South	JVWCD	Site restoration (10,850 Sq. ft)	None

1.10 NOTIFICATION BY CONTRACTOR

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, notify the owners or agencies responsible for such facilities not less than three days nor more than seven days prior to excavation so that a representative of said owner or agencies can be present during such Work if they so desire.
- B. When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.
- C. Contact, cooperate with, and provide written notice (including Contractor's phone number) at least seven days prior to beginning Work on each street. The written notice shall include the approximate schedule and explanation of Work and shall be given to each homeowner, business, all emergency agencies, schools, and residents, which will be affected by the project; particularly in reference to temporary interruptions to vehicular access. At least twenty-four

hours prior to initiation of Work, provide a second notice to confirm the scope of scheduled Work. Submit a copy of the notifications to Engineer, for approval, prior to the start of construction. Make verbal door-to-door communication prior to construction to remind all affected parties of the construction to take place. In addition, be responsible to answer and resolve any conflicts that may arise between a homeowner or business owner and the construction personnel.

- D. Refer to Section 01 71 40 - Public Information Program for detailed notification requirements and general responsibilities regarding public information.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 71 51
AQUEDUCT PROTECTION AND MONITORING

PART 1 - GENERAL

1.1 THE REQUIREMENTS

- A. The work in this section includes specific measures required to protect the Jordan Aqueduct from potential damages during construction of the Southwest Aqueduct.
- B. The Jordan Aqueduct is owned by the United States Bureau of Reclamation (BOR, USBOR, Reclamation) and operated and maintained by the Jordan Valley Water Conservancy District (JVWCD, District). Both entities may be referred to as Aqueduct Owner in these specifications.
- C. The Jordan Aqueduct is located in the BOR easement and runs parallel to the JVWCD easement for the Southwest Aqueduct. Existing Jordan Aqueduct horizontal and vertical alignment, based upon original BOR design drawings, are shown on the plans. Limits of the BOR right-of-way are shown on the plans.
- D. The existing aqueduct was constructed in the 1970's using gasketed bell and spigot style pipe. The Jordan Aqueduct consists of 78-inch diameter welded steel pipe (WSP) along 3200 West (Reach 2, JA-2) and at the 11400 South Vault site.
- E. The size and age of the aqueduct and lack of joint restraint requires that extreme caution be exercised when operating equipment and constructing facilities along or adjacent to the BOR right-of-way. Excessive vibration, loading, or settlement of the aqueduct may cause joints to leak and the pipeline to fail. The aqueduct must continuously convey water for a significant portion of the population of the Salt Lake Valley. The aqueduct cannot be taken out of service for maintenance and repair without significant advance planning and expense, and then only during limited (low wintertime demand) periods of the year for short and long-planned schedule durations.
- F. Requirements of this Section are based upon the Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, and 4, and the U.S. Department of the Interior Bureau of Reclamation Engineering and O&M Guidelines for Crossings. Copies of these documents are included in the Reference Document Attachments, Appendix C.
- G. Note that this Section is intended to provide a summary of the key requirements of the above documents as they relate to the Jordan Aqueduct Protection along the 3200 West Corridor for the Southwest Aqueduct Reach 2 Project and at the 11400 South Vault site. It is not intended to be a comprehensive list of BOR requirements. All requirements of these documents shall be adhered to when operating along or adjacent to the Jordan Aqueduct and United States right-of-way.

1.2 RELATED SECTIONS

- A. Section 33 11 11 – Steel Pipe
- B. Section 09 90 00 – Protective Coatings and Linings

C. Section 09 90 10 – Pipeline Coatings and Linings

1.3 REFERENCES

- A. Engineering and O&M Guidelines for Crossings – Bureau of Reclamation Water Conveyance Facilities, April 2008
- B. Exhibit A Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, & 4 – Protection Criteria
- C. Standard Form 299 – Application for Transportation and Utility Systems and Facilities on Federal Lands
- D. 29 CFR 1926: OSHA Safety and Health Regulations for Construction

1.4 DEFINITIONS NOT USED

1.5 SUBMITTALS

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

1.6 QUALITY CONTROL

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

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

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

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 BOR ENCROACHMENT APPLICATION PROCESS

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

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

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

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

3.3 UTILITY CROSSINGS

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

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

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

- A. Load restrictions must be carefully observed to protect the Jordan Aqueduct from damages that could be caused by excessive live or dead loading or vibrations during construction. The Load Restricted Area surrounding the Jordan Aqueduct is defined as a zone within 12-feet of both sides of the centerline of the pipeline (24-feet total width).
- B. Limit equipment, operation, procedures, and methods of construction within the Load Restricted Area to ensure that any combination of either live loads or dead loads does not exceed the design capabilities of the aqueduct. Comply with the following constraints, procedures, and load restrictions which apply to all construction activities and operations located within this zone.
- C. The largest equipment loading (live load) which shall be permitted within the Load Restricted Area is HL-93 and there must be a temporary minimum soil cover of 3-feet or greater.
- D. Prevent heavy equipment (exceeding an HL-93 loading) from encroaching within the Load Restricted Area. Dynamic loading of equipment, including soil compaction equipment, shall not exceed HL-93 loading. In all cases there shall be a temporary minimum of 3 feet of cover within the Load Restricted Area.
- E. Operation of backhoes, augers, excavation or lifting equipment which may impose point loads from outriggers, wheels, or jacks is not permitted within the Load Restricted Area.
- F. The allowable soil loading (dead load) or depth of cover over the aqueduct is restricted to a minimum of 4 feet for all pipe classes, and a maximum of 5 feet for Class A pipe, maximum of

10 feet for Class B, maximum of 15 feet for Class C, and maximum of 20 feet for Class D. Note that the aqueduct changes pipe class frequently along its alignment. Class changes are based upon the original design depth of cover that was present along the aqueduct. Pipe classes are shown in Tables 1 and 2 below (for each Schedule of work), and BOR reference plans.

Table 1
Jordan Aqueduct Reach 2 at 3200 West
78-inch Concrete Cylinder Pipe (CCP) Classifications

Location – Segment¹	Begin JA Stationing	End JA Stationing	Approximate Distance from SWA-2 Centerline (ft)	Pipe Class	Max Cover (ft)
13400 S to 13290 S	710+00	718+00	30	B	10
13290 S to 13140 S	718+00	728+60	24	A	5
13140 S to 13074 S	728+60	732+10	26	B	10
13074 S to 12950 S	732+10	740+00	26	A	5
12950 S to 12780 S	740+00	751+15	46	B	10
12780 S to 12615 S	751+15	762+42	46	A	5
12615 S to 12555 S	762+42	766+00	34	B	10
12555 S to 12350 S	766+00	780+00	35	A	5
12350 S to 12330 S	780+00	781+80	39	B	10
12330 S to 12290 S	781+80	784+82	39	A	5
12290 S to 12280 S	784+82	785+32	39	B	10
12280 S to 12210 S	785+32	789+12	38	A	5
12210 S to 12095 S	789+12	796+80	33	B	10
12095 S to 12055 S	796+80	799+54	29	A	5
12055 S to 11690 S	799+54	824+00	30	B	10

1. Location or Segment is based on residential addresses to identify the approximate location where the pipe class changes. Exact location of class change is based on BOR Reference Plans and requires additional investigation.

Table 2
Jordan Aqueduct Reach 2 at 11400 South
78-inch Welded Steel Pipe (WSP) Classifications

Location – Segment¹	Begin JA Stationing	End JA Stationing	Pipe Class	Max Cover (ft)
South of 11400 South and Utah Lake Distributing Canal to north side of 11400 South roadway	839+02	843+43.5	B	10
North side of 11400 South roadway, thru vault and north to Alpine Creek Way (outside project extents)	843+43.5	867+43	A	5

1. Location or Segment is based on approximate location where the pipe class changes. Exact location of class change is based on BOR Reference Plans and requires additional investigation.

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

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

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

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

3.6 SPECIAL PROTECTIONS FOR POTENTIAL GROUND SETTLEMENT

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

3.7 SPECIAL PROTECTIONS FOR VIBRATION CONTROL DURING CONSTRUCTION

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

END OF SECTION

**SECTION 01 74 19
DISPOSAL OF WATER**

PART 1 - GENERAL

1.1 SUMMARY

- A. Prepare a detailed listing of all discharges and overflows that will occur during the disinfection procedure.

1.2 REFERENCES

- A. American Water Works Association (AWWA) standards, latest edition.
 - AWWA C651 Disinfection Water Mains
 - AWWA C652 Disinfection of Water Storage Facilities

1.3 SUBMITTALS

- A. Submit a listing of every significant discharge from a drain valve, pump well, overflow, drain piping, and from all related appurtenances. "Significant discharge" is defined as a volume that is greater than that required to exercise or fill piping with chlorinated water and briefly flush. The listing shall be utilized as input for the Construction Progress Schedule to identify the volume and duration for every discharge that must be accounted for. Very minor discharges for air-release piping or drains that are exercised briefly to ensure disinfection do not need to be identified on the Construction Progress Schedule for dechlorination or discharge.
- B. Include the proposed method and equipment for dechlorination, including type of agent, temporary feed pumps, and appurtenant feed equipment.
- C. Final Report: Submit to Engineer a final report of each significant discharge, its locations, dates sampled for effectiveness of dechlorination, and the test results.

PART 2 - PRODUCTS

2.1 MATERIALS FOR DECHLORINATION

- A. Where dechlorination of water released back to the environment is required, use a sodium bisulfate or equivalent dechlorinator. Sodium bisulfite, if used, shall be applied at a ratio of at least 1.47 parts per every part of chlorine to be removed. This is to remove all the free active chlorine. Since the reaction produces a byproduct of hydrochloric acid, it will also tend to lower the pH of the water and remove calcium carbonate from the water. If the pH drops below 6.0, add calcium carbonate back into the water during the dechlorination process to restore the pH to an acceptable level of at least 6.0.

PART 3 - EXECUTION

3.1 MAJOR DISCHARGES, PUMP WELLS, OVERFLOWS

- A. General: List each drain valve, pump well, and overflow, along with proposed volume and duration of discharge during the disinfection procedure. Locations requiring dechlorination shall be indicated. Refer to Drawings to obtain detailed information on size, location, and layout of facilities and access conditions. Review the site of each proposed discharge for the conditions at the proposed discharge.

END OF SECTION

**SECTION 01 77 00
PROJECT CLOSEOUT**

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 SUBMITTALS

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

1.3 CLOSEOUT TIMETABLE

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

1.4 COMPLETION PROCEDURES

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

1. All final punch list items have been corrected, signed off by Contractor and Engineer, and demonstrated to Owner during a final walk-through.
 2. All updates to record drawings, and *Operations and Maintenance Manuals* have been made.
 3. Demobilization and site cleanup are complete.
 4. Facilities and/or equipment have been properly demonstrated to be functioning as required.
 5. Owner has received releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.
 6. New permanent cylinders and key blanks for all locks have been provided to Owner.
- D. Final Inspection and Payment
1. When all items have been completed or corrected, Engineer, Contractor, and Owner will promptly make a final inspection to verify completion. Final payment and Engineer's *Notice of Acceptability* will then be processed in accordance with the General Conditions of the Contract.
- E. Partial Utilization may be desired at Owner's option, as described in the General Conditions. If Partial Utilization is requested, the same procedure for completion of that portion of the Work as indicated in paragraphs A and B above, will be used.

1.5 CLOSE-OUT PROCEDURE

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

1.6 MAINTENANCE AND GUARANTEE

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

1.7 BOND

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

3.2 WASTE DISPOSAL

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

3.3 TOUCH-UP AND REPAIR

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

3.4 DEMOBILIZATION

- A. Demobilization shall include moving equipment, field trailers, construction materials, debris, and so forth from the Site as well as performing final cleanup.
1. Disturbed areas shall be restored to their original state or better.
 2. Permanent improvements damaged during construction operations shall be repaired or replaced at no additional cost to Owner.
 3. Remove all equipment, materials, waste, and debris from the site and restore site to original condition upon completion of construction.
 4. The work area shall be restored to its original or better condition and shall be inspected and approved by Engineer.

END OF SECTION

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SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

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

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

1.3 MARKING DEVICES

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

1.4 RECORDING

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

F. All surveying for record documents shall be performed by a licensed surveyor.

1.5 CLOSEOUT SUBMITTALS

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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**SECTION 01 81 10
SEISMIC DESIGN CRITERIA**

PART 1 - GENERAL

1.1 SUMMARY

- A. This section Includes seismic design criteria for the following:
1. Anchorage of mechanical and electrical equipment and piping.
 2. Seismic design of tanks and anchorage of tanks.
 3. Other structures or items as specified or indicated on the Drawings.

1.2 REFERENCES

- A. International Code Council (ICC) documents as follows:
- | | |
|-----|--|
| IBC | International Building Code, 2021 Edition [with Utah state amendments] |
|-----|--|
- B. American Society of Civil Engineers (ASCE) documents as follows:
- | | |
|--------|---|
| ASCE 7 | Minimum Design Loads for Buildings and Other Structures, 2016 Edition |
|--------|---|

1.3 SUBMITTALS

- A. Shop Drawings and Calculations: Submit shop drawings and structural calculations in accordance with Section 01 33 20 - Submittal Procedures. All drawings and calculations shall be signed and sealed by a licensed Civil or Structural engineer as required below under "Qualifications".
- B. ICC-ES reports for concrete anchors.

1.4 QUALITY ASSURANCE

- A. Qualifications
1. Licensed Professionals: Design of items required by this Section and other items not specifically shown in the Contract Documents shall be performed by a Civil or Structural Engineer licensed to practice in the state of Utah.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Design Criteria: Design in accordance with the requirements of the International Building Code and ASCE 7.
1. Seismic acceleration variables to be used in design are as follows:
 - a. The design 5 percent damped spectral response acceleration at short periods, $S_{DS} = 0.97g$.

- b. The design 5 percent damped spectral response acceleration at a period of 1 second, $S_{D1} = 0.7g$.
 - c. The mapped maximum considered earthquake, 5 percent damped, spectral response acceleration at short periods, $S_S = 1.42g$.
 - d. The mapped maximum considered earthquake, 5 percent damped, spectral response acceleration at a period of 1 second, $S_1 = 0.47g$.
 - e. Risk Category: IV
 - f. Soil Site Class = D.
 - g. Seismic Design Category = D.
- 2. Seismic Importance Factor for Anchorage of Mechanical and Electrical Equipment: 1.50.
 - 3. Seismic Importance Factor for the Design of Tanks and the Anchorage of Tanks: 1.50.
 - 4. Do not use friction to resist sliding due to seismic forces.
 - 5. Use only headed anchor bolts, adhesive anchors, or welded studs for anchors resisting seismic forces. Embedded anchor bolts used to resist seismic forces shall have a standard hex bolt head.
 - a. Adhesive anchors must have current ICC-ES reports showing that the anchors meet IBC requirements when installed in cracked substrates.
 - b. Do not use other types of anchors unless indicated on the Drawings or approved in writing by Engineer.
 - c. Seismic forces must be resisted by direct bearing on the fasteners used to resist seismic forces. Do not use connections which use friction to resist seismic forces.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 82 11
WIND DESIGN CRITERIA**

PART 1 - GENERAL

1.1 SUMMARY

- A. This section Includes design criteria for the following when exposed to wind forces:
1. Anchorage of mechanical and electrical equipment and piping.
 2. Design of tanks and anchorage of tanks.
 3. Other structures or items as specified or indicated on the Drawings.

1.2 REFERENCES

- A. International Code Council (ICC) documents as follows:

IBC International Building Code, 2021 Edition [\[with Utah state amendments\]](#)

- B. American Society of Civil Engineers (ASCE) documents as follows:

ASCE 7 Minimum Design Loads for Buildings and Other Structures, 2016 Edition

1.3 SUBMITTALS

- A. Shop Drawings and Calculations: Submit shop drawings and structural calculations in accordance with Section 01 33 20 - Submittal Procedures. All drawings and calculations shall be signed and sealed by a licensed Civil or Structural engineer as required below under "Qualifications".
- B. ICC-ES reports for concrete anchors.

1.4 QUALITY ASSURANCE

- A. Qualifications
1. Licensed Professionals: Design of items not specifically shown in the Contract Documents shall be performed by a professional Civil or Structural Engineer licensed to practice in the state of Utah.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Design Criteria: Design in accordance with the requirements of the International Building Code and ASCE 7.
1. Basic Wind Speed: 115 miles per hour
 2. Risk Category: IV
 3. Exposure: B

4. Topographic Factor: 1.0
5. Use only headed anchor bolts, adhesive anchors, or welded studs for anchors resisting wind forces. Embedded anchor bolts used to resist seismic forces shall have a standard hex bolt head.
 - a. Adhesive anchors must have current ICC-ES reports showing that the anchors meet IBC requirements.
 - b. Do not use other types of anchors unless indicated on the Drawings or approved in writing by the Engineer.
 - c. Wind forces must be resisted by direct bearing on the fasteners used to resist wind forces.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**DIVISION 03
CONCRETE**

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**SECTION 03 11 00
CONCRETE FORMING**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES

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

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

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

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

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

1.4 SYSTEM DESCRIPTION

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

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

1.5 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 GENERAL

- A. Except as otherwise expressly accepted by Engineer, utilize new material for all lumber brought on the job site for use as forms, shoring, or bracing. Unless otherwise indicated, form surfaces are to be smooth and fabricated from the following materials:
 - 1. Walls: Steel or plywood panel.
 - 2. Roof and Floor: Plywood.
 - 3. All Other Work: Steel panels, plywood or tongue and groove lumber
- B. Form materials which may remain or leave residues on or in the concrete that is in contact with potable water must be classified as acceptable for potable water under NSF 61 within 30 days of application or use.

2.2 MANUFACTURERS

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

2.3 FORM AND FALSEWORK MATERIALS

- A. Provide materials for concrete forms, formwork, and falsework that conform to the following requirements:
1. Lumber: Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with U.S. Product Standard PS 20.
 2. Plywood: New, waterproof, synthetic resin-bonded, exterior type Douglas Fir or Southern Yellow Pine plywood manufactured especially for concrete formwork, conforming to the requirements of PS 1 for Concrete Forms, Class I, edge sealed.
 3. Form materials: Metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.
- B. Unless otherwise indicated, provide exterior corners in concrete members with 3/4-inch chamfers. Re-entrant corners in concrete members do not require fillets unless otherwise indicated.
- C. Design forms and falsework to support the roof and floor slabs for the total dead load, plus a live load of 50 psf (minimum). The minimum design load for combined dead and live loads is 100 psf.

2.4 FORM TIES

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

2.5 FABRICATION

- A. Form tolerances: Provide forms in accordance with ACI 347, ACI 318, or 350 and the following tolerances.
1. Wall tolerances:
 - a. Straight wall surface:
 - 1) Exposed wall surface: Flat planes within tolerance specified.
 - 2) Plumb within 1/4 inch in 10 feet or within 1 inch from top to bottom for walls over 40 feet tall.
 - 3) Depressions in wall surface: Maximum 5/16 inch when 10-foot straightedge is placed on high points in all directions.
 - 4) Thickness: Maximum +1/4 inch or -1/2 inch from dimensions shown.
 2. Slab tolerances:
 - a. Exposed slab surfaces: Comprise of flat planes as required within tolerances specified.
 - b. Slab finish tolerances and slope tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on end blocks, no low spots that allow a block of twice the tolerance in thickness to pass under the supported 10-ft straightedge:

- 1) Steel gage block: 1/4 inch thick.
- c. Finish slab elevation: Slope slabs to floor sumps, drains, and gutter, to drain regardless of tolerances.
- d. Thickness: -1/4 inch or +1/2 inch from thickness shown, except when thickness tolerance will affect slope, drainage, or slab elevation.
3. For all other tolerances, refer to ACI 117.
4. Make transitions from plus to minus tolerances gradual, even, and smooth.

PART 3 - EXECUTION

3.1 GENERAL

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

3.2 FORM CONSTRUCTION

- A. Construct forms in conformance with ACI 347.
- B. Set forms true to the required shape and size and conform to the established alignment and grade. Provide sufficient strength and rigidity to maintain form position and shape under the loads and operations incident to placing and vibrating the concrete. Provide suitable and effective means on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. Assemble the forms tight to prevent the loss of water, cement, and fines during placing and vibrating of the concrete. Specifically, provide the bottom of wall forms that rest on concrete footings or slabs with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form. Provide adequate clean-out holes at the bottom of each lift of forms. The size, number, and location of such clean-outs must be as acceptable to Engineer. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, provide pour

windows of the size and spacing needed to allow placement of concrete to the requirements of Section 03 30 00 - Cast-in-Place Concrete. Provide size, number, and location of such form windows acceptable to Engineer.

- C. Vertical surfaces: Form all vertical surfaces of concrete members except where placement of the concrete against the ground is shown. Add no less than 1 inch of concrete to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed and has set.
- D. Construction joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to Engineer. When a second lift is placed on hardened concrete, take special precautions to include the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory affect on the concrete. Set pipe stubs and anchor bolts in the forms where required.
- E. Form ties
 - 1. Embedded Ties: Ream holes left by the removal of form tie cones with suitable toothed reamers to leave the surface of the holes clean and rough before being filled with mortar as specified for finish of concrete surfaces in Section 03 30 00 - Cast-in-Place Concrete. Wire ties for holding forms will not be permitted. Leave no form-tying device or part thereof, other than metal, embedded in the concrete. Do not remove ties in such manner to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, provide rubber grommets where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods must remain embedded and must terminate not less than 2 inches back from the formed face or faces of the concrete.

3.3 REMOVAL OF FORMS

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

3.4 REUSE OF FORMS

- A. Forms may be reused only if in good condition and only if acceptable to Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view.

3.5 MAINTENANCE OF FORMS

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

3.6 FALSEWORK

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

END OF SECTION

**SECTION 03 20 00
CONCRETE REINFORCING**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES

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

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

- B. American Welding Society (AWS):

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

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

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

Placing Reinforcing Bars

Manual of Standard Practice

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE AND HANDLING

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

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 REINFORCEMENT STEEL

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

2.3 BOLSTERS, CHAIRS AND ACCESSORIES

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

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

2.4 PRECAST CONCRETE BLOCK BAR SUPPORTS (DOBIES)

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

2.5 MECHANICAL COUPLERS

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

2.6 EPOXY GROUT

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

2.7 FABRICATION

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

2.8 TESTING

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

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

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

3.2 FIELD QUALITY CONTROL

- A. Reinforcement Congestion and Interfaces:
 - 1. Notify Engineer whenever the specified clearances between rebars cannot be met.
 - 2. Do not place any concrete until Engineer submits a solution to rebar congestion problem.
 - 3. Rebars may be moved slightly to avoid interference with other reinforcement steel, conduits, or embedded items.
 - 4. If rebars are moved more than 1 bar diameter, or enough to exceed above tolerances, obtain Engineer's approval of resulting arrangement of rebars.
 - 5. No cutting of rebars shall be done without written approval of Engineer.

- B. Employ a testing laboratory to perform and report following:
 - 1. Review and approve Contractor proposed welding procedures and processes for conformance with AWS D1.4.
 - 2. Qualify welders in accord with AWS D1.4.
 - 3. Test three samples of each bar size and each type of weld in accord with AWS D1.4. The tensile strength of each test shall be not less than 125 percent of the required yield strength of the rebar tested.
 - 4. Conduct nondestructive field tests (radiographic or magnetic particle) on not less than one random sample for each 10 welds. In addition, if any welds are found defective, test five previous welds performed by the same welder.
 - 5. Visually inspect each weld for presence of cracks, undercuts, inadequate size, and other visible defects.

3.3 COORDINATION

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

END OF SECTION

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

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

- A. Section 03 11 00 – Concrete Forming.
- B. Section 03 20 00 – Concrete Reinforcing.
- C. Section 03 60 00 – Grouting.
- D. Section 07 14 00 – Fluid-Applied Waterproofing.

1.3 REFERENCES

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

ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
B.	ASTM International (ASTM) standards, most recent editions:
ASTM C31	Standard Specification Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specifications for Concrete Aggregates
ASTM C39	Test for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Standard Specifications for Ready-Mixed Concrete
ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C260	Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C586	Standard Test Method for Potential Alkali Reactivity of Carbonate Rocks as Concrete Aggregates (Rock-Cylinder Method)
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C827	Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

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|------------|---|
| ASTM C1260 | Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method) |
| ASTM C1293 | Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction |
| ASTM C1567 | Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method) |
| ASTM D412 | Test Methods for Rubber Properties in Tension |
| ASTM D746 | Test Method for Brittleness Temperature of Plastics and Elastomers by Impact |
| ASTM D747 | Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam |
| ASTM D1751 | Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM D1752 | Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction |
| ASTM D2240 | Test Method for Rubber Property - Durometer Hardness |
| ASTM D2419 | Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate |
- C. International Concrete Repair Institute (ICRI) standards, latest editions:
- | | |
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| Guideline No 310.1R | Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion |
| Guideline No 320.2R | Guide for selecting and specifying Materials for repair of Concrete Surfaces |
- D. NSF International (NSF), most recent edition:
- | | |
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| NSF 61 | Drinking Water System Components, Health Effects |
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- E. U. S. Army Corps of Engineers standards, most recent editions:
- | | |
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| CRD-C 572 | PVC Waterstops |
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1.4 DEFINITIONS

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

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Product data:
 - 1. Concrete mix design(s) proposed for use. Proposed concrete mix design submittal to include the following information:
 - a. Sieve analysis and source identification of fine and coarse aggregates. Include sand equivalency.
 - b. Source test results for aggregate organic impurities.
 - c. Source test results for deleterious aggregate per ASTM standards.
 - d. Proportioning of all materials.
 - e. Type of cement with mill certificate for cement.
 - f. Slump.
 - g. Air Content.
 - h. Brand, type, ASTM designation, and quantity of each admixture proposed for use.
 - i. 28-day cylinder compressive test results of trial mixes per ACI 350 and as indicated herein.
 - j. Shrinkage test results.
 - k. Standard deviation value for concrete production facility.
 - 2. Manufacturer and type of joint filler, joint sealant, curing agent, and finishing aid.
 - 3. Waterstops:
 - a. Provide manufacturer's current test reports with written material certification.

- b. Provide samples of extruded or molded sections of each size or shape to be used in the Work. Samples shall represent in all aspects, the material to be furnished under this Contract.
 - c. Provide sample of fabricated cross-construction of each size or shape of waterstop to be used. Fabricate samples so that material and workmanship represent the materials to be furnished in the Work.
 - d. Provide manufacturer's written certification as an integral part of the shipping form, to show that the material shipped to Work meets or exceeds the physical property requirements specified.
- 4. Manufacturer and type of bonding and patching mortar and bonding adhesive used at construction joints.
 - 5. Pour plan for concrete pour sequence.

1.6 CONCRETE CONFERENCE

- A. A meeting to review the detailed requirements of the Contractor's proposed concrete design mixes and to determine the procedures for producing proper concrete construction shall be held no later than 14 days after the notice to proceed.
- B. All parties involved in the concrete work shall attend the conference, including the following:
 - 1. Contractor's representative.
 - 2. Testing laboratory representative.
 - 3. Concrete subcontractor.
 - 4. Reinforcing steel subcontractor and detailer.
 - 5. Concrete supplier.
 - 6. Admixture manufacturer's representative.
- C. The conference will be held at a mutually agreed upon time and place. Notify Engineer no less than 5 days prior to the date of the conference.

1.7 QUALITY ASSURANCE

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

1.8 DELIVERY, STORAGE AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Mixing, transporting, handling, placing, curing, and testing concrete in accordance with applicable ACI and ASTM specifications and as specified.
- C. Storage of material:
 - 1. Cement:
 - a. Protect cement from exposure to moisture until used.
 - b. Do not use if caked or lumpy.

- c. Store sacked cement to permit access for inspection and sampling.
 - 2. Aggregate:
 - a. Store to prevent segregation and contamination with other sizes or foreign materials.
 - b. Obtain samples for testing from aggregates at point of batching.
 - c. Do not use frozen or partially frozen aggregates.
 - d. Do not use the bottom 6 inches of stockpiles in contact with ground.
 - e. Allow sand to drain until moisture content is uniform prior to use.
 - 3. Admixtures:
 - a. Protect from contamination, evaporation, freezing, or damage.
 - b. Maintain within temperature range recommended by manufacturer.
 - c. Completely mix solutions and suspensions prior to use.
- D. Delivery:
- 1. Prepare a delivery ticket for each load of ready-mix concrete delivered to the project. Truck operator shall hand ticket to Engineer at time of delivery, which shows the following information for each load:
 - a. Mix identification mark.
 - b. Quantity delivered (by volume).
 - c. Amount of each material in batch.
 - d. Outdoor temperature in the shade.
 - e. Time at which cement was added.
 - f. Amount of water added at jobsite by Contractor.
 - g. Amount of superplasticizer added where applicable.

1.9 SITE ENVIRONMENTAL REQUIREMENTS

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

1.10 COORDINATION

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Expansion joint fillers:
 - a. WR Meadows, Inc.
 - b. NMW, Incorporated
 - c. Rubberite Cypress Sponge Corporation
 - d. Engineer approved equal.
2. Membrane Curing Compound.
 - a. 1100-Clear, WR Meadows, Inc.
 - b. Clear Resin Cure (J11w), Dayton Superior.
 - c. L&M Cure R, L&M Construction Chemicals, Inc
 - d. Engineer approved equal.
3. Evaporation Retardant:
 - a. AquaFilm (J74), Dayton Superior.
 - b. Eucobar, Euclid Chemical Company.
 - c. MasterKure ER 50, Master Builders.
 - d. Engineer approved equal.
4. Waterstops, Plastic Serrated Type:
 - a. BoMetals, Inc.
 - b. Durajoint, DCA Construction Products
 - c. Greenstreak, Sika, Inc.
 - d. Vinylex, Sika, Inc
 - e. Engineer approved equal.
5. Waterstops, Plastic Adhesive Type:
 - a. Lockstop, Sika, Inc.
 - b. Synko-Flex, Henry Company
 - c. Engineer approved equal.
6. Waterstops, Hydrophilic Type
 - a. Ultraseal, Adeka, Inc.
 - b. Adcor ES, WR Grace,
 - c. Hydro-Flex, Henry Company.
 - d. Hydrotite, Sika, Inc.
 - e. Engineer approved equal.
7. Bonding agent:
 - a. Armatek 110 EpoCem, Sika, Inc.
 - b. Engineer approved equal.
8. Set Controlling Admixtures
 - a. For air temperature at the time of placement over 80°F; set-retarding and hydration control:
 - 1) MasterSet Delvo, Master Builders.
 - 2) Recover, GCP Applied Technologies.
 - 3) SikaTard 440, Sika Corporation.
 - 4) Engineer approved equal.
 - b. For air temperature at the time of placement under 40°F: Non-corrosive set accelerating:
 - 1) Daraset 400, GCP Applied Technologies.
 - 2) MasterSet FP 20, Master Builders.
 - 3) Plastocrete 161FL by Sika Corporation.
 - 4) Engineer approved equal.
9. Air-entraining Agent:
 - a. MasterAir AE 200, Master Builders.

- b. Daravair 1000, GCP Applied Technologies.
 - c. Sika AEA-15, Sika Corporation.
 - d. Engineer approved equal.
10. Finishing Aids:
- a. Day1 Finishing Aid, Solomon Colors.
 - b. Slab Assist, TK Products.
 - c. Engineer approved equal.
11. Crystalline Waterproofing Repair Grout:
- a. Mortar IC, AquaFin, Inc.
 - b. Penecrete Mortar, Penetron International, LTD.
 - c. Concentrate Dry Pac, Xypex Chemical Corporation.
 - d. Engineer approved equal.
12. Pigments for Underground Conduit Banks:
- a. Arizona Oxides, #1835.
 - b. Bayer, Bayferrox #130.
 - c. Davis, #117.
 - d. As currently approved by Rocky Mountain Power Company.
13. Liquid Chemical Floor Hardener:
- a. Surfhard, Euclid Chemical Company, Cleveland, Ohio.
 - b. Burke-O-Lith, EDOCO.
 - c. Solidus Hardener, Lambert Corporation.
 - d. Engineer-approved equal.

2.2 MATERIALS

- A. Blended Hydraulic Cement: Comply with ASTM C595, Type IL (10) (MS), grey color.
- 1. Cement shall not contain more than 0.60 percent equivalent alkalis.
 - 2. Limestone content is limited to 10 percent.
 - 3. Single brand of cement used throughout Work; brand approved by Engineer.
- B. Fly Ash: ASTM C618, Class F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- 1. Maximum of 25 percent replacement at 1.0 pounds of fly ash per pound of cement replaced.
- C. Coarse Aggregate: Conforming to ASTM C33 and as noted below.
- 1. Clean, hard, durable gravel, crushed gravel, crushed rock or combination thereof.
 - 2. Reactivity: Non-reactive or below innocuous behavior level.
 - 3. Prepare and handle coarse aggregates in two or more size groups for combined aggregates with maximum size greater than 3/4 inch.
 - 4. When aggregates are proportioned for each batch of concrete, combine the size groups.
 - 5. Obtain coarse aggregates from sources approved by Engineer.
- D. Combined Aggregates: Well graded from course to fine sizes; uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradation will be established during the trial batch process.

- E. Fine Aggregates: Natural or combination of natural and manufactured sand that is hard and durable.
1. Lightweight Sand for Fine Aggregate: Not permitted.
 2. Sand Equivalency: Tested in accordance with ASTM D2419; not less than 80 percent for an average of 3 samples; not less than 80 percent for an individual test.
 3. Gradation: In accordance with ASTM C33; 15 to 30 percent passing number 50 screen; 5 to 10 percent passing number 100 screen.
 4. Fineness Modulus: Not over 3.00.
 5. Reactivity: Non-reactive or below innocuous behavior level.
 6. Obtain fine aggregates from sources approved by Engineer.
- F. Water: Clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities, as determined by Engineer.
- G. Admixtures:
1. Maximum total water-soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials, and admixtures by weight percent of cement:
 - a. 0.06 For prestressed concrete.
 - b. 0.10 For all other concrete.
 2. Do not use calcium chloride.
 3. Provide admixtures of same type, manufacturer, and quantity as used in establishing required concrete proportions in the mix design.
 4. Air entraining admixtures: ASTM C260.
 5. Water reducing admixtures:
 - a. Comply with ASTM C494, Type A.
 - b. Conform to applicable provisions of ACI 212.3R.
 - c. Follow manufacturer's instructions.
 - d. Use chloride free admixtures only.
 6. Set controlling admixtures with or without water-reducing properties.
 - a. ASTM C494, Types B through E.
 - b. Conform to applicable provisions of ACI 212.3R.
 - c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no additional cost to Owner.
 - d. Follow manufacturer's instructions.
 - e. Use chloride free admixtures only.
 7. High Range Water Reducers:
 - a. In accordance with ASTM C494, Type F.
 - b. Conform to applicable provisions of ACI 212.3R.
 - c. Locations for use of high range admixtures shall be as shown on the Contract Drawings. Do not use high range admixtures in other locations unless specifically approved by Engineer and at no additional cost to Owner.
 - d. Added at the plant unless written permission is given by Engineer to add the product at the Site.
 - e. Mixing: Minimum 70 revolutions or 5 minutes after addition of high-range water reducer.
 - f. Slump before Addition: Maximum 2 inches.
 - g. Slump after Addition: Minimum of 6 inches and maximum of 10 inches.

8. Pigments for Underground Conduit Banks: Add pigment to concrete encasing electrical duct banks as required by governing agency.

H. Curing Materials

1. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C156 shall not exceed 0.055 grams per square centimeter of surface.
2. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU B 790A (1) (2). The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.
3. Polyethylene-coated burlap for use as concrete curing blanket shall be 4 mils thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.
4. Membrane Curing Compound: ASTM C309, Type 1, Class B. Sodium silicate compounds will not be allowed.

I. Expansion Joint Filler

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

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

K. Waterstop, Plastic Serrated Type:

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

	<u>VALUE</u>	<u>ASTM STD.</u>
<u>PHYSICAL PROPERTY, SHEET MATERIAL</u>		
Tensile Strength-minimum (psi)	1750	D412, Die C
Ultimate Elongation-minimum (%)	350	D412, Die C
Low Temp. Brittle-maximum (°F)	-35	D746
Stiffness in Flexure-minimum (psi)	400	D747
<u>ACCELERATED EXTRACTION (CRD-C572)</u>		
Tensile Strength-minimum (psi)	1500	D412, Die C
Ultimate Elongation-minimum (%)	300	D412, Die C
<u>EFFECT OF ALKALIES (CRD-C572)</u>		

	VALUE	ASTM STD.
Change in Weight (%)	+0.25/-0.10	-----
Change in Durometer, Shore A	+5	D2240
FINISHED WATERSTOP		
Tensile Strength minimum (psi)	1400	D412, Die C
Ultimate Elongation minimum (%)	280	D412, Die C

- d. Style:
- 1) Flat Strip, 6 inches long unless noted otherwise.
- L. Waterstop, Plastic Adhesive Type: Non expansive plastic adhesive strip type conformable, manufactured solely for the purpose of preventing water from passing through construction joints.
1. Primer as recommended by waterstop manufacturer.
- M. Waterstop, Hydrophilic Type: Expansive, conformable blended rubber-based material.
1. Primer as recommended by waterstop manufacturer.
- N. Liquid Chemical Floor Hardener:
1. Colorless, aqueous solution containing magnesium fluosilicate combined with a wetting agent.
 - a. Premeasured, premixed, and packaged at the factory.
 - b. Not less than 2 pounds fluosilicate per gallon.
 - c. Provide material which does not react with, inhibit, or otherwise interfere with adhesives and bonding of future floor finishes.
- O. Elastomeric Bearing Materials:
1. Rubber bearing pads shall be furnished with the dimensions, material properties, and elastomer grade as required by the Drawings and in accordance with ASTM D2240, Type A, Shore 30 or 40 Durometer.
 2. Prepare concrete support surfaces and adhere pads to concrete per manufacturer's recommendations.
- P. Finishing Aids:
1. Topically applied colloidal silica compound.
 2. Do not use as a curing compound.
 3. Only to be used to assist in finishing by working into the surface immediately after application.
- Q. Waterproofing: Refer to Section 07 14 00 – Fluid-Applied Waterproofing.

2.3 EQUIPMENT

- A. On-Site Batch Plants:
1. Direct weighing equipment approved by Engineer for measuring cement and aggregate. Scales certified by Bureau of Weights and Measures. Certification current within 6 months.
 2. Equip mixer with suitable water meter or another measuring device approved by Engineer.

- a. Meter capable of measuring water in variable amounts within a tolerance of 1 percent.
 - b. Water feed control mechanism capable of being locked in position to deliver constant supply of specified amount of water to each batch of concrete.
 - c. Meter equipped with setback register with a readily visible vertical face and double hands indicating in cubic feet and decimals.
 - d. Provide positive, quick-acting cut-off valve in the water line to the mixer. Operating mechanism must not leak when valves are closed.
3. Batch mixer of an approved type and size, designed to ensure uniform distribution of all component materials throughout the mass during the mixing operation. Install and use a batch timer and counter, including lock release and audible indicator on each concrete mixer.
- B. Concrete Pumps:
1. Provide pumping equipment with two cylinders, designed to operate with only one cylinder in case one is not functioning. In lieu of this requirement, provide a standby pump on the site during pumping.
 - a. Minimum Diameter of Hose (conduit): 4 inches.
 - b. Aluminum conduits for conveying the concrete will not be permitted.
- C. Vibrators:
1. Internally vibrated, high speed power vibrators of an approved immersion type. In sufficient numbers with standby units as required.
- D. Truck Mixers:
1. At the Contractor's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C94, including the following supplementary requirements.
 2. Ready-mixed concrete shall be delivered to the site of the Work, and discharge shall be completed within 90 minutes after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.
 3. Truck mixers shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.
 4. Mix each batch of concrete in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
 5. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the Work unless the causing condition is corrected and satisfactory performance is

verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

6. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

2.4 REINFORCEMENT STEEL

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

2.5 CONCRETE MIXES

- A. General: Concrete shall be composed of cement, admixtures, aggregates, and water. These materials shall be of the qualities specified and in accordance with ACI 301 specifications. The exact proportions in which these materials are to be used for different parts of the Work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. All changes shall be subject to review by the Engineer.

B. Fine Aggregate Composition:

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

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

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

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

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

1. Compressive Strength: minimum at 28 days of age.
 2. Slump as shown above, plus or minus 1 inch.
 - a. When plasticizing agents are added at the Site, measure slump before addition of any plasticizing agents.
 - b. Measure at point of discharge of the concrete from delivery truck per ASTM C143.
 - c. Concrete of lower than maximum slump may be used provided it can be properly placed and consolidated.
 3. Minimum cement content:
 - a. Reinforced Concrete: Six sacks (564 lbs) Portland Cement per cubic yard.
 - b. Unreinforced Concrete: Five sacks (470 lbs) Portland Cement per cubic yard.
 4. Air content: Provide air entrainment resulting in a total air content of 4 to 7 percent for all types of construction.
 - a. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.
 - b. Air may be omitted from interior slabs to be trowel finished.
- D. Selection of Proportions:
1. General: Proportion ingredients to produce proper workability, durability, strength, and other required properties. Prevent segregation and collection of excessive free water on the surface.
 2. Pan stair fill:
 - a. Coarse aggregate: 100 percent passing a 1/2-inch sieve.
 - b. Proportions:
 - 1) One sack (94 lbs) cement.
 - 2) 150 pounds coarse aggregate.
 - 3) 150 pounds fine aggregate (sand).
 - 4) Adjust mix to obtain satisfactory finishing.
 3. Submit mix design data for approval as required by this specification Section.
 4. Proportion mixture to provide desired characteristics using one of the methods described below:
 - a. Method 1 (Trial Mix): Per ACI 350, Chapter 5, except as modified herein.

- 1) Air content within range specified above.
 - 2) Record and report the temperature of trial mixes.
 - 3) Proportion trial mixes per ACI 211.1.
 - b. Method 2 (Field Experience): Per ACI 350, Chapter 5, except as modified herein.
 - 1) Field test records must be acceptable to Engineer to use this method.
 - 2) Test records shall represent materials, proportions, and conditions similar to those specified herein.
 - c. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of ACI 350, using the standard deviation of the proposed concrete production facility.
5. Shrinkage Limitation
- a. Shrinkage limitations apply only to structural concrete.
 - b. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036 percent or 0.042 percent, respectively per ASTM C157, as modified herein.
 - c. Use a mix design for construction that has first met the trial batch shrinkage requirements.

2.6 SOURCE QUALITY CONTROL

- A. Trial Batch: Based on submitted concrete mixes for each class of concrete.
- B. Aggregates:
1. Fine and coarse aggregates shall be tested in accordance with ASTM C1260 or ASTM C1293 to show compliance with ASTM C33 for alkali-silica reactivity and shall be non-reactive unless employing the following additional measures:
 - a. When the above test results show the aggregates to be reactive, and fly ash or other supplementary cementing material (SCM) is approved for use in order to control alkali-aggregate reactivity, the proposed concrete mixture shall be tested in accordance with ASTM C1567 and produce expansion results of less than 0.10 percent at 14 days.
 - b. When a lithium admixture is approved for use to control alkali-aggregate reactivity, the proposed concrete mixture shall be tested in accordance with ASTM C1293 and produce expansion results of less than 0.04 percent in one year.
 2. The fine and coarse aggregates shall be tested in accordance with ASTM C586 to show compliance with ASTM C33 for alkali-carbonate reactivity and shall be non-reactive.
 3. The fine aggregate shall be tested in accordance with ASTM C40 to show compliance ASTM C33 for organic impurities.
 4. The fine and coarse aggregate shall be tested in accordance with ASTM C88 to show compliance with ASTM C33.
 5. The fine and coarse aggregate shall be tested in accordance with ASTM C142 to show compliance with ASTM C33.
 6. The fine and coarse aggregate shall be tested in accordance with ASTM C123 to show compliance with ASTM C33.

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

C. Concrete Testing:

1. Concrete testing to be performed by certified laboratory under direction of professional engineer licensed to practice in the State of Utah. Submit test results to Engineer and obtain approval prior to placement of concrete.
2. When concrete mix design is done per ACI 350, Method 1, (Trial Mix) incorporate shrinkage testing as specified herein into the mix design for all structural concrete mixes.
3. When concrete mix design is done per ACI 350, Method 2, (Field Experience), provide three drying shrinkage with seven compressive strength test specimens for approval of structural concrete mixes, using the actual materials and proportions proposed for the mixes. Provide additional trial batch testing when required by Engineer because of unsatisfactory test results.
4. Test four compression test cylinders at 7 days and three at 28 days:
 - a. Determination of compressive strength in units of psi will be made in accordance with ASTM C31.
 - b. Test in accordance with ASTM C469.
 - c. Modulus of elasticity determined by following formula:
 - 1) $E_c = 33 * W * 1.5\sqrt{f'_c}$
 - a) E_c = Modulus of Elasticity
 - b) W = Weight of Concrete, lb/ft³.
 - c) f'_c = Required 28 day strength, psi.
5. Drying Shrinkage Tests:
 - a. Perform drying shrinkage tests for the trial batch.
 - b. Provide one set of three specimens from each class of structural concrete.
 - c. Specimen Prisms: 4 inches by 4 inches by 11 inches with effective 10-inch gauge length, fabricated, cured, dried, and measured in accordance with ASTM C157, modified as follows:

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

PART 3 - EXECUTION

3.1 PREPARING FOR CONCRETING

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

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

- G. Waterstops:
1. Preparation
 - a. Uncoil waterstop minimum of 24 hours prior to installation for ease of handling and fabrication.
 - b. Position waterstop to ensure proper distance from steel reinforcing bars and to prevent rock pockets and honeycomb.
 - c. Clean concrete joint and waterstop after first pour to remove debris and dirt.
 2. Installation
 - a. Position waterstop across joints as specified herein and as indicated on Drawings.
 - b. Center waterstops on joint unless shown otherwise.
 - c. When centerbulb is present at moving joints, ensure that it is not embedded.
 - d. All waterstops fully continuous for the extent of the joint.
 - e. Secure plastic serrated waterstop in correct position before concrete placement with hog rings and wire to adjacent reinforcing steel at 12-inch maximum spacing. Center-to-center spacing may be increased upon written request and approval of Engineer.
 - f. Take suitable precautions and means to support and protect waterstops during the progress of the work.
 - g. Carefully place concrete without displacing waterstop from proper position.
 - h. For waterstops in slabs, limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, then place remaining concrete to full height of slab.
 3. Field Splices
 - a. Only butt splices are permitted in the field. Butt splices shall be made by the method of continuous heat welding using a manufacturer-approved waterstop welding iron.
 - b. Splice PVC waterstops neatly and in accordance with manufacturer's written instructions.
 - c. Excessive PVC weld spatter is not acceptable.
 - d. A maximum of one splice is permitted in any straight 20 feet of waterstop.
- H. Construction, Expansion, and Contraction Joints:
1. Provide at locations indicated or as approved by Engineer.
 2. Install construction joints in beams, slabs, and girders perpendicular to the planes of their surfaces.
 3. At least 48 hours shall elapse between placing of adjoining concrete construction.
 4. Before new concrete is placed against existing concrete, coat all construction joints with an approved bonding adhesive used and applied in accordance with manufacturer's instructions.
- I. Thoroughly clean surfaces of metalwork to be in contact with concrete immediately before concrete is placed.
- J. Remove ponded water from the excavation and moisten fill.

- K. Remove laitance, tighten forms, roughen, clean, wet and slush hardened concrete with cement grout prior to placing fresh concrete at construction joints. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.
- L. Cylinder Storage Device
 - 1. Provide and maintain a cylinder storage device at a protected location on the Site, acceptable to Engineer and as follows:
 - a. Maintain concrete test cylinders at a temperature range of 60 degrees F to 80 degrees F for the initial 24-hour curing period.
 - b. Once placed in the storage device, do not move the cylinders during this period.
 - c. Equip the storage device with an automatic 24-hour temperature recorder that continuously records on a time/temperature chart with an accuracy of ± 1 degree F.
 - d. Have the storage device available at the point of use at least 24 hours before concrete placement.
 - e. A 24-hour test run may be required before placement of concrete.
 - 2. Engineer may stop placement of concrete if the storage device is not functional or cannot accommodate the required number of test cylinders.
 - 3. Use water containing hydrated lime if water is to be in contact with cylinders.

3.2 PLACING CONCRETE

- A. Notify Engineer not less than 24 hours in advance of the times and places at which Contractor intends to place concrete.
- B. Place concrete in compliance with ACI Specifications and requirements of this Section.
- C. Place concrete only in presence of duly authorized representative of Engineer.
- D. Remove and replace concrete not placed as specified or of inferior quality, as determined by Engineer, and assume associated expense.
- E. Ready Mix Equipment:
 - 1. Do not exceed manufacturer's rated capacity of the mixer.
 - 2. Ensure sufficient mixing time for uniform distribution of materials.
 - 3. Discharge all concrete from mixer prior to mixing new batch.
 - 4. In accordance with ASTM C94.
- F. Transporting:
 - 1. Transport concrete from mixer to place of deposit by methods, which prevent segregation or loss of material.
 - 2. Provide runways when wheelbarrows are used to transport concrete.
 - 3. Do not wheel conveying equipment over reinforcement or support runways on reinforcement.
- G. Placing:
 - 1. Deposit concrete in a continuous manner and as rapidly as possible within planned joints or sections.

2. Do not use concrete that has attained initial set or contained mixing water for more than 90 minutes.
3. Uniformly distribute concrete during process of depositing and in no case move deposited concrete in forms more than 6 feet in horizontal direction.
4. Do not drop freely more than 5 feet in unexposed work or more than 3 feet in exposed work; where greater drops are required, use duct or other approved method.
5. Do not place concrete against icy or frost covered earth surfaces.

H. Compacting:

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

I. Finishing/Trowel Aid:

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

J. Temperature of Delivered Concrete:

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

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

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

K. Concrete Protection:

1. Protect all concrete against physical injury until final acceptance by Owner.
2. Protect concrete from reduced strength due to weather extremes.
3. Protect concrete that is still plastic and whenever precipitation is imminent or occurring, as determined by Engineer.
4. When the temperature is below 40 Degrees F or is likely to fall below 40 Degrees F during the 24-hour period after placing the concrete, follow the recommendations of ACI 306R, except as modified herein.

- a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice, or snow.
 - b. After the mean daily temperature in the vicinity of the Project site falls below 40 degrees F for more than 1 day, maintain concrete at a temperature above 50 degrees F for at least 72 hours after it is placed, with additional requirements listed under Article 3.3 - Curing below.
 - c. When removing protection, do not allow concrete to cool suddenly.
 - d. Calcium chloride will not be permitted as a concrete accelerator or to thaw frozen subgrade prior to concrete placement.
5. When the temperature is 90 Degrees F or above, or is likely to rise above 90 Degrees F within the 24-hour period after concrete placement; or when there is any combination of high air temperature, low relative humidity, and wind velocity which would impair concrete strength or quality, follow the recommendations of ACI 305R and the following:
- a. Keep concrete as cool as possible during placement and curing.
 - b. Do not allow concrete temperature to exceed 90 Degrees F at placement.
 - c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
 - d. Dampen subgrade and forms with cool water immediately prior to placement of concrete.
 - e. Apply an evaporation retardant per manufacturer's instructions between placement and finishing operations.
 - f. Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
 - g. Take appropriate precautions per ACI 305R when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R.

3.3 CURING

- A. Cure concrete for not less than 14 days after placing as follows:
- 1. Leave forms in place at least 14 days.
 - 2. Strictly follow careful procedures for the removal of forms and perform with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted.
 - 3. Keep encasement concrete, concrete cradles and anchor blocks moist until covered. The surface shall be covered with moist earth not less than 4 hours, or more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.
 - 4. Concrete slabs may be cured by either of the following two methods:
 - a. Method 1:
 - 1) After finishing slab, wet surface with a fine spray of water and cover with polyethylene-bonded waterproof paper sheeting.
 - 2) Lap sheets 4 inches at sides and ends and seal with adhesive tape to form a continuous watertight joint.
 - 3) Weigh sheeting down with wood planks to keep sheeting in contact with concrete.
 - 4) Repair or replace sheets immediately if damage occurs.
 - b. Method 2:

- 1) Cover concrete with water-saturated polyethylene-coated burlap curing mats and keep continuously wet for curing period.
 - 2) Lap sheets 4 inches at sides and ends and seal with adhesive tape to form a continuous watertight joint.
 - 3) Weigh sheeting down with wood planks to keep sheeting in contact with concrete.
 - 4) Repair or replace sheets immediately if damage occurs.
- B. As an alternative to above referenced curing methods for formed and slab concrete, spray surface with liquid curing compound that does not affect bond of paint to concrete surface.
1. Apply curing compound in accordance with manufacturer's instructions as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after completion of finish or stripping of forms, if stripped in less than 14 days.
 - a. Maximum coverage rate of 200 square feet per gallon, applied in such a manner as to cover surface with a uniform film to seal thoroughly.
 2. Curing vertical surfaces with a curing compound:
 - a. Cover vertical surfaces with a minimum of two coats of the curing compound.
 - b. Apply the first coat of curing compound immediately after form removal. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - c. Allow the preceding coat to completely dry prior to applying the next coat.
 - d. Vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.
 3. Curing Compound: As specified herein.
 4. Take care to avoid damage to seal during curing period.
 5. Repair broken or damaged seals occurring before expiration of curing period by application of additional curing compound over damaged portion.
 6. Do not use curing film method where construction joints are to be made
- C. In hot weather, follow curing procedures outlined in ACI 305R and the following:
1. Begin curing unformed surfaces immediately after finishing and continue for 24 hours. Curing shall consist of application and maintenance of water saturated material to all exposed surfaces; horizontal, vertical, and otherwise. After 24-hour interval, continue curing, using one of the following methods:
 - a. Moist cure for six more days.
 - b. Application of curing compound as specified above.
 2. Begin curing formed concrete immediately after placing. Curing shall consist of keeping forms continuously wet for 24 hours. Thereafter, continue curing, using one of the following methods:
 - a. Loosen forms and position soaker hose so that water runs down along concrete surfaces. Continue for six more days.
 - b. Strip forms and apply curing compound as specified for vertical surfaces above. Do not allow concrete surfaces to dry prior to application of curing compound.
- D. In Cold Weather, following curing procedures outlined in ACI 306R and the following:
1. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F; provided

- that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.
2. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 Degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise, the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 Degrees F. Concrete cured by water curing shall be protected against freezing temperatures for 72 hours immediately following the 72 hours of protection at 50 Degrees F.
 3. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 Degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 Degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 Degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.
 4. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications

3.4 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined, and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer. In no case will extensively patching honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Remove and replace concrete containing extensive voids, holes, honeycombing, or similar depression defects. Promptly execute all repairs and replacements herein specified at no additional expense to Owner.
- B. Perform all repairs in accordance with the manufacturer's recommendations and with ICRI Guideline No 310.1R and Guideline No 320.2R. Follow these guidelines for removal geometry, exposing and undercutting reinforcing steel, cleaning and repair of reinforcing steel, and edge and surface condition of concrete, regardless of the amount of corrosion present or not present in the reinforcing steel.
 1. Remove unsound deteriorated concrete from Work by high pressure water blasting machines capable of scoring concrete surfaces to minimum amplitude roughness of 3/16-inch. Remove to provide for minimum thickness specified for mortar. If reinforcing is exposed in this process, remove additional concrete until the surface is a minimum of 1-inch or 1 bar diameter behind the exposed reinforcing.
 2. Clean exposed reinforcing bars of rust and other deleterious materials which may prevent bonding of the repair product.
 3. Keep surface at saturated surface dry (SSD) condition for a minimum of 24-hours prior to placement of repair material.

4. Place and cure repair grout as specified in Section 03 60 00 – Grouting and in accordance with manufacturer’s written recommendations.
 5. For exposed walls, include a portion of white Portland cement as required to make the color of the patch match the color of the surrounding concrete.
- C. Ream holes left by tie-rod cones with suitable toothed reamers to leave the surfaces of the holes clean and rough. Repair these holes in an approved manner with dry-packed cement grout specified in Section 03 60 00 - Grouting. Do not ream holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension but repair them in an approved manner with dry-packed cement grout specified in Section 03 60 00 - Grouting.
- D. Build up and shape repairs in such a manner that the completed Work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Cure surfaces of said repairs as required for the concrete in the repaired section.
- E. Prior to filling any structure with water, repair all cracks that may have developed by grooving and filling as shown on the Contract Drawings. Perform this repair method on the water bearing face of members. Prior to backfilling, repair cracks on faces of members in contact with fill, which are not covered with a waterproofing membrane, as specified herein.

3.5 PATCHING HOLES IN CONCRETE

A. Patching Small Holes

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

B. Patching Large Holes

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

3.6 CONCRETE FINISH

- A. General: Provide surfaces free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, with finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are specified herein. These tolerances are to be distinguished from irregularities in finish as described herein.
- B. Do not use aluminum finishing tools.
- C. Formed Surfaces:
 - 1. Exterior buried surfaces require no treatment after form removal except for curing, repair of defective concrete, and treatment of surface defects.
 - 2. Finish surfaces exposed to view as specified under "Architectural Concrete Finish" below.
- D. Surface holes larger than 1/2 inch in diameter or deeper than 1/4-inch are defined as surface defects in basins and exposed walls.
- E. Unformed Surfaces: After proper and adequate vibration and tamping, bring all unformed top surfaces of slabs, floors, walls, and curbs to a uniform surface with suitable tools. Immediately after the concrete has been screeded, treated with a liquid evaporation retardant. Use the retardant again after each operation as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:
 - 1. Finish U1 – Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8 inch. No further special finish is required.
 - 2. Finish U2 After sufficient stiffening of the screeded concrete, float finish surfaces with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Minimize floating as necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities are limited to 1/4-inch. Tool joints and edges where shown or as determined by the Engineer.
 - 3. Finish U3 After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel trowel with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. Provide finish that is smooth and free of all irregularities.
 - 4. Finish U4 Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, lightly broom the surface with broom lines perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.
- F. Floor Hardener:
 - 1. Apply to all exposed concrete floor surfaces.
 - 2. Apply after concrete has cured minimum 7 days.
 - 3. Apply in accordance with manufacturer's recommendations.

4. Keep floors covered and free of traffic and loads for a minimum of 10 days after completion.

3.7 ARCHITECTURAL CONCRETE FINISH

- A. General: Architectural finish is required for permanently exposed concrete surfaces and in other locations where specifically called out on the Contract Drawings.
 1. Immediately after the forms have been stripped, inspect the concrete surface, and repair any poor joints, voids, rock pockets, or other defective areas. Fill all form-tie holes as indicated herein.
 2. Do not apply architectural finishes until the concrete surface has been repaired as required and the concrete has cured at least 14 days.
 3. Conform all architecturally treated concrete surfaces to the accepted sample required herein in texture, color, and quality. Maintain and protect the concrete finish.
- B. Smooth Concrete Finish
 1. Wet the concrete surface and apply grout with a brush. Use grout made by mixing one part Portland cement and one part fine sand that will pass a No. 16 sieve with sufficient water to give it the consistency of thick paint. Use 1/2 gray and 1/2 white Portland Cement as determined by Engineer. Vigorously rub the freshly applied grout into the concrete surface with a wood float filling all small air holes. After all the surface grout has been removed with a steel trowel, allow the surface to dry and, when dry, vigorously rub with burlap to remove completely all surface grout so that there is no visible paint-like film of grout on the concrete. Complete the entire cleaning operation for any area the day it is started and leave no grout on the surface overnight.
 2. Terminate cleaning operations for any given day at panel joints. It is essential that the various operations be carefully timed to secure the desired effect which is a light-colored concrete surface of uniform color and texture without any appearance of a paint or grout film.
 3. If improper manipulation results in an inferior finish, rub such inferior areas with carborundum bricks.
 4. Before beginning any of the final treatment on exposed surfaces, treat in a satisfactory manner, a trial area of at least 200 square feet in some inconspicuous place selected by the Engineer and preserve said trial area undisturbed until the completion of the job.

3.8 WATERPROOFING

- A. Apply waterproofing to exterior surface of all buried roof slabs and walls of underground concrete structures.
- B. Refer to Section 07 14 00 – Fluid-Applied Waterproofing.

3.9 TOLERANCES:

- A. Construction Tolerances: Set and maintain concrete forms and perform finishing operations so as to ensure that the completed Work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances.

Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the Specifications, permissible deviations will be in accordance with ACI 117.

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

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

3.10 FIELD QUALITY CONTROL

A. General

1. Tests on component materials and for slump, temperature, air content, unit weight, compressive strength and shrinkage of concrete will be performed as specified herein.
2. The cost of all laboratory tests for qualification of mix designs on cement, aggregates, and concrete, including strength and shrinkage testing will be borne by Contractor. The cost of all field-testing during construction, including slump, temperature, air, strength, and shrinkage will also be borne by Owner. However, Contractor will be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications.
3. Provide access for Engineer to aggregate stockpiles for concurrent sampling during construction.
4. Provide access for Engineer to batch plant for monitoring batching procedures during construction.
5. Supply concrete for testing at no additional cost to Owner. Assist Engineer in obtaining samples, and disposal and cleanup of excess material.
6. Take composite samples of concrete placed in the Work in accordance with ASTM C172 from the first placement of each class of concrete and at the following minimum frequency for each class:
 - a. Not less than one sample per day on which concrete is placed.
 - b. Not less than one sample for each 50 cubic yards of concrete placed.
 - c. Not less than one sample for each 5,000 square feet of surface area for slabs or walls.
 - d. Not less than 5 samples from randomly selected batches for the Work.

B. Slump Tests

1. Perform in accordance with requirements of ASTM C143 at frequency indicated for sampling above.

- C. Temperature Tests
 - 1. Test concrete temperature per ASTM C1064 at frequency indicated for sampling above.
- D. Air Content Tests
 - 1. Test air content per ASTM C231 at frequency indicated for sampling above.
- E. Unit Weight
 - 1. Test unit weight per ASTM C138 at frequency indicated for sampling above.
- F. Shrinkage Tests
 - 1. Drying shrinkage tests will be made for the first placement of each class of structural concrete, and during construction every 3 months to ensure continued compliance with these Specifications. Make A minimum of 1 test per structure shall be made regardless of the timing.
 - 2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried, and measured in accordance with ASTM C157 as modified in this Section.
 - 3. The maximum concrete shrinkage for specimens cast in the field may not exceed the trial batch maximum shrinkage test value by more than 25 percent.
 - a. If the required shrinkage limitation is not met during construction, take any or all the following actions, at no additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.
- G. Field Compression Tests
 - 1. Field compression test specimens will be made at the frequency indicated for sampling above.
 - 2. Each set of test specimens will be a minimum of five cylinders.
 - 3. Make compression test specimens for concrete in accordance with ASTM C31. Specimen size: Cylinders, 6-inch diameter by 12-inch high.
 - 4. Perform compression tests in accordance with ASTM C 39. Test one cylinder at 7 days and two at 28 days. The remaining cylinders will be held to verify test results, if needed.
- H. Evaluation and Acceptance of Concrete
 - 1. Evaluation and acceptance of the compressive strength of concrete will be according to the requirements of ACI 350 and as specified herein.
 - 2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results may not exceed 640 psi, when ordered at equivalent water content as estimated by slump.
 - 3. If any concrete fails to meet these requirements, take immediate corrective action to increase the compressive strength for all subsequent batches of the type of concrete affected.
 - 4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the

statistical requirement that the probability of any test being more than 500 psi below or the average of any three consecutive tests being below the specified compressive strength is 1 in 100. Calculate the required average strength using Criterion No. 3 of ACI 214 with the actual standard of deviation.

5. All concrete which fails to meet the ACI requirements and these Specifications, is subject to removal and replacement at no increase in cost to the Owner.

3.11 APPLICATION OF LOADS

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

3.12 SCHEDULES

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

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

END OF SECTION

**SECTION 03 60 00
GROUTING**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES

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

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

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

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

ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
ASTM C827	Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete By Slant Shear
ASTM C884	Standard Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
ASTM C939	Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C1090	Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout
ASTM C1107	Packaged Dry, Hydraulic Cement Grout (Nonshrink)
ASTM C1181	Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts
ASTM C1202	Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
ASTM C1339	Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D696	Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

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

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

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Product Data:
 - 1. Submit certified test results verifying the compressive strength, shrinkage, and expansion requirements indicated herein.
 - 2. Submit manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of nonshrink and epoxy grout used in the Work.
- C. Certification:
 - 1. Provide manufacturer's independent certification of compliance with ASTM C1107 without modification to the standard methods certifying that the Class B or C grout's post-hardening non-shrink properties are not based on gas expansion.
 - 2. Provide Manufacturer's certification that grouts have strengths of 3500 psi at 1 day, 6500 psi at 3 days and 7500 psi at 28 days when cured at 72 degrees F as well as meeting the 3, 7, and 28-day strengths when tested and cured at the 45 deg F and 95-degree F limits and all other requirements of ASTM C1107.
 - 3. The Contractor shall engage an independent testing laboratory to run a 24-hour grout evaluation in accordance with ASTM C1107 of each grout submitted for approval showing compliance with all aspects of the evaluation. Submit results to the Engineer for review.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 - 1. Nonshrink, nonmetallic grout:
 - a. 5 Star Grout, Five Star Products, Inc.

- b. Masterflow 928, BASF Building Systems, Inc.
 - c. NS Grout, Euclid Chemical Company.
 - d. Sika Grout 212, Sika Corporation.
 - e. Engineer approved equal.
2. Epoxy grout:
- a. HP Epoxy Grout, Five Star Products, Inc.
 - b. Masterflow 648 CP Plus, BASF Building Systems, Inc.
 - c. E3-Flowable, Euclid Chemical Company.
 - d. Sikadur 42 Grout-Pak, Sika Corporation.
 - e. Engineer approved equal.
3. Grout for pumps and motors:
- a. Escoweld, ITW Polymer Technologies.
 - b. Chockfast Red, ITW Polymer Technologies.
 - c. DP Epoxy Grout, Five Star Products, Inc.
 - d. Engineer approved equal.

2.2 CEMENT GROUT

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

2.3 NONSHRINK GROUT

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

- F. Application:
1. Class B or C non-shrink grout shall be used for grouting under all base plates for structural steel members, grouting under all equipment base plates except for pumps and motors, and at all locations where grout is required by the Contract Documents except where epoxy grout or grout for pumps and motors is specifically required. Class B or C non-shrink grout shall be used in place of Class A non-shrink grout for all applications. Class B or C non-shrink grout shall not be used for dry packing applications or repair of concrete.

2.4 EPOXY GROUT

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

2.5 GROUT FOR REPAIR OF CONCRETE

- A. Vertical, overhead, and shotcrete applications:
1. Shall not produce a vapor barrier.
 2. One component, reoplastic, cement based, shrinkage compensated, non-expansive, gray concrete product.
 3. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only the addition of water.

4. Free of chlorides and other chemicals causing corrosion with the following properties:
 - a. Minimum Slant Shear Bond Strength: 2500 PSI at 28 days when tested in accordance with ASTM C882.
 - b. Minimum Compressive strength: 6,500 PSI at 28 days when tested in accordance with ASTM C109.
 - c. Minimum Tensile Bond Strength: 200 PSI at 28 days per ASTM C307.
 - d. Minimum Flexural Strength: 1,200 PSI when tested in accordance with ASTM C348.
 - e. Modulus of Elasticity: 3.6E6 PSI when tested in accordance with ASTM C469.
 - f. Maximum Rapid Chloride Permeability: 772 coulombs when tested in accordance with ASTM C1202.

B. Horizontal and formed applications:

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

2.6 GROUT FOR PUMPS AND MOTORS

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

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

8. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperatures as high as 150 degrees F, with a load of 2,000 PSI.
- B. Primer, if required, shall conform to the written recommendations of the grout manufacturer.
- C. Surface preparations shall conform to the written recommendations of the grout manufacturer.
- D. Placement and Curing
 1. Placement and curing procedures shall be in accordance with the written recommendations of the grout manufacturer.
 2. A grouting performance demonstration/training session shall be conducted by the grout manufacturer's representative prior to foundation and baseplate preparation and the first grouting on site. This training session shall demonstrate proper preparation and installation methods and that the grouting material meets the strength requirements.

2.7 CONCRETE TOPPING GROUT AND CONCRETE FILL

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

2.8 CURING MATERIALS

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

2.9 CONSISTENCY

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

2.10 MEASUREMENT OF INGREDIENTS

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

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 MANUFACTURER'S SERVICES

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

3.3 GROUTING PROCEDURES

- A. Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Base Plate Grouting:
 - 1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a 1 inch thickness of grout or a thickness as indicated on the Contract Drawings.
 - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by Engineer, alternate grouting methods shall be submitted for acceptance by Engineer.
- C. Concrete Topping Grout:
 - 1. All mechanical, electrical, and finish Work shall be completed prior to placement of concrete topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.

2. The minimum thickness of grout topping and concrete fill shall be one inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 6-inches wide by 1-1/2 inches deep.
3. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is complete free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping of fill placement. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.
4. Concrete topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

D. Grout for Repair of Concrete

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

E. CONSOLIDATION

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

END OF SECTION

DIVISION 05
METALS

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**SECTION 05 50 00
METAL FABRICATIONS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish, fabricate, and install metal fabrications in accordance with Contract Documents.

1.2 RELATED SECTIONS

- A. Section 05 52 13 – Pipe and Tube Railings
B. Section 09 90 00 – Painting and Coating
C. Section 09 97 01 – Pipeline Coatings and Linings

1.3 REFERENCES

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

ASTM A6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A36	Specification for Structural Steel
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Gray Iron Castings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A197	Standard Specification for Cupola Malleable Iron
ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
ASTM A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A325	Specification for Structural Bolts, Steel Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A563	Specification for Carbon and Alloy Steel Nuts

ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTMA668	Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992	Standard Specification for Steel for Structural Shapes for Use in Building Framing
ASTM A1085	Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)
ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B211	Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B308	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Standard Specification for Stainless Steel Nuts
ASTM F1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
B.	American National Standards Institute (ANSI) standards, most recent editions:
ANSI A14.3	Standard for Ladders - Fixed - Safety Requirements
C.	American Welding Society (AWS) Standards, most recent editions:
AWS D1.1	Structural Welding Code – Steel

- | | |
|----------------------|---|
| AWS D1.2 | Structural Welding Code – Aluminum |
| AWS D1.6 | Structural Welding Code – Stainless Steel |
| AWS QC1 | Specification for AWS Certification of Welding Inspectors |
| AWS Welding Handbook | |
- D. American Water Works Association (AWWA) standards, most recent editions:
- | | |
|-----------|---|
| AWWA C105 | American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems |
| AWWA C217 | Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines |
- E. National Sanitation Foundation (NSF), most recent edition:
- | | |
|--------|---|
| NSF 61 | Drinking Water System Components, Health Effects. |
|--------|---|
- F. Federal Specifications:
- | | |
|------------|--|
| MIL-A-907E | Anti-seize Thread Compound, High Temperature |
|------------|--|
- G. Occupational Safety and Health Administration (OSHA), most recent editions:
- | | |
|--------------|---------------|
| OSHA 1910.27 | Fixed Ladders |
|--------------|---------------|
- H. Society for Protective Coatings (SSPC):
- | | |
|-----------|--|
| SSPC-PA 1 | Shop, Field, and Maintenance Painting of Steel |
|-----------|--|
- 1.4 DEFINITIONS
- A. Metal Fabrications: Defined as items to be fabricated from metal shapes, plates, or bars and their products.
- 1.5 SUBMITTALS
- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Shop Drawings: Submit shop drawings of all metal fabrications to the Engineer for review.
1. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
 2. Submit layout drawings for grating showing the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners. Submit load and deflection tables for each style and depth of grating used.

- C. Submit ICC-ES report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor submitted. Submit manufacturer's recommended installation instructions and procedures for adhesive anchors. Upon review, by Engineer, these instructions shall be followed specifically.
- D. No substitution for the indicated adhesive anchors will be considered unless accompanied by an ICC-ES report verifying strength and material equivalency, including temperature at which load capacity is reduced to 90 percent of that determined at 75 degrees F.

1.6 QUALITY ASSURANCE

- A. All weld procedures and welder qualifications shall be available in the Contractor's field office for review.
- B. Qualification of Welders: Use welders with current certifications (previous 12 months) for the material, type, and position of welding used. Certify in accordance with AWS Specifications according to the following:
 - 1. AWS D1.1, Structural Welding Code – Steel.
 - 2. AWS D1.2, Structural Welding Code – Aluminum.
 - 3. AWS D1.6, Structural Welding Code – Stainless Steel.
- C. Furnish a welding inspector who is qualified in accordance with AWS requirements and approved by Engineer. Inspector to inspect all welding.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Metal fabrications shall be loaded for transport in such a manner that they may be transported and unloaded without being excessively stressed, deformed, or otherwise damaged.
- C. Protect metal fabrications from corrosion and deterioration.
- D. Store material in a dry area and do not place in direct contact with the ground.
 - 1. Do not place materials on the structure in a manner that might cause distortion or damage to the members or supporting structures.
 - 2. Repair or replace damaged materials or structures as directed.

1.8 PROJECT CONDITIONS

- A. Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. Safety stair nosing:
 - a. Style 231-A, American Abrasive Metals Company.
 - b. 31-A American Mason Safety Tread Company.
 - c. Supergrit Type 231, Wooster Products Company.
 - d. Engineer approved equal.
 2. Concrete and masonry anchors:
 - a. Hilti, Inc.
 - b. ITW Ramset/Redhead.
 - c. Simpson Strong Tie Company, Inc.
 - d. Engineer approved equal.
 3. Castings, trench covers, and accessories:
 - a. D&L Foundry and Supply
 - b. Deeter Foundry company.
 - c. Neenah Foundry Company.
 - d. Engineer approved equal.
 4. All-purpose metal framing
 - a. Allied Tube and conduit.
 - b. B-Line Systems.
 - c. Unistrut Building Systems.
 - d. Engineer approved equal.
 5. Steel Ladder Rungs:
 - a. Perforated "Traction Tread"; McNichols, Co.
 - b. Engineer approved equal.
 6. Floor hatches:
 - a. Type "APS" or "APD", Nystrom.
 - b. Type "J" or "JD", Bilco.
 - c. Type "SLG" or "DLG", Dur-Red Products.
 - d. Engineer approved equal.
 7. Anti-seize lubricant:
 - a. AS-470 by Dixon Ticonderoga
 - b. PURE WHITE by Anti-Seize Technology
 - c. Engineer approved equal.
 8. Drill-in anchors:
 - a. Epoxy anchors (Concrete):
 - 1) HIT-HY 200.
 - 2) Set 3G, Simpson Strong-Tie.
 - 3) Pure110+, DeWalt
 - 4) Red Head C6+, ITW Ramset/Redhead.
 - 5) Engineer approved equal.
 - b. Expansion anchors:
 - 1) Kwik-Bolt TZ, Hilti.
 - 2) Strong-Bolt 2, Simpson Strong-Tie.
 - 3) Trubolt, ITW Ramset/Redhead.
 - 4) Engineer approved equal.

- c. Screw anchors:
 - 1) KH-EZ, Hilti.
 - 2) Titen HD, Simpson Strong-Tie.
 - 3) Tapcon LDT, ITW Ramset/Redhead.
 - 4) Engineer approved equal.

2.2 MATERIALS

A. Steel:

- 1. Wide flange steel shapes shall be ASTM A992. Other steel shapes, plates, and bars shall be in accordance with ASTM A6 and ASTM A36, unless otherwise shown.
- 2. Structural steel pipe shall be ASTM A53, Type E or S, Grade B.
- 3. Structural tubing shall be ASTM A500, Grade C or ASTM A1085. Furnish members full length without splices unless otherwise noted or approved by Engineer.
- 4. Welded anchor studs shall be headed concrete anchor studs (HAS), or deformed bar anchors (DBA), or threaded studs (TAS), as indicated in the Contract Documents.

B. Steel Forgings: ASTM A668.

C. Stainless steel: ASTM A666 and ASTM A276, Type 316 or 316L

D. Aluminum: Alloy 6061 – T6 conforming to the following specifications:

- 1. Sheet and plate: ASTM B209.
- 2. Rolled Bars and Rods: ASTM B211.
- 3. Extruded bars, rods, shapes, and tubes: ASTM B221.
- 4. Rolled or extruded structural shapes: ASTM B308.
- 5. Extruded structural pipe and tube: ASTM B429.

E. Iron:

- 1. Ductile iron: ASTM A536.
- 2. Gray cast iron: ASTM A48.
- 3. Malleable iron: ASTM A47, A197.

F. Bolts and Anchors:

- 1. Standard Service (non-corrosive applications): Unless otherwise indicated, provide steel bolts, anchor bolts, washers, and nuts as indicated herein. Form threads on galvanized bolts and nuts with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, provide steel for bolt material, anchor bolts, and cap screws in accordance with the following:
 - a. Anchor bolts: ASTM F1554, [Grade 36](#), of dimensions indicated, with nuts conforming to ASTM A563 and flat washers where indicated.
 - b. Install high-strength structural connections using ASTM A325 bolts and nuts per ASTM A563, coated to match material being connected.
- 2. Corrosive Service: Provide stainless steel for bolts, nuts, and washers in the locations listed below.
 - a. All buried locations except as noted below for pipe flange, fitting, and coupling connections.
 - b. All submerged locations.
 - c. Inside hydraulic structures, below the top of the structure.

- d. Inside buried vaults, manholes, and structures that do not have a forced-air ventilation system and either a gravity drain or a sump with a sump pump.
 - e. All chemical handling areas.
 - f. Other locations indicated by the Contract Documents or designated by the Engineer to be provided with stainless steel bolts.
3. Stainless steel bolts, anchor bolts, nuts, and washers shall be Type 316 stainless steel, conforming to ASTM F593 for bolts and to ASTM F594 for nuts. Protect all threads on stainless steel bolts with an anti-seize lubricant suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E and classified as acceptable for potable water use by NSF. Coat buried bolts in poorly drained soil the same as the buried pipe.
4. Pipe Flange, Fitting and Coupling Connection Applications: Unless otherwise noted, all pipe flange, fitting and coupling connection bolts shall be carbon steel per ASTM A307, Grade A hex bolts, with nuts per ASTM A563. All bolts, nuts and washers shall be zinc plated. Protect all threads on bolts and nuts with anti-seize lubricant.
- a. Exposed Connections: For exposed pipe connections in buried vaults, manholes, and structures with forced-air ventilation and which drain through a gravity sewer or to a sump with a pump, prepare and coat bolts and nuts after installation with the same system as the adjacent flanged piping, in accordance with Section 09 90 00 – Painting and Coating.
 - b. Buried Connections: Coat all buried connections in accordance with Section 09 97 01 – Pipeline Coatings and Linings. Provide wax tape coating per AWWA C217 for steel pipe connections, including sleeve couplings and restrained sleeve couplings. For other pipe materials, grease and wrap connections per AWWA C105.
5. Bolt Requirements:
- a. The bolt and nut material shall be free-cutting steel.
 - b. The nuts shall be capable of developing the full strength of the bolts.
 - c. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads.
 - d. Provide bolts with hexagon heads. Provide nuts conforming to Heavy Hexagon Series.
 - e. Install all bolts and nuts with washers fabricated of material matching the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification.
 - f. Install lock washers with washers where indicated and fabricated of material matching the bolts.
- G. Provide bolts of length such that after joints are made up, each bolt extends through the entire nut, but in no case more than 1/2-inch beyond the nut.
- H. Drill-in anchors:
- 1. Epoxy anchors: Unless otherwise indicated, all drilled concrete and masonry anchors shall be epoxy anchors. No substitutions will be considered unless accompanied by ICC-ES reports verifying strength and material equivalency.
 - a. Epoxy anchors are required for drilled anchors exposed to weather, in submerged, wet, splash, and corrosive conditions, and for anchoring handrails, pumps, mechanical equipment, and reinforcing bars. Provide threaded stainless steel rod, Type 316.

- b. Unless otherwise indicated, epoxy anchors will also be permitted in locations not indicated above.
 - 2. Expansion Anchors: Expansion anchors will only be permitted when specifically approved by the Engineer. Expansion anchors that are to be fully encased in grout may be carbon steel. For non-encased buried or submerged anchors, provide stainless steel anchors.
 - 3. Screw Anchors: Screw anchors will only be permitted when specifically approved by the Engineer. Screw anchors that are to be fully encased in grout may be carbon steel. For non-encased buried or submerged anchors, provide stainless steel anchors.
- I. Corrosion Protection:
- 1. Hot dip galvanize all miscellaneous steel metalwork after fabrication.
 - a. Galvanizing: ASTM A123 or A653 with minimum coating of 1.5 ounce per square foot.
- 2.3 MANUFACTURED UNITS
- A. Handrails and Guardrails: Refer to Section 05 52 13 – Pipe and Tube Railings.
- B. Bollards:
- 1. Standard weight steel pipe, diameter as shown on Drawings.
 - 2. Minimum 48 inches projection above finish grade.
 - 3. Minimum 42 inches embedment in concrete.
 - 4. Fabricate sleeves for removable bollards from steel pipe with 1/4-inch thick steel plate welded to bottom of sleeve.
- C. Abrasive Stair Nosings:
- 1. Extruded aluminum shape with cast-in abrasive strips and integral extruded anchors.
 - 2. Material: Alloy 6063-T6 extruded aluminum, mill finish, heat treated.
 - 3. Color to be selected by Engineer from manufacturer's standard colors.
 - 4. Units: 3 inches wide by 4 inches less in length than stair tread width, centered on tread width.
- D. Stairs, Grating:
- 1. Treads: Grating treads as specified with exception that nosing shall have integral non-slip edge. Checkered plate nosings are not acceptable.
 - 2. Landings: Grating as shown on Contract Documents or specified herein.
 - 3. Fabricate and design stair tread, landing assembly, and connections not shown on Contract Documents to support a 500-lb concentrated, moving load or 100 psf uniform load, whichever requires the greater component.
 - 4. Design, fabricate and install in compliance with applicable codes.
 - 5. Maximum deflections as specified below under "Metal grating."
 - 6. Material:
 - a. Aluminum: Alloy 6061-T6 or 6063-T6.
 - b. Steel: ASTM A36, galvanized as specified.
- E. Ladders:
- 1. Ladders shall be of stainless steel or galvanized steel as shown on the Contract Documents. When material is not specifically noted, material shall be stainless steel.

2. Design to support minimum 300-pound concentrated vertical load with 150-pound concentrated horizontal load.
 - a. Maximum allowable stresses per AISC manual.
 - b. Maximum lateral deflection: Side rail span/300.
 - c. Design in accordance with OSHA standards.
3. Fabricate ladders for the locations shown, with dimensions, spacings, details, and anchorages as indicated. Comply with requirements of ANSI A14.3.
4. Side rails, minimum sizes: Continuous, 1 1/2-inch nominal diameter pipe. Fabricate with eased edges, spaced 18 inches apart.
5. Rungs: 1-1/8 inch by 1-5/8 inch by 14 gage perforated "traction tread" rungs.
 - a. Top rung level with top platform.
6. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
7. Support each ladder at top and bottom and at intermediate points spaced not more than 4 feet on center with welded or bolted steel brackets.
8. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 9 inches.
9. When required by Drawings, every ladder that does not have an exterior handhold shall be equipped with a pop-up extension. Pop-up extension device shall be manufactured of the same material and finish as the ladder with telescoping tubular section that locks automatically when fully extended. Upward and downward improvement shall be controlled by stainless steel spring balancing mechanisms. Units shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.

F. Metal Grating:

1. Metal grating shall be of the design, sizes, and types indicated. Completely band at all edges and cutouts using material and cross section equivalent to the bearing bars. Such banding shall be welded to each cut bearing bar. Support grating at bearings by support members. Where grating is supported on concrete, embedded support angles matching grating material shall be used unless indicated otherwise. Such angles shall be mitered and welded at corners.
2. Bearing Bars:
 - a. Type: Rectangular bar.
 - b. Thickness: 3/16 inch minimum.
 - c. Depth: 1-1/2 inch unless otherwise indicated on Contract Documents.
 - d. Spacing: 1 3/16 inch maximum.
 - e. Configuration of top surface: Plain unless otherwise indicated on Contract Documents.
3. Cross Bars:
 - a. Cross bars shall be welded or mechanically locked tightly into position so that there is no movement allowed between bearing and cross bars.
 - b. Spacing: 4 inches maximum.
4. All pieces of grating shall be fastened in at least two locations to each support.
5. Where grating forms the landing at the top of a stairway, the edge of the grating, which forms the top riser, shall have an integral non-slip nosing, width equal to that of the stairway.
6. Where grating depth is not given, grating shall be provided which will be within allowable stress levels, and which shall not exceed a deflection of 1/4-inch or the span divided by 180, whichever is less. For standard duty plank, and safety grating, the loading to be used for determining stresses and deflections shall be the uniform live

load of the adjacent floor or 100 psf, whichever is greater or a concentrated moving load of 1000 pounds.

7. Material:
 - a. Galvanized Steel: Except where indicated otherwise, bar grating shall be fabricated entirely of hot-dip galvanized carbon steel.
 - b. Aluminum: Bearing and banding bars, alloy 6063-T5.
 - c. Grating which may be partially or wholly submerged shall be fabricated entirely of stainless steel.
8. No single piece of grating shall weigh more than 80 pounds or be wider than 3 feet, unless indicated otherwise on Contract Documents.

G. Floor Hatches:

1. Where floor access hatches are called for on the Contract Documents to be mounted on a floor slab (including top slabs which are not covered with a roofing membrane) or on a concrete curb, the hatch shall be a flush type as indicated herein.
2. Material: Aluminum alloy 6061-T6 unless otherwise indicated. Provide Type 316 stainless steel hardware.
3. Design Live Load: Minimum 150 psf.
4. Provide hatch opening sizes, number and directional swing of door leaves, and locations as indicated on the Drawings. Sizes given are for the clear opening. Where the number of leaves is not indicated, provide double-leaf doors for openings larger than 42 inches in either direction. Unless indicated otherwise, locate hinges on the longer dimension side. Unless indicated otherwise, ladder hatches shall be a minimum of 36 inches wide by 36 inches long, with the door hinge opposite the ladder.
5. Hatch shall have oversized recessed padlock clip that can accommodate a lock with a 2.5" shackle length.
6. Hatch shall be equipped with recesses safety grating for fall protection.
7. Door leaves shall be a minimum of 1/4-inch checkered pattern plate. Channel frames shall be a minimum of 1/4-inch material with an anchor flange around the perimeter. Hatches shall be provided with an automatic hold-open arm with release handle. Hatches shall be designed for easy opening from both inside and outside.
8. Aluminum surfaces in contact with other metals or concrete shall be painted for aluminum metal isolation. Caulk the mounting flange of access hatches for water tightness when mounted to concrete curbs.

H. Iron Castings:

1. Iron castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. They shall be smooth and well cleaned by shot blasting. Castings shall be prefabricated, conforming to ASTM A48 or A536.
2. Covers and grates shall fit together evenly, so that the cover fits flush with the surrounding finished surface and so that the cover does not rock or rattle when loading is applied. Round covers and frames shall have machined bearing surfaces.
3. Covers and grates with matching frames shall be designed to support the following loadings:
 - a. Where located within a structure, the design loading shall match that required for the adjacent floor area, or, if no floor loading is given, a minimum of 300 pounds per square foot.
 - b. Exterior covers and grates shall be designed for AASHTO HS-20 loading unless indicated otherwise.

- I. All Purpose Metal Framing:
 - 1. Material: Carbon Steel.
 - 2. Channels and inserts:
 - a. Minimum 12 gage.
 - b. Channels to have one side with a continuous slot and inturned lips.
 - 3. Fittings: Hot-rolled steel strip and plate.
 - 4. Nuts: Steel, ASTM A563, with toothed grooves in top of nuts to engage the inturned lips of channels.
 - 5. Finish: Epoxy coated. Galvanize items which cannot be epoxy coated.

2.4 FABRICATION

- A. Verify field conditions and dimensions prior to fabrication.
- B. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- C. Form exposed work true to line and level with accurate angles and surfaces straight and sharp edges.
- D. Drill and punch holes with smooth edges.
- E. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Range: 0 degrees F minimum to 110 degrees F maximum ambient temperature.
- F. Shear and punch metals cleanly and accurately. Remove burrs.
- G. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- H. Remove sharp or rough areas on exposed traffic surfaces.
- I. Welding
 - 1. Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.
 - 2. In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as indicated by the AWS Code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours

and dimensions. All sharp corners of material that are to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3. Weld corners and seams continuously to comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercutting or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

- J. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners whenever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

- K. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- L. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- M. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

- N. Fabricate joints that will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

2.5 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Hot dip galvanize after fabrication.

2.6 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel studs for embedding into concrete.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports.

- C. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection.
- D. Cut, drill, and tap units to receive hardware, hangers, and similar items.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- B. Inspect and verify condition of substrate. Correct any surface defects or conditions which might interfere with or prevent a satisfactory installation.
- C. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.2 INSTALLATION

- A. Set metal work level, true to line, plumb.
- B. In fabrication and erection of structural steel, conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."
- C. Shim and grout as necessary.
- D. To the maximum extent possible, use bolted field connections. Where practicable, conceal the fastenings. When field welding is warranted, comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercutting or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish/grind exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- E. Unless notes or specified otherwise:
 - 1. Connect steel members to steel members with 3/4-inch diameter high strength bolts.
 - 2. Connect aluminum to aluminum with 3/4-inch diameter aluminum bolts.
 - 3. Connect aluminum to structural steel using 3/4-inch diameter stainless steel bolts.
 - 4. Connect aluminum and steel members to concrete and masonry using 3/4-inch stainless steel epoxy anchors. Provide a minimum of 5 1/2 inches of embedment into concrete or masonry.
- F. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing. Provide fully welded splices where continuity is required.

- G. Provide each fabricated item complete with attachment devices as indicated or required to install.
- H. Anchor metal items so that items will not be distorted, nor fasteners overstressed from expansion and contraction.
- I. Install bollards in concrete as detailed. Fill pipe with concrete and round off at top of pipe.
- J. Center abrasive stair nosings in stair width.
- K. Attach grating to end and intermediate supports with grating saddle clips and bolts.
 - 1. Maximum spacing: 2 feet on center with a minimum of two attachments per support.
 - 2. Attach individual units of grating together with clips or attachments at 2 feet on center maximum with a minimum of two clips per side.
- L. Coat ferrous metals in accordance with Section 09 90 00 – Painting and Coating.
- M. Coat surfaces of aluminum that will come in contact with grout, concrete, masonry, wood or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.3 DRILLED ANCHORS

- A. Drilled-in anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dried. Drilled anchors shall not be installed until the concrete has reached the specified 28-day compressive strength. Epoxy anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

3.4 SETTING LOOSE PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose level and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use non-shrink grout in concealed locations where not exposed to moisture.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780

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**SECTION 05 52 13
PIPE AND TUBE RAILINGS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes guardrails and handrails to be fabricated and installed complete, in accordance with the Contract Documents.
1. Aluminum pipe railings.
 2. Steel pipe railings.
 3. Stainless steel pipe railings.

1.2 RELATED SECTIONS

1. Section 03 60 00 – Grouting
2. Section 05 50 00 – Metal Fabrications
3. Section 09 90 00 – Painting and Coating

1.3 REFERENCES

- A. Aluminum Association (AA) standards, most recent editions:

ADM 1	Aluminum Design Manual, Part 1-A Aluminum Structures, Allowable Stress Design
ASD 1	Aluminum Standards and Data
DAF 45	Designation System for Aluminum Finishes
SAA 46	Standards for Anodized Architectural Aluminum

- B. American Institute of Steel Construction (AISC) standards, most recent editions:

AISC 360	Specification for Structural Steel Buildings
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- C. American Society of Civil Engineers (ASCE) standards, most recent editions:

ASCE 8	Specification for the Design of Cold-Formed Stainless Steel Structural Members
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- D. ASTM International (ASTM) standards, most recent editions:

ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A312	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A510	Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A743	Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B26	Standard Specification for Aluminum-Alloy Sand Castings
ASTM B108	Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM B633	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM F1267	Standard Specification for Metal, Expanded, Steel
ASTM F1941	Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))

- E. American Welding Society (AWS) standards, most recent editions:
 - D1.1 Structural Welding Code – Steel
 - D1.2 Structural Welding Code – Aluminum
 - D1.6 Structural Welding Code – Stainless Steel
- F. National Association of Architectural Metal Manufacturers (NAAMM) standards, most recent editions:
 - Metal Finishes Manual for Architectural and Metal Products
 - AMP 521 Pipe Railing Systems Manual
- G. The Society for Protective Coatings standards, most recent editions:
 - SSPC-SP 6 Commercial Blast Cleaning

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Shop Drawings: Submit shop drawings of all railings to the Engineer for review, including the following information:
 1. Manufacturer's installation details.
 2. Layout drawings showing location of each railing, type of railing, and type of anchorage to be used.
 3. Manufacturer's recommendations on fastening and cleaning after installation.
- C. Mill Certificates: Signed by manufacturers of stainless steel products certifying that products furnished comply with requirements.
- D. Product Test Reports: From a qualified testing agency indicating railings comply with ASTM E985, based on comprehensive testing of current products and current building code required by authority having jurisdiction, whichever is more stringent.
- E. Certification: Submit a written certification, prepared by a Professional Engineer, licensed to practice in the state of Utah, verifying that the railing system design and related structural connections will meet the indicated loading requirements specified herein and included in the codes and standards referenced.
- F. Engineer's seal and signature to be affixed to shop drawings, and certification.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single manufacturer.
- B. Welding
 1. Maintain all weld procedures and welder qualifications available in the Contractor's field office for review.

2. Qualification of Welders: Use welders with current certifications (previous 12 months) for the material, type, and position of welding used. Certify in accordance with AWS Specifications according to the following:
 - a. AWS D1.1, Structural Welding Code – Steel.
 - b. AWS D1.2, Structural Welding Code – Aluminum.
 - c. AWS D1.6, Structural Welding Code – Stainless Steel.
 3. All welding shall be inspected by a Contractor-furnished inspector qualified in accordance with AWS requirements and approved by the Engineer.
- C. Licensed Professional: Design railings, including comprehensive engineering analysis by a qualified Professional Engineer who is licensed to practice in the state of Utah, using performance requirements and design criteria indicated herein.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Deliver products to site in original, unbroken packages, containers, or bundles and bearing the label of the manufacturer.
- C. Store all materials off the ground and protect from weather until ready for use.

1.7 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, which are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. General: Unless otherwise indicated, install all railings complete and ready for use with all anchors, attachments, balusters, brackets, caps, fasteners, gates, posts, sleeves, trim, and other items required or necessary for the complete installation. Attachment details shown on the Contract Drawings are for the purpose of indicating the type of attachment and may be substituted with the Manufacturer's standard products for the same type of attachment.
- B. Structural Design Requirements:
 1. Unless otherwise specifically noted, all railings, guardrails and handrails shall conform to the code requirements for industrial-commercial, non-public use under the State-approved OSHA. Railings, guardrails, and handrails, when part of a means of egress as defined by the governing codes, shall conform to the requirements of the most stringent of the codes or reference standards. The whole project shall conform to the code and State-approved OSHA for industrial-commercial, non-public use

unless otherwise indicated. Limited public use shall mean that the facility is not designed for public use; however, occasionally the public is allowed controlled access when approved.

2. Loading Conditions: Provide railings and handrail brackets capable of withstanding the following loading conditions without exceeding the allowable working stress of the material and without permanent deformation:
 - a. General: Distribute loads to the various parts of the railing system consistent with methodology described in ANSI/NAAMM AMP 521 - Pipe Railing Systems Manual.
 - b. Top Rail of Guards: Concentrated load of 200 pounds applied at any point and in any direction, and a uniform load of 50 pounds per lineal foot applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.
 - c. Handrails Not Serving As Top Rails: Concentrated load of 200 pounds applied at any point and in any direction, and a uniform load of 50 pounds per lineal foot applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.
 - d. Intermediate Rails: Uniform load of 50 pounds per lineal foot applied horizontally. Reactions due to this loading are not required to be applied concurrently with loadings specified above.
 - e. Posts: Concentrated load of 200 pounds applied at any point and in any direction.
 3. In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - a. Steel: AISC 360.
 - b. Aluminum: Referenced Aluminum Association publications.
 - c. Stainless Steel: ASCE 8.
- C. Height Requirements: Set top of upper railing at 42 inches above the working surface or toe line of stairs. Install toe boards not more than 1/4 inch off the working surface and provide where indicated and required by codes or referenced standards. Provide a separate handrail at stair locations.
- D. Guardrail Configuration: Three-rail system with equal open spaces between rails (and toe board when required) as required by OSHA.
- E. Thermal Movements:
 1. Exterior railing systems to provide for 1/4 inch expansion and contraction per 20 linear feet of railing.
 2. Interior railing systems to provide for 1/8 inch expansion or contraction per 20 linear feet of railing.
 3. Temperature change (range): 120 Degrees F, ambient; 180 Degrees F, material surfaces.
- F. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.2 MATERIALS

A. Iron and Steel

1. Pipe: ASTM A53, Type S, Grade B, 1-1/2 inch diameter, Standard Weight (Schedule 40), unless another grade and weight is required by structural loads.
 - a. Provide galvanized finish for exterior installations and where indicated.
 2. Plates, Shapes, and Bars: ASTM A36.
 3. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.
 4. Expanded Metal: ASTM F1267, Type II (expanded and flattened), Class 1 (uncoated).
 - a. Style Designation: 1-1/2 number 10.
 5. Perforated Metal: Galvanized-steel sheet, ASTM A653, G90 coating, commercial steel Type B, 0.064 inch thick, with 1/4-inch holes 3/8 inch on center in staggered rows.
 6. Woven-Wire Mesh: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A510.
- B. Stainless Steel
1. Pipe: ASTM A312, Grade TP316L, 1-1/2 inch diameter, Standard Weight (Schedule 40) unless another grade and weight is required by structural loads.
 2. Castings: ASTM A743 Grade CF8M or CF3M.
 3. Plate and Sheet: ASTM A240 or ASTM A666, Type 316L.
- C. Aluminum
1. Pipe: Alloy 6061-T6 or 6063 - T6, ASTM B429, 1-1/2 inch diameter, Schedule 40 unless another grade and weight is required by structural loads.
 2. Sheet and plate: Alloy 6061 - T6 or 6063-T6, ASTM B209.
 3. Extruded bars, rods, shapes, and tubes: Alloy 6061-T6 or 6063-T6, ASTM B221.
 4. Cast fittings: Aluminum, ASTM B108 or ASTM B26.
- D. Brackets: Handrail brackets shall be stainless steel or aluminum that matches the handrail or railing of which they are a part, including the finish.
- E. Toe Boards: Toe board material and finish shall match railing system and be not less than 4 inches in height. Toe boards shall be formed in an angle or channel section for strength.
- F. Connection splices: Internal mechanical connection splices for aluminum railings shall be of extruded aluminum.
- G. Fasteners:
1. Non-galvanized Steel Railings: Plated steel fasteners complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5 for zinc coating.
 2. Hot-Dip Galvanized Railings: Type 316 stainless-steel.
 3. Aluminum Railings: Type 316 stainless-steel fasteners.
 4. Stainless-Steel Railings: Type 316 stainless-steel fasteners.
 5. Fasteners for anchoring railings to other construction shall be of stainless steel, per requirements of Section 05 50 00 - Metal Fabrications.
 6. Fasteners for Anchoring Railings to Other Construction: Select fasteners to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads. Unless otherwise indicated, provide stainless steel fasteners per requirements of Section 05 50 00 - Metal Fabrications.

7. Fasteners for interconnecting railing components shall be of the same basic metal as the fastened metal. Do not use metals that are corrosive or incompatible with materials being joined.

H. Miscellaneous Materials:

1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded. For both aluminum and stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
2. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
3. Galvanizing Repair Paint: High-zinc-dust-content paint compatible with coatings specified to be used over it.
4. Shop Primers: Refer to Section 09 90 00 – Painting and Coating.
5. Intermediate Coats and Topcoats: Refer to Section 09 90 00 – Painting and Coating.
6. Grout: Refer to Section 03 60 00 – Grouting.

2.3 FABRICATION

A. General

1. Fabricate handrails and railing systems with welded or non-welded (aluminum only), internal and mechanical connections to comply with manufacturer's printed requirements, Construction Documents, details, dimensions, finish and member sizes, including post spacing and anchorage, but not less than the structural requirements to support applied loadings.
 - a. Clearly mark component units for site assembly and installation.
 - b. Use only connections that maintain structural capacity of joined members.
2. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
3. Provide weep holes or other means to exit entrapped water from hollow section of railing members exposed to exterior, condensation, or moisture from other sources.
4. Fabricate smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness.
5. Form exposed elements with smooth, long radius bends, accurate angles and straight sharp edges.
 - a. Ease exposed edges to a radius of approximately 1/32 inch.
 - b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the work.
6. For aluminum railings with exposed connections with flush, smooth, hairline joints.
 - a. Hand file to remove burrs and sharp edges before assembly.
 - b. Use recessed screws or flush blind rivets.
 - c. Top rail splices and expansion joints shall be located within 8 inches of post or other support.
7. Provide for anchorage to side face of support unless shown otherwise in Contract Drawings. Where this is impractical, provide for top face attachment.
8. Handrail Termination:
 - a. Fit exposed ends of handrails with solid terminations.
 - b. Handrails to extend not less than 12 inches beyond the toe of the top and bottom risers in a run of stairs.

- c. Ends of handrails to be returned to the wall or to be terminated in posts or safety terminals. Posts and safety terminals may be used only when approved by the Engineer. Close ends of returns unless clearance between end of railing and wall is 1/4 inch or less.
- B. Welded Railing Fabrication:
 - 1. All welding to be continuous.
 - 2. Remove flux immediately.
 - 3. All exposed welds to be ground and buffed smooth and flush to match and blend with adjoining surfaces.
 - 4. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
- C. Non-welded Railing Fabrication:
 - 1. All railings to be prefabricated or component formed, marked and sized for on-site installation.
 - 2. Top railing to be single continuous length attached to a minimum of three posts where possible.
 - 3. Posts and intermediate railings shall be single continuous lengths of pipe.
- D. Form changes in direction by bending or by inserting prefabricated elbow fittings.
 - 1. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of members throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
 - 1. For railing posts set in concrete, provide steel as detailed on the Drawings.
 - 2. For removable railing posts, fabricate slip-fit sockets from tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - a. Provide stainless steel chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated.
 - 3. Expanded-Metal Infill Panels: Fabricate infill panels from expanded metal made from same metal as railings in which they are installed.
 - a. Edge panels with U-shaped channels made from metal sheet, of same metal as expanded metal and not less than 0.043 inch thick.
 - b. Orient expanded metal with long dimension of diamonds parallel to top rail.
 - 4. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from same metal as railings in which they are installed.
 - a. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than 0.043 inch thick.
 - b. Orient perforated metal with pattern parallel to top rail.
 - c. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch metal channel frames. Make wire mesh and frames from same metal as railings in which they are installed.
 - d. Orient wire mesh with wires perpendicular and parallel to top rail.

2.4 FINISH

A. General

1. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage per manufacturer's recommendations.
3. Noticeable variations in appearance within the same piece or adjacent pieces are not acceptable.

B. Steel and Iron Finishes

1. Galvanized Railings:
 - a. Hot dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 - b. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
 - c. Comply with ASTM A123 for hot-dip galvanized railings.
 - d. Comply with ASTM A153 for hot-dip galvanized hardware.
 - e. When galvanized railings are to be coated, do not quench or apply post galvanizing treatments that might interfere with paint adhesion. After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
2. Non-Galvanized Railings:
 - a. For non-galvanized steel railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanized anchors embedded in exterior concrete or masonry.
 - b. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6.
 - c. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Primer need not be applied to surfaces embedded in concrete or masonry.
 - 1) Do not apply primer to galvanized surfaces.
3. Shop-Painted Finish: Refer to Section 09 90 00 Painting and Coating.
 - a. Color: As selected by Engineer from manufacturer's full range.

C. Stainless Steel

1. Remove or blend tool and die marks and stretch lines into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish, free of cross scratches. Run grain with long dimension of each piece.
3. Bright, Directional Polish: No. 4 finish.
4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- 5.

D. Aluminum

1. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
 - a. Anodized finish shall be Class I provided in accordance with AA-M12 C22 A41, clear.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine system components, substrate, and conditions where railing systems are to be installed. If unsatisfactory conditions exist, notify Engineer in writing of unsatisfactory conditions, and do not begin this Work until such conditions have been corrected.
- B. Commencing installation of this Work constitutes acceptance of conditions.

3.2 PREPARATION

- A. Prepare surrounding construction to receive railing system installations complying with railing manufacturer's requirements.
- B. Review and coordinate setting drawings, shop drawings, templates, and instructions for assembly and installation of railing system and related items to be embedded in concrete and masonry.

3.3 DISSIMILAR MATERIALS

- A. When aluminum railing components come into contact with dissimilar metals, masonry, or concrete, surfaces shall be kept from direct contact by painting the contact surface with a heavy coat of bituminous paint (cast aluminum) or two coats of clear lacquer (extruded aluminum).

3.4 INSTALLATION

- A. Install railing system and related components in strict accordance with approved shop drawings and manufacturer's printed instructions.
- B. Preassemble railing system, including posts, into the largest practical sections possible.
 - 1. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members, do not exceed tolerances specified in this Section. Erect work free from distortion or defects detrimental to appearance or performance.
 - 2. Separate aluminum which might contact concrete, masonry and other dissimilar metals to prevent electrolytic action.
- C. Align railings prior to securing in place to assure proper matching at abutting and expansion joints and correct alignment throughout their length.
 - 1. Provide for thermal expansion and contraction by use of expansion joints in top rails at 20-foot maximum intervals.
 - 2. Space posts not more than 6 feet on center.
 - 3. Space wall brackets not more than 5 feet on center.
- D. Provide anchorage for posts as indicated on Contract Drawings and in the following manner:
 - 1. Top of concrete and masonry walls, slabs, walkways, stairs and removable railing sections:

- a. Furnish posts with floor flange, welded or mechanically attached to post, with predrilled holes for bolting to surface.
 - 2. Side of concrete and masonry walls, slabs, walkways, stairs, and removable railing sections:
 - a. Furnish posts with side plate, welded or mechanically attached to post, with predrilled holes for bolting to surface.
 - 3. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete or attached to side as indicated on Drawings.
- E. Attach wall railings to wall with wall brackets except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
- F. Gates and removable sections:
 - 1. Provide safety gates in railing systems where ladder tops occur and at other locations shown on the Contract Drawings. Safety chains will not be accepted. Provide gates with self-closing hinges and self-closing latch bolts.
 - 2. Provide removable railing sections where indicated on the Contract Drawings.
 - 3. Provide gate and removable railing section hardware with color to match the railing system of which it is a part.

3.5 TOLERANCES

- A. Limit variation of cast-in-place inserts, sleeves, and field-drilled anchor and fastener holes to the following:
 - 1. Spacing: $\pm 3/8$ inch.
 - 2. Alignment: $\pm 1/4$ inch.
 - 3. Plumbness: $\pm 1/8$ inch.
- B. Handrails and Guardrail System Plumb Criteria:
 - 1. Limit variation of completed handrail and guardrail system alignment to 1/4 inch in 12 feet with posts set plumb to within 1/16 inch in 3 feet.
 - 2. Align rails so variations from level for horizontal members and from parallel with rake of stairs and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Provide "hairline" thin butt joints.

3.6 CLEANING

- A. As installation is completed, clean the railings in accordance with the manufacturer's printed instructions.
- B. If cleaning operations remove anodized finish, remove the affected rail and replace it with new material.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.
- 3.7 PROTECTION
- A. Suitably protect rail surfaces against lime mortar stains, discoloration, surface abrasion, and other construction abuses. Remove stained or otherwise defective work and replace with material that meets specification.

END OF SECTION

DIVISION 06
WOOD, PLASTICS, AND COMPOSITES

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SECTION 06 60 00
FIBERGLASS REINFORCED PLASTIC FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install fiberglass reinforced plastic fabrications, complete and serviceable as shown on the Drawings and as specified herein.
- B. Section Includes:
 - 1. Structural shapes.
 - 2. Grating.
 - 3. Grating floor system.

1.2 REFERENCES

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

ASTM D256	Standard Test Methods for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics
ASTM D570	Standard Test Method for Water Absorption of Plastics
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D696	Standard Test Method for Coefficient for Coefficient of Linear Thermal Expansion of Plastics Between -30 Degrees C and 30 Degrees C with a Vitreous Silica Dilatometer
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D2344	Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
ASTM D2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM E84	Surface Burning Characteristics of Building Material

Occupational Safety and Health Administration (OSHA), most recent editions:

OSHA 1910.27 Fixed Ladders

1.3 DEFINITIONS

A. FRP: Fiberglass reinforced plastic.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 20 – Contractor Submittals.

B. Product Data: Submit manufacturer’s published literature including material specifications, structural design data, structural properties and load and deflection tables for each style and type of fabrication used, corrosion resistance tables and anchoring systems and allowable load tables as applicable.

C. Shop Drawings: Submit shop drawings of all FRP fabrications and accessories.
1. For grating, show direction of span, type and depth of grating, size and shape of individual panels, seat angle details, and details of grating clip fasteners.

D. Structural Calculations: Provide design calculations for items and systems not sized or designed in the Contract Documents.

E. Samples: The Engineer may require sample pieces of any item specified herein for acceptance as to quality and color. When required, submit samples manufactured by the method to be used in the Work.

F. Certified Test Reports: Provide when requested by Engineer.

G. Stop Log Leak Test: Provide results of stop-log leak tests to Engineer.

H. Qualification Statements: Provide qualification documents for manufacturer’s experience history.

I. Warranty Documentation: Provide certificate of warranties specified herein.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer having a minimum of 10 years’ experience in the design and manufacture of similar products and systems to those specified herein. When requested, provide evidence of at least 5 previous successful installations in the past 5 years.

B. Maintain a continuous quality control program and provide Engineer with certified test reports of physical tests on samples when requested.

C. Provide only new FRP material for the fabrications specified.

D. Licensed Professional Engineer: When design calculations are required, they must be signed and sealed by an engineer licensed to practice in the state of Utah.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Delivery and Acceptance Requirements: Deliver manufactured materials in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Package adhesives, resins, and their catalysts and hardeners separately and not such to facilitate movement to a dry indoor storage area.
- C. Storage and Handling Requirements: Store all materials carefully to prevent them from being damaged. Store adhesives, resins, and their catalysts in dry indoor facilities between 70 degrees F and 85 degrees F until they are required.

1.7 WARRANTY

- A. Provide manufacturer's written 3-year warranty on all FRP products against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable.
 - 1. Grating and Treads
 - a. Fibergrate Composite Structures, Inc. (Safe-T-Span).
 - b. CorGrate Fiberglass Systems (CorGrate FW).
 - c. Strongwell (Duradek).
 - d. Engineer approved equal.
 - 2. Grating Floor System
 - a. American Grating LLC.
 - b. Fibergrate Composite Structures, Inc.
 - c. Engineer approved equal.

2.2 GENERAL

- A. FRP items shall be composed of fiberglass reinforcement and resin in quantities, qualities, properties, arrangements, and dimensions as necessary to meet the design requirements and dimensions indicated.
- B. Provide FRP products with tested flame spread rating of 25 or less per ASTM E84.
- C. Resins for FRP products shall be vinyl ester with chemical formulation necessary to provide the corrosion resistance, strength, and other physical properties as required.
- D. Finish
 - 1. Provide all finished surfaces of fiberglass items and fabrications smooth, resin-rich, free of voids, and without dry spots, crazes, or unreinforced areas.
 - 2. Provide for corrosion resistance and weathering.
 - 3. Outer surfaces with no glass fibers exposed.

- E. Supports and Fasteners: Provide all bolts, anchor bolts, washers, nuts, and supports as required for FRP items specified in this Section, in accordance with the requirements of the manufacturers of the FRP items.
 - 1. Unless specified otherwise, provide connectors of Type 316 stainless steel.
- F. Include an ultraviolet (UV) inhibitor in all FRP items. Additionally, provide an extra 1-mil UV coating on all FRP products located in exterior locations, exposed to the weather, or in UV facilities.
- G. Design and install fiberglass items providing accommodation for expansion and contraction. Prevent shearing of bolts, screws, and other fastenings, and provide close fitting of sections. Design joints exposed to weather to exclude water.
- H. Fabricate FRP products free from warps, twists, or other defects with affect appearance and serviceability.

2.3 STRUCTURAL SHAPES

- A. Manufacture all structural shapes by the pultrusion process with a glass content minimum of 45 percent and a maximum of 55 percent by weight.
- B. Minimum longitudinal mechanical properties are as follows.

Property	ASTM Method	Minimum Value	Units
Tensile Strength	D638	30,000	psi
Tensile Modulus	D638	2.5 x 10 ⁶	psi
Flexural Strength	D790	30,000	psi
Flexural Modulus	D790	1.8 x 10 ⁶	psi
Short Beam Shear	D2344	4,500	psi
Shear Modulus	N/A	4.5 x 10 ⁵	psi
Coefficient of Thermal Expansion	D696	4.4 x 10 ⁻⁶	In/in/deg F

2.4 GRATING

- A. Furnish and install FRP grating in areas shown on the Drawings, including FRP angle supports and embeds, fasteners, and accessories.
- B. Manufacture
 - 1. Depth: As shown on Drawings.
 - 2. Bearing bars and cross-rods manufactured by the pultrusion process having a maximum of 70 percent and a minimum of 60 percent continuous glass content (by weight).
 - 3. Interlock bearing bars and bond to cross-rods to provide a panel that resists twisting forces and prevents internal movement of the bearing bars.
 - 4. Non-slip Surface: Provide grating with quartz grit bonded and baked to the top surface of the finished grating product.
 - 5. Color: Yellow

- C. Load/Deflection Requirements: Provide grating capable of spanning the distances indicated without exceeding a deflection of span divided by 240 or 3/8 inch maximum when loaded at 100 psf.
- D. Penetrations: Provide cutouts where needed for utility penetrations through the grating. Reinforce around such cutouts where necessary to meet the load/deflection requirements.
- E. Fabricate individual grating panels into easily removable sections as large as possible, up to 80 pounds.
- F. Grating Clips: Install mechanical grating clips manufactured from Type 316 stainless steel and coated with epoxy coating. Provide a minimum of 4 clips per panel at a maximum of 4 feet on center.

2.5 GRATING FLOOR SYSTEM

- A. Provide grating floor system in areas shown on the Drawings. Include all FRP angle supports, FRP adjustable pedestal supports, FRP cross bracing, fasteners, and accessories as required for a complete system. Provide products from a single manufacturer.
- B. Manufacture
 - 1. Depth: As shown on Drawings.
 - 2. Design: Bidirectional molded FRP grating.
 - 3. Live Load: 100 psf, deflection limited to 1/4 inch.
 - 4. Non-slip Surface: Provide grating with quartz grit bonded and baked to the top surface of the finished grating product.
 - 5. Color: Yellow
- C. Fabricate individual grating panels into easily removable sections as large as possible, up to 80 pounds.
- D. Grating Clips: Install mechanical grating clips manufactured from Type 316 stainless steel and coated with epoxy coating. Fasteners shall not project above the walking surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Field verify all dimensions before fabrication of products and indicate such measurements on shop drawing layouts. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

3.2 INSTALLATION

A. General

- 1. Install FRP structures in accordance with manufacturer's assembly shop drawings. Field cut and drill FRP products with carbide or diamond tipped bits and blades only. Seal cut or drilled surfaces in accordance with manufacturer's instructions.
- 2. Bond FRP items with epoxy adhesive recommended by the manufacturer of the particular items. Use solvent and abrasives to sufficiently remove the surface gloss

and to remove any mold release agent or other contaminants which may interfere with proper bonding. Follow adhesive manufacturer's instructions and do not stress bonded items for a minimum of 48 hours after bonding.

B. Structural Shapes

1. Seal all field cuts and drilled edges sealed with a resin compatible with the original resin and recommended by the manufacturer to prevent premature fraying at the field cut edges.

C. Grating

1. Layout: Each grating section shall be readily removable, except where indicated. As much as possible, provide openings and holes where indicated on the Contract Drawings. Make grating openings which fit around protrusions (pipes, cables, machinery, etc.) discontinuous at approximately the centerline of opening so each section of grating is readily removable.
2. Install the grating with a minimum 1.5-inch bearing surface at the support ends.
3. Tolerances Between Sections: Not more than ¼-inch clearance between adjacent sections or between grating and frames. Assemble adjacent sections to line up forming an uninterrupted straight line, where possible.
4. Provide grating free from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles, and pits. Except for non-slip surfaces provide a smooth finish.
5. Miter and bond seat angles corners to produce smooth, even, level seating surface.
6. Install grating so that the top surface is level and even with adjacent walking surfaces. There shall be no protrusions above the top surface.
7. Fasten all grating to supports as specified herein.

END OF SECTION

DIVISION 07
THERMAL AND MOISTURE PROTECTION

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**SECTION 07 14 00
FLUID-APPLIED WATERPROOFING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide and apply single-component, fluid-applied liquid waterproofing system to below grade concrete slabs, walls, and footings, including surface preparation.

1.2 RELATED SECTIONS

- A. Section 03 30 00 Cast-in-Place Concrete
B. Section 07 92 00 Joint Sealants.

1.3 REFERENCES

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

ASTM C836	Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
ASTM D1644	Standard Test Methods for Nonvolatile Content of Varnishes
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM E96	Standard Test Methods for Water Vapor Transmission of Materials

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Product Data: For each type of product indicated. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions which may be required.
- D. Qualification Data: For qualified Installer.

- E. Product Test Reports: For waterproofing, based on evaluation of comprehensive tests performed by a qualified testing agency.
- F. Field quality-control reports.
- G. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is approved or licensed by manufacturer for installation of waterproofing required for this Project and is eligible to receive special warranties specified.
- B. Source Limitations: Obtain waterproofing materials from single source from single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below 0 Degrees F.
 - 1. Do not apply membrane when air, material, or surface temperatures are expected to fall below 30 Degrees F within four hours of completed application.
 - 2. Do not apply membrane if rainfall is forecast or imminent within 12 hours.
 - 3. Do not apply waterproofing membrane to any surfaces containing frost.
 - 4. Consult manufacturer for applications to green concrete.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.8 WARRANTY

- A. Special Warranty: The special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents, and shall be

in addition to, and run concurrent with, other warranties made under requirements of the Contract Documents.

- B. Provide a written warranty signed by waterproofing manufacturer and installer agreeing to repair or replace waterproofing that does not meet requirements or that does not remain watertight within the specified warranty period.
- C. Warranty Period: 3 years after date of Substantial Completion.
- D. Warranty does not include failure of waterproofing due to failure of substrate or formation of new joints and cracks in substrate that exceed 1/16 inch in width.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers and products are acceptable:
 - 1. Fluid Applied Waterproofing:
 - a. Epro Services, Inc., Ecobase Waterproofing Membrane.
 - b. Tremco Barrier Solutions, Tuff-N-Dri H8 Waterproofing.
 - c. Engineer approved equal.

2.2 PERFORMANCE CRITERIA

- A. Waterproofing Membrane:
 - 1. Single-component, polymer-enhanced liquid-applied membrane with the following minimum properties:
 - a. Solids content, ASTM D1644, 60% minimum.
 - b. Tensile Strength, ASTM D412: 15 psi, minimum.
 - c. Elongation, ASTM D412: 1100%, minimum.
 - d. Water Vapor Transmission, ASTM E96: 1 perms maximum (40 mil dry coat).
 - e. Hydrostatic Pressure Resistance, 8 feet water head, minimum.
 - f. Adhesion, ASTM C836, minimum 11 lb/inch to peel from concrete and masonry.
- B. Sealants and Accessories: Manufacturer's recommended sealants and accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.

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

3.2 PREPARATION

- A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- E. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

3.3 JOINTS, CRACKS, AND TERMINATIONS

- A. Prepare and treat substrates to receive waterproofing membrane, including expansion joints, construction joints, cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.

3.4 MEMBRANE APPLICATION

- A. Apply using appropriate equipment and nozzles, per manufacturer's recommendations. Start application with manufacturer's authorized representative present.
- B. Membrane: Spray apply asphalt emulsion membrane to substrates and adjoining surfaces indicated. Spread to a minimum wet thickness per manufacturer's specification to achieve listed hydrostatic resistance, minimum of 60 mils.
- C. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.
- D. Allow product to cure prior to backfilling.
- E. When buried surfaces that have been waterproofed are not backfilled within 30 days of membrane applications, membrane shall be coated with whitewash. Any formula for mixing the whitewash may be used which is not detrimental to the membrane and produces a uniformly coated white surface which remains until backfill is placed.

3.5 FIELD QUALITY CONTROL

- A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; and application of the membrane, flashings, protection, and drainage components; furnish daily reports to Engineer.

3.6 CLEANING AND PROTECTION

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes sealant work associated with joints between similar and dissimilar materials in the Work.
- B. Work included consists of, but is not necessarily limited to the following:
 - 1. Sealing all joints which would otherwise permit penetration of moisture, unless sealing work is specifically required under other sections.
 - a. Flashing reglets and retainers.
 - b. Exterior wall joints.
 - c. Flooring joints.
 - d. Isolation joints.
 - e. Joints between paving and sidewalks and building.
 - f. Concrete control and expansion joints, exterior and interior.
 - g. Joints at penetrations of walls, floors, and decks by piping and other services and equipment.
 - h. Exterior and interior perimeters of exterior and interior door and window frames, louvers, grilles, etc.
 - i. Thresholds at exterior doors.
 - j. Sealing of plumbing fixtures to floor or wall.
 - k. Other joints where caulking, sealant, or compressible sealant is indicated.

1.2 REFERENCES

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

ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1087	Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
ASTM C1193	Standard Guide for Use of Joint Sealants
ASTM C1247	Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids
- B. Federal Specification (FS), most recent editions:

TT-S-001543A	Sealing Compound: Silicone Rubber Base (for Caulking, Sealing, and Glazing in Buildings and Other Structures)
TT-S-00230C	Sealing Compound: Elastomeric Type, Single Component (For Caulking, Sealing, and Glazing in Buildings and Other Structures)

TT-S-00227E

Sealing Compound: Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures)

C. Underwriters Laboratories Inc. (UL):

Building Materials Directory

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

NSF 61 Drinking Water System Components, Health Effects

1.3 DEFINITIONS

A. Words "caulk," "sealant," and "caulking" mean sealant Work.

B. "Interior wet areas" mean toilets, showers, sinks, and similar areas.

C. "Applicator" means the individual actually on site performing the installation.

D. "Vertical" means any surface with a slope greater than 1.5 horizontal to 1.0 vertical.

1.4 SUBMITTALS

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

B. Product Data

1. Letter of certification that products submitted meet requirements of standards referenced.
2. Manufacturer's installation instructions.
3. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling, and bond breaker.
4. Applicator qualifications.
5. Warranty.
6. Certification from sealant manufacturer stating that product being used is recommended for and is best suited for joint in which it is being applied.

C. Field Samples

1. Cured sample of each color for Engineer's color selection. Color chart not acceptable.

D. Preconstruction field test reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in below in QUALITY ASSURANCE.

E. Product test reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Sealant applicator shall have a minimum of five years of experience on projects with similar scope.

B. Mock-ups:

1. Before caulking work is started, a sample of each type of joint shall be caulked where directed by Engineer. The approved samples shall show the workmanship, bond, and color of caulking materials as specified or selected for the Work and shall be the minimum standard of quality on the entire Project.

C. Preconstruction compatibility and adhesion testing:

1. Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - a. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - b. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - c. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - d. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - e. Testing will not be required if sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Preconstruction field-adhesion testing: Before installing elastomeric sealants, field test their adhesion to joint substrates found in the Work as follows:

1. Locate test joints where indicated in the Work or, if not indicated, as directed by the Engineer.
2. Conduct tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
3. Notify Engineer a minimum of 7 days in advance of dates and times when test joints will be evaluated.
4. Test method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 of ASTM C1193.
5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of preconstruction field-adhesion test results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 25 10 - Products, Materials, Equipment and Substitutions.
- B. Deliver material in manufacturer's original unopened containers with labels intact. Labels shall indicate contents and expiration date of material.
- C. Store all materials off the ground and protect from rain, freezing, or excessive heat until ready for use.
- D. Condition the specified products before use as recommended by the manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Schedule Work to be performed when temperature and humidity are as recommended by the sealant manufacturer during and after installation until products are fully cured.

1.8 WARRANTY

- A. Material and Labor Warranty:
 - 1. Sealant work shall be free of defects for a period of 5 years from date of final acceptance.
 - 2. Failure of watertightness constitutes a defect.
 - 3. Remove any defective work and/or materials and replace with new materials.
 - 4. Warranty must be signed jointly by applicator and sealant manufacturer.
- B. Special installer's warranty:
 - 1. Installer's standard form in which installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified herein within specified warranty period.
 - a. Warranty period: Five years from date of final acceptance.
 - 2. Special warranties herein specified exclude deterioration or failure of elastomeric joint sealants from the following:
 - a. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design.
 - b. Disintegration of joint substrates from natural causes exceeding design specifications.
 - c. Mechanical damage by individuals, tools, or other outside agents.
 - d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

1.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 - 1. Polyurethane sealants.

- a. Pecora.
 - b. PSI Polymeric Systems, Inc.
 - c. Sika Chemical Corporation.
 - d. BASF Master Builders.
 - e. Engineer approved equal.
2. Silicone sealants:
- a. Dow Corning Corporation.
 - b. General Electric.
 - c. Tremco
 - d. Engineer approved equal.
3. Fire Resistant Sealant:
- a. 3M Corporation.
 - b. Dow Corning.
 - c. Engineer approved equal.

1.2 MATERIALS

A. Sealants – General:

- 1. Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- 2. Where compound is exposed to view in finished Work, provide colors matching materials being sealed.
- 3. Where compound is not exposed to view in finished Work, provide manufacturer's color with best performance.
- 4. For joints in potable water reservoirs, provide only 2-component polyurethane sealant with NSF 61 certification.
- 5. Provide non sagging sealant for vertical and overhead joints.
- 6. Sealants for horizontal joints:
 - a. Self-leveling pedestrian/traffic grade.
- 7. Suitability for immersion in liquids: Where elastomeric sealants are indicated for submerged use, provide products that have undergone testing according to ASTM C1247 and qualify for the length of exposure indicated by reference to ASTM C920 for Classes 1 or 2. Liquid used for testing sealants is chlorinated potable water, unless otherwise noted.

B. Polyurethane Sealant:

- 1. One or two components.
- 2. Meet ASTM C920; F.S. TT-S-00230C, Type I or Type II, Class A, or TT-S-00227E, Type I or Type II, Class A.
 - a. Pecora Dynatrol I, Dynatrol II, Urexpam NR-200 or NR-201.
 - b. PSI PSI-270.
 - c. Sika Sikaflex-1A, Sikaflex-2C.
 - d. Master Builders MasterSeal NP-1, NP-II, SL-1.

C. Silicone Sealant:

- 1. One component.
- 2. Meet F.S. TT-S-001543A, Class A:
 - a. Dow Corning 790, 795, 786.
 - b. General Electric Silpruf, Silglaze, Sanitary SCS 1700 sealant.

- c. Tremco Spectrem.
- D. Bond breaker tape: Polyethylene tape of other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint surfaces of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
 - 1. Unless specifically shown on the Drawings, bond breaker shall not be used in joints within the reservoir.
- E. Joint Cleaner, Primer, Bond Breaker:
 - 1. As recommended by sealant manufacturer.
- F. Sealant Backer Rod: Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer to:
 - 1. Control joint depth
 - 2. Break bond of sealant at bottom of joint
 - 3. Provide proper shape of sealant bead.
- G. Fire-Resistant Sealant:
 - 1. One or two component.
 - 2. Furnish sealant which has been tested for use as a fire and smoke penetration seal.
 - a. 3M Corporation Fire Dam 150.
 - b. Dow Corning Firestop.
 - 3. UL approved for intended use.

PART 3 - EXECUTION

1.1 PREPARATION

- A. Before using any sealant, investigate its compatibility with adjacent joint surfaces, fillers, and other materials in the joint system.
- B. Use only compatible materials.
- C. Clean and prime joint surfaces in accordance with manufacturer's instructions.
 - 1. Limit application to surfaces to receive sealant.
 - 2. Mask off adjacent surfaces.
- D. Commencing sealant installation constitutes acceptance of joints and surfaces.

1.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Where finish coating or covering is to be applied to surface, wait until such coating or covering has been applied before installing sealant; e.g., paint, wall covering, glazed coatings.
- C. Make all joints water and airtight.

- D. Make depth of sealing compounds not more than one-half width of joint, but in no case less than 1/4 inch nor more than 5/8 inch.
- E. Provide correctly sized backer rod in all joints to proper depth.
- F. Apply bond breaker where required.
- G. Tool sealants using sufficient pressure to fill all voids.
- H. Upon completion, leave sealant with smooth even neat finish.

1.3 CLEANING

- A. Clean adjacent soiled surfaces free of sealant.

1.4 PROTECTION

- A. Protect finished installation.
- B. Protect sealants until fully cured.

1.5 SCHEDULES

- A. Furnish sealant as indicated for the following areas:
 - 1. Exterior areas:
 - a. Joints in concrete and masonry:
 - 1) Use 2-component polyurethane only.
 - b. All other joints:
 - 1) Single or 2-component Polyurethane or.
 - 2) Silicone.
 - 2. Interior wet areas:
 - a. Joints in concrete and masonry:
 - 1) Use 2-component polyurethane only.
 - b. All other joints:
 - 1) Single or 2-component Polyurethane or.
 - 2) Silicone.
 - 3. Interior non-wet, corrosive areas:
 - a. Joints in concrete and masonry:
 - 1) Use 2-component polyurethane only.
 - b. All other joints:
 - 1) Single or 2-component Polyurethane or.
 - 2) Silicone.
 - 4. Interior non-wet, drywall and plaster noncorrosive areas:
 - a. All Joints:
 - 1) Single or 2-component Polyurethane or.
 - 2) Silicone.
 - 5. Fire-rated construction: Fire-resistant sealant.

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DIVISION 09
FINISHES

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**SECTION 09 90 00
PROTECTIVE COATINGS AND LININGS**

PART 1 GENERAL

1.1 WORK INCLUDED

- A. This section covers surface preparation, furnishing, and application of protective coatings, complete.
- B. It is the intent of this specification that all new or existing exposed metal surfaces shall be coated with a protective coating, unless specifically excluded.
- C. Shop or existing surface preparation methods, cleanliness, and existing paint, rust, and mill scale removal is not known nor documented. Contractor shall be solely responsible for determining work effort, abrasive blast requirements, and any other factors that may affect work productivity as required to provide the specified surface preparation cleanliness; regardless of prior system preparation or coating application.

1.2 RELATED SECTIONS:

- A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- B. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
- C. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - 1. Section 01 33 20 - Submittal Procedures.
 - 2. Section 09 90 10 - Pipeline Coatings and Linings

1.3 GENERAL:

- A. See section GENERAL CONDITIONS, which contain information and requirements that apply to the work specified and are mandatory for this project.

1.4 ABBREVIATIONS

ANSI	American National Standards Institute
AWWA	American Water Works Association
CSP	Concrete Surface Profile
MDFT	Minimum Dry Film Thickness
MDFTPC	Minimum Dry Film Thickness Per Coat
mil	Thousandths of an Inch
OSHA	Occupational Safety and Health Act

PSDS	Paint System Data Sheet
SFPG	Square Feet Per Gallon
SFPGPC	Square Feet Per Gallon Per Coat
SP	Surface Preparation
SSPC	Steel Structures Painting Council
TLCP	Toxicity Characteristic Leaching Procedure
VOCs	Volatile Organic Compounds

1.5 REFERENCE STANDARDS

- A. This specification recognizes AWWA, NACE, and SSPC standards as minimum industry standards and they are referenced for purpose of conformance, except where modified herein. The requirements of this specification section have been written to a higher design standard with the intent of achieving a long-term coating performance of 100 years.

NACE SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE RP-0274	High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
SSPC-SP-1	Solvent Cleaning Surface Preparation
SSPC-SP-2	Hand Tool Cleaning Surface Preparation
SSPC-SP-3	Power Tool Cleaning Surface Preparation
SSPC-SP-5	White Metal Abrasive Blast Surface Preparation
SSPC-SP-6	Commercial Abrasive Blast Surface Preparation
SSPC-SP-10	Near-White Metal Abrasive Blast Surface Preparation
SSPC-SP-11	Power Tool Cleaning to Bare Metal Surface Preparation
SSPC-SP-13	Surface Preparation of Concrete

1.6 SUBMITTAL REQUIREMENTS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Shop Drawings: Catalog cuts and other information for all products proposed. Provide copy of approved coating system submittals to the coating applicator.
- C. Quality Control Submittals: Furnish the following:
1. Signed letter from the coating manufacturer prefacing any coating product submittal. This letter shall indicate that the coating manufacturer's representative is aware of the Project and recommends the specific products included in the submittal for use on the Project.
 2. Applicator's Experience with list of references substantiating compliance.
 3. Coating manufacturer's certification stating the individual coating applicators have met the qualification certification requirements as specified this section.
 4. The coating manufacturer shall provide a copy of the manufacturer's coating application quality assurance manual.
 5. If the manufacturer of field-applied coating differs from that of the shop applied primer, provide written confirmation from topcoat manufacturer certifying compatibility.

- D. Product Data: Furnish the following Data Sheets:
 - 1. For each paint system used herein, furnish a Paint System Data Sheet (PSDS), Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system. A sample PSDS form is appended at the end of this section.
 - 2. The required information shall be submitted on a system-by-system basis.
 - 3. The Contractor shall also provide copies of the paint system submittals to the coating applicator.
 - 4. Indiscriminate submittal of manufacturer's literature only is not acceptable.
- E. Where ANSI/NSF Standard 60 and 61 approvals is required, submit ANSI/NSF certification letter for each coating in the system indicating product application limits on size of tank or piping, dry film thickness, number of coats, specific product tested, colors certified, and approved additives.
- F. Provide TCLP test data for lead and other regulated heavy metals in non-recyclable, slag type abrasive blast media to be used on the project. Acceptable abrasive test data shall indicate the abrasive manufacturer, location of manufacture, and media gradation and type. Surface preparation will not be permitted to begin until acceptable test data has been submitted.

1.7 QUALITY ASSURANCE

- A. Coating Applicator's Experience and Certification:
 - 1. Coating Application Company and coating application supervisor (Certified Applicator) shall have a minimum of 5 years' experience applying the specified coating system.
 - 2. Coating application personnel, who have direct coating application responsibility, shall have a minimum of 2 years practical experience in application of the indicated coating system.
 - 3. Coating applicator shall be certified by the coating manufacturer as an approved applicator.
- B. Continuity of Contractor: Contractor's site supervisor shall be coordinated with the Engineer. Any replacement of the supervisor on site will require notification of Engineer 72 hours in advance and will be subject to approval by the Owner.
- C. Coating and/or lining manufacturer shall provide a technical representative to visit the jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these Specifications, and as may be necessary to resolve field problems attributable to, or associated with, the manufacturer's products furnished under this Contract. Sales representatives are not acceptable as a technical representative unless written authorization from the coating manufacturer is provided which states the sales representative has full authority to act in behalf of the coating manufacturer.

1.8 WARRANTY

- A. The Contractor and coating manufacturer shall jointly and separately warrant to the Owner and guarantee the work under this section against defective workmanship and materials for a period of 2 year(s) commencing on the date of final acceptance of the work.

1.9 ENGINEER OBSERVATIONS

- A. The Contractor shall give the Owner Representative notice a minimum of 14 days prior to start of work for scheduling shop or field observation.
- B. Provide Owner Representative a minimum 3 days' notice for actual start of surface preparation and coating application work.
- C. Provisions shall be made to allow Owner's representative full access to facilities and appropriate documentation regarding coating application.
- D. Observation by the Owner's representative or the waiver of observation of any portion of the work shall not be construed to relieve the Contractor of his responsibility to perform the work in accordance with these Specifications.
- E. Materials shall be subject to testing for conformance with this specification as the Owner's representative may elect, prior to or during incorporation into the work.
- F. Perform work in the presence of ENGINEER or Owner Representative, unless prior approval to perform such work in Engineer's absence is granted. Approval to perform work in the Engineer's absence is limited to the current day unless specifically noted to extend beyond the completion of the workday.

PART 2 PRODUCTS

2.1 GENERAL

- A. Coatings and linings will be stored and handled per manufacturer's written directions.
- B. All metallic surfaces shall be prepared and coated in accordance with referenced standards, written instructions of the coating or lining manufacturer, and these specifications, whichever is more stringent, unless specified otherwise.
- C. Coatings shall be the product of a single manufacturer. Product substitutions during the project will not be permitted without ENGINEER approval.

2.2 PAINT DELIVERY, STORAGE, AND HANDLING

- A. Delivered paint to the project site in unopened containers that plainly show, at the time of use, the designated name, date of manufacture, color, and name of manufacturer.

- B. Store paints in a suitable protected area that is heated or cooled as required to maintain temperatures within the range recommended by the paint manufacturer.
- C. Shipping:
 1. Where shop finish coated or primed items are to be shipped to the jobsite, protect coating from damage. Batten coated items to prevent abrasion.
 2. Use nonmetallic or padded slings and straps in handling.
 3. Items will be rejected for excessive damage.

2.3 PAINT AND COATINGS MANUFACTURERS

- A. A manufacturer letter code as follows will be found following the generic descriptions of materials outlined in the Specifications. Address is that of the general offices. Contact these offices for information regarding the location of representative nearest the project site.
- B. MANUFACTURER CODE A - COATINGS MANUFACTURERS (Able to supply most heavy-duty industrial coatings and architectural paints):
 1. Carboline Coatings Company, St. Louis, MO.
 2. ICI Devoe Coatings Company, Louisville, KY.
 3. International Coatings, Cerritos, CA
 4. Pittsburgh Paints (PPG), Pittsburgh, PA.
 5. Sherwin Williams, Cleveland, OH
 6. Tnemec Coatings, Kansas City, MO

2.4 PAINT MATERIALS

- A. Products shall meet federal, state, and local requirements limiting the emission of VOCs. Specific information may be secured through the local office of the Air Pollution Control Officer.
- B. Materials Including Primer and Finish Coats: Produced by same paint manufacturer of other components of the coating system, as previously stated.
- C. Thinners, Cleaners, Driers, and Other Additives: As recommended by manufacturer of the coating system. Where coatings are required to meet ANSI/NSF Standard 60 and 61, addition of thinners, driers, and other paint additives not approved under the ANSI/NSF certification letter will not be permitted.
- D. Paint products are listed according to their approximate order of appearance in the paint systems. The letter designating the manufacturer code refers to Article PAINT AND COATING MANUFACTURERS.

Products	Description
Epoxy, NSF	Amine or polyamine epoxy coating, two parts, suitable for immersion service, 75% volume solids minimum, capable of 4

	to 8 MDFT per coat, approved for potable water contact in conformance to ANSI/NSF Standard 60 and 61, and suitable for the application temperatures and conditions. MANUFACTURER CODE: A
Epoxy	Polyamine or polyamide epoxy, two parts, suitable for immersion service, 75% volume solids minimum, capable of 4 to 8 MDFT per coat, and suitable for the application temperatures and conditions. MANUFACTURER CODE: A
Polysiloxane	Acrylic polysiloxane hybrid coating, single component, suitable for shop or field application at 32 degrees F, minimum, recoat window of not less than 12 months with preference for products with unlimited overcoat capability, solids content of 85% minimum, high gloss, and tintable colors. Tinted colors shall be capable of storage for 30 days or longer prior to application. Coating shall be capable of spray, roller, or brush application on all metal substrates and specified prime and intermediate coats. MANUFACTURER CODE: A
Inorganic Zinc Primer	Solvent or water based, 14 lbs. metallic zinc content per gallon minimum; unlimited recoat window, conform to manufacturer's recommended topcoats as specified herein. MANUFACTURER CODE: A
Wash Primer	Vinyl butyral acid or equivalent coating for enhancing finish coat adhesion to galvanized steel surfaces. MANUFACTURER CODE: A
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish, suitable for continuous dry service at 200 degrees F without discoloration or peeling. MANUFACTURER CODE: A

2.5 COLORS

- A. Provide as selected by the Owner.
- B. Formulated with colorants free of lead, lead compounds, or other materials which might be affected by the presence of hydrogen sulfide or other gas likely to be present at the project.
- C. Proprietary identification of colors is for identification only. Any authorized manufacturer may supply matches.
- D. Equipment Colors:
 1. Equipment shall be meant to include the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.
 2. Paint non-submerged portions of equipment in the same color as the process piping it serves, except as itemized below:

a. Dangerous parts of equipment and machinery:	OSHA Orange
b. Fire protection equipment and Apparatus:	OSHA Red
c. Radiation hazards:	OSHA Purple
d. Physical hazards in normal operating area:	OSHA Yellow

3. Fiberglass reinforced plastic (FRP) equipment with an integral-colored gel coat does not require painting, provided the color is as specified.

2.6 QA/QC TESTING AND INSPECTION

A. General

1. Applicator shall inspect and test the coating system in accordance with referenced standards and these specifications, whichever is more stringent.
2. Quality control testing as specified in AWWA standards are minimum industry standards and it is the intent of this specification to provide a higher level of quality control for the objective of achieving maximum coating performance.
3. If any conflict between this specification and referenced standards occurs, the more stringent requirement shall apply and any interpretation of this requirement or results shall be with the objective of achieving maximum coating performance.
4. The frequency of the testing shall be determined by the applicator, but shall not be less than the requirements of this specification.

B. Surface Profile Testing

1. Surface profile of abrasive blasted surfaces to be tested with "Press-O-Film" tester tape or equivalent in accordance with NACE RP287.
2. Tester tape shall be suitable for the intended profile height.
3. Profile shall be measured to a minimum tolerance of 0.1 mils, maximum.
4. Electronic surface profilometer shall be used, where deemed necessary, to verify tester tape measurements.

C. Adhesion testing: As specified in Section 09 90 10, where directed by the Engineer for assessing coating application problems.

D. Holiday Testing

1. Holiday tests on epoxy coatings or linings will be conducted on the completed coating or lining after cure or 24-hours, whichever is less, using a high voltage spark test in accordance with NACE SP-0188 and these specifications.
2. Coating thickness used for high voltage holiday testing setting shall be the average dry coating thickness.

E. Dry Film Thickness Testing

1. Coatings shall be tested for dry film thickness using a properly calibrated magnetic pull off, eddy current, or ultrasonic equipment.
2. Coating thickness measurements shall be conducted as necessary and without limitation. Testing conformance to the requirements of SSPC PA-2 is specifically excluded from this specification.

PART 3 EXECUTION

3.1 GENERAL

- A. The intention of this specification is for all existing and new, interior and exterior surfaces to be painted, whether specifically mentioned or not, except as modified herein. Concealed structural steel surfaces shall receive prime coat only unless modified herein. Exterior concrete surfaces will not be painted unless specifically indicated hereinafter.
- B. Surface preparation and coating application shall be in conformance with these specifications and the coating manufacturer's written product data sheets and written recommendations of the manufacturer's technical representative. Where conflicts occur between the manufacturer's recommendations and these specifications, the more stringent of the two shall apply unless otherwise approved by the Engineer.
- C. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating for any purpose until completion of curing cycle.

3.2 REGULATORY REQUIREMENTS

- A. Meet federal, state, and local requirements limiting the emission of VOCs and worker exposures.
- B. Protect workers and comply with applicable federal, state, and local air pollution and environmental regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, coating application and dust prevention including, but not limited to the following Acts, Regulations, Standards, and Guidelines:
 - 1. Clean Air Act
 - 2. National Ambient Air Quality Standard
 - 3. Resource Conservation and Recovery Act (RCRA)
- C. Comply with applicable federal, state, and local regulations for confined space entry.
- D. Provide and operate equipment that meets explosion proof requirements.

3.3 ENVIRONMENTAL CONDITIONS

- A. Do not perform abrasive blast cleaning whenever the relative humidity exceeds 85 percent, whenever surface temperature is less than 5 degrees F above the dew point of the ambient air.
- B. Surface preparation power tools and blast equipment shall contain dust collection equipment that will prevent discharge of dust particles into the atmosphere.
- C. Do not apply paint when:
 - 1. Surface temperatures exceed the maximum or minimum temperature recommended by the paint manufacturer,
 - 2. In dust, smoke-laden atmosphere, damp or humid weather, or under conditions which could cause icing on the metal surface.
 - 3. When it is expected that surface temperatures will drop below 5 degrees above dew point within 8 hours after application of coating.

3.4 DEHUMIDIFICATION

- A. Where environmental conditions cannot be met or controlled, Contractor shall provide and operate desiccant dehumidification equipment to maintain environmental conditions for 24 hours a day during abrasive blasting and coating application and cure. Liquid, granular, or loose lithium chloride drying systems will not be acceptable.
- B. Contractor shall provide dehumidification equipment sized to maintain dew point temperature 17 degrees or more below surface temperature of metal surfaces to be cleaned and coated. System shall provide ventilation within the environmentally controlled areas as required for the following requirements:
 - 1. One air exchange per hour, minimum,
 - 2. Maintenance of personnel exposures limits (PEL) at 50 percent of OSHA PEL limits for all chemicals used in the performance of the work, and
 - 3. Maintenance of lower explosive limits (LEL) to less than 50 percent of the most volatile solvent used in the performance of the work.
- C. Dehumidification equipment type, size, air flow, and power requirements shall be designed by a qualified company knowledgeable in dehumidification equipment, and its operation based on project requirements and anticipated seasonal weather conditions for the project schedule. Design to include evaluation of existing conditions, humidity, and temperature, proper air exchange requirements, ventilation requirements, ducting requirements for adequate air flow, and any other issues necessary to achieve the specified performance and environmental conditions throughout the duration of the project.
- D. Contractor to submit written recommendations from dehumidification subcontractor for bulkhead locations, bulkhead venting, duct work for each bulkhead section, any secondary ventilation requirements for coating cure, dust collection equipment CFM requirements, and drying requirements for blast hose compressed air necessary to maintain environmental control as specified herein.
- E. Dehumidification subcontractor shall either operate the equipment or provide training to Contractor on the proper operation and setup of dehumidification equipment. Dehumidification subcontractor shall provide a technical representative on site for a minimum of two 8-hour days to ensure proper operation of the equipment, achievement of desired environmental control, and to ensure Contractor can properly setup, operate, monitor, and maintain the equipment.
- F. Dehumidification shall be operated in a manner that prevents all condensation or icing throughout surface preparation and coating application and cure.
- G. Reblasting of flash rusted metal surfaces or removal of damaged coatings, as a result of equipment malfunction, shutdown, or other events that result in the loss of environmental control, will be at the sole expense of the Contractor. Cleaned metal surfaces subject to flash rusting shall be cleaned to the same cleanliness as prior to the flash rust formation and shall be approved by the Engineer.
- H. Contractor shall monitor ambient temperature, humidity, dew point temperature, and pipe surface temperature both outdoors and within the work area at the start,

midpoint, and end of each work shift, minimum, but not greater than 5 hours between measurements.

- I. Daily environmental condition monitoring and maintenance of the equipment shall be documented in writing and provided to the Engineer.

3.5 VENTILATION AND ILLUMINATION

- A. Adequate illumination shall be provided while work is in progress. Whenever required by the inspector, the Contractor shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the inspector.
- B. Ventilation shall be used to control potential dust and hazardous conditions within the tank. Ventilation flow rates shall be in accordance with OSHA regulations and as required to reduce air contamination to nonhazardous conditions.

3.6 SURFACES NOT REQUIRING PAINTING

- A. Unless otherwise stated herein or shown, the following areas or items will not require painting:
 1. Concrete and masonry surfaces except where indicated on the Drawings.
 2. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, monel, aluminum, chromium plate, atmospherically exposed weathering steel, and stainless steel, except where:
 - a. Required for electrical insulation between dissimilar metals.
 - b. Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
 - c. Color coding of equipment and piping is required.
 3. Nonmetallic materials such as glass, PVC, wood, porcelain, and plastic (FRP) except as required for architectural painting or color coding.
 4. Prefinished electrical and architectural items such as motor control centers, switchboards, switchgear, panel boards, transformers, disconnect switches, acoustical tile, cabinets, elevators, building louvers, wall panels, etc.; color coding of equipment is required.
 5. Non-submerged electrical conduits attached to unpainted concrete surfaces.
 6. Cathodic protection anodes.
 7. Items specified to be galvanized after fabrication unless specifically required elsewhere or subject to immersion.
 8. Insulated piping and/or insulated piping with jacket will not require exterior coating, except as required for architectural painting or color coding.

3.7 PREPARATION OF SURFACES

- A. Surface Preparation Inspection:
 1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of paint manufacturer whose product is to be applied.
 2. Provide Engineer minimum 3 days' notice prior to start of surface preparation work or coating application work.

3. Perform such work only in the presence of Engineer, unless Engineer grants prior approval to perform such work in Engineer's absence.
- B. Metal Surface Preparation:
1. General:
 - a. Do not perform a surface preparation blast prior to submission of samples. Workmanship for metal surface preparation as specified shall meet current Steel Structures Painting Council (SSPC) Specifications as follows:
 - (1) Solvent Cleaning: SP 1
 - (2) Hand Tool Cleaning: SP 2
 - (3) Power Tool Cleaning: SP 3
 - (4) White Metal Blast Cleaning: SP 5
 - (5) Commercial Blast Cleaning: SP 6
 - (6) Brush-Off Blast Cleaning: SP 7
 - (7) Pickling: SP 8
 - (8) Near-White Blast Cleaning: SP 10
 - (9) Bare Metal Power Tool Cleaning: SP 11
 - b. All surface preparation shall be assumed to be on a SSPC Grade A steel surface condition, unless specifically noted otherwise.
 - c. Wherever the words "solvent cleaning", "hand tool cleaning", "wire brushing", or "blast cleaning", or similar words of equal intent are used in these Specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC Specifications listed above.
 - d. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers' recommendations for wet blast additives and first coat application shall apply. Wet blasting methods shall be approved by the Engineer.
 - e. Hand tool clean areas that cannot be cleaned by power tool cleaning.
 2. Welds and adjacent areas:
 - a. Prepared such that there is:
 - (1) No undercutting or reverse ridges on the weld bead.
 - (2) No weld spatter on or adjacent to the weld or any other area to be painted.
 - (3) No sharp peaks or ridges along the weld bead.
 - b. Grind embedded pieces of electrode or wire flush with the adjacent surface of the weld bead.
 3. Preblast Cleaning Requirements:
 - a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
 - b. Cleaning methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
 - c. Clean small isolated areas as above or solvent cleaned with suitable solvents and clean cloths.
 - d. Round or chamfered all sharp edges and grind smooth burrs, jagged edges, and surface defects.
 4. Blast Cleaning Requirements:
 - a. General:
 - (1) Type of Equipment and Speed of Travel: Designed to obtain specified degree of cleanliness.
 - (2) Select type and size of abrasive to produce a surface profile that meets the coating manufacturer's recommendations for the particular coating

to be applied or not less than 20 percent of the specified coating thickness, whichever is more stringent.

(3) Meet applicable federal, state, and local air pollution control regulations for blast cleaning and disposition of spent aggregate and debris.

(4) Do not reuse abrasive, unless abrasive is recyclable steel grit or shot abrasive.

b. Shop Blasting

(1) Notify Engineer at least 7 days prior to start of shop blast cleaning to allow for inspection of the work during surface preparation and shop application of paints. Work shall be subject to the Engineer's approval before shipment to the jobsite.

(2) Items such as structural steel, metal doors and frames, metal louvers, and similar items as reviewed by the Engineer may be shop prepared and primed. Centrifugal wheel blast cleaning is an acceptable alternate to shop blast cleaning. Blast clean and prime in accordance with these Specifications.

c. Field Blasting

(1) Perform sandblasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed. Materials, equipment, procedures, shall meet requirements of Steel Structures Painting Council.

(2) Field blasting in areas with electrical or mechanical equipment, within buildings, or on coated surfaces with lead paint greater than 2,000 mg/L total lead shall be performed with dustless abrasive systems such as "Sponge-Jet", dry ice abrasive blasting.

5. Post-Blast Cleaning and Other Cleaning Requirements:

a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wiped with a tack cloth.

b. Paint surfaces the same day they are sandblasted. Reblast surfaces that have started to rust before they are painted.

C. Concrete Surface Preparation:

1. Do not begin until 30 days after the concrete has been placed.

2. Remove grease, oil, dirt, salts or other chemicals, loose materials or other foreign matter by solvent, detergent, or other suitable cleaning methods.

3. Clean concrete using mechanical or chemical methods for the degree of cleaning specified for the coating system in accordance with SSPC SP-13, Surface preparation of Concrete.

4. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to coating.

5. Prepare concrete surface to CSP 5 as verified by Engineer.

6. Bug holes, air pockets, and other voids in the concrete will be filled or patched in chemical exposure areas, secondary containment, and where specifically required.

7. Concrete Surface Preparation Inspection:

a. Adhesion Testing:

(1) Tensile testing of the surface preparation shall be performed by the Engineer as necessary using Type 4 or Type 5 pneumatic adhesion

testing equipment in accordance with ASTM D4541 using 2-inch diameter dollies for concrete surface adhesion testing.

- (2) Applied coating greater than 20 mils in thickness or with a tensile strength greater than 2,500 psi shall be scored for concrete adhesion testing.
- (3) Adhesive failure greater than 50 percent of the dolly surface area shall indicate inadequate surface preparation.
- (4) Cohesive failures which results in loss of sound concrete will be acceptable provided the loss is greater than 50 percent of the dolly surface area.
- (5) Low adhesion cohesive failures with a thin layer of concrete due to weak concrete or laitance over 50 percent of the dolly surface will be rejected.

b. Concrete Soundness:

- (1) Concrete soundness shall be determined using the scratching or hammer impact methods as defined in SSPC SP-13.

c. Moisture Content:

- (1) Moisture shall be tested as Specified in SSPC SP-13 and shall not exceed the moisture content recommended by the coating manufacturer.

D. Brush-off Blast Cleaning:

1. Equipment, procedure, and degree of cleaning shall meet SSPC-SP 7, Brush-off Blast Cleaning and shall achieve a profile on the coating equivalent to 80 grit sandpaper with no exposed metal. Profile shall be uniform over the surface with no glossy areas visible.
2. Where metal substrate is exposed, Contractor shall apply full coating system as specified for new metal surfaces.
3. Repair or replace surfaces damaged by blast cleaning, where damage is defined as visible metal substrate. If less than 5 percent of prepared surface has the metal substrate visible, the coating shall be repaired by application of a brush applied intermediate coat. If greater than 5 percent the coating shall be fully removed to meet the specified surface cleanliness and recoated with the specified coating system.
4. Abrasive: Either conventional abrasive blasting with sand, grit, or nut shells or specialized abrasive blasting. Abrasives shall be 60 mesh grit, maximum.
5. Select various surface preparation parameters such as size and hardness of the abrasive, nozzle size, air pressure, and nozzle distance from the surface such that the surface is cleaned without pitting, chipping, or other damage.
6. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.
7. The Engineer shall approve trial blast cleaned area and shall use area as a representative sample of surface preparation.

E. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods which involve a solvent or cleaning action.
2. Method meets SSPC-SP 1.

3.8 PROTECTION OF MATERIALS NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
- B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.
- D. Mask openings in motors to prevent paint and other materials from entering the motors.

3.9 PAINT MIXING

- A. Multiple-component coatings:
 - 1. Prepare using all the contents of the container for each component as packaged by the paint manufacturer.
 - 2. No partial batches will be permitted.
 - 3. Do not use multiple-component coatings that have been mixed shall not be used beyond their pot life.
 - 4. Provide small quantity kits for touchup painting and for painting other small areas.
 - 5. Mix only components specified and furnished by the paint manufacturer.
 - 6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.
 - 7. Fast set or plural component products shall be applied using an appropriate multipart pump that properly mixes both components at the recommended ratio using equipment recommended by the coating manufacturer. Hot mixing of fast set or plural component products will not be permitted.
- B. Keep paint materials sealed when not in use and provide nitrogen blanket on fast set, plural, or moisture cured coatings on opened product containers when stored or not in use more than 8 hours.
- C. Where more than one coat of a material is applied within a given system, alternate color to provide a visual reference that the required number of coats have been applied.

3.10 APPLICATION OF PAINT

- A. General:
 - 1. Schedule and attend a Pre-Application Conference with Engineer prior to proceeding with coating application. Attendees should include any subcontractors intended to participate in the application of coatings on the Project.
 - 2. Inspection: Schedule with Engineer in advance for cleaned surfaces and all coats prior to the succeeding coat.
 - 3. Apply coatings in accordance with the paint manufacturer's recommendations. Allow sufficient time between coats to assure thorough drying of previously applied paint.

4. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
 5. Paint units to be bolted together and to structures prior to assembly or installation.
 6. Shop Primed or Factory Finished Surfaces:
 - a. Inspection: Schedule with Engineer in advance for shop primed or factory-finished items delivered to jobsite for compliance with these Specifications.
 - b. Hand or power sand areas of chipped, peeled, or abraded coating, feathering the edges. Follow with a spot primer using specified primer.
 - c. For two-package or converted coatings, consult the coatings manufacturer for specific procedures as relates to top coating of these products.
 - d. Prior to application of finish coats, clean shop primed surfaces of dirt, oil, and grease, and apply a mist coat of specified primer, 1.0 mil dry film thickness.
 - e. After welding, prepare and prime holdback areas as required for the specified paint system. Apply primer in accordance with manufacturer's instructions.
 7. Manufacturer Applied Paint Systems:
 - a. Repair abraded areas on factory-finished items in accordance with the equipment manufacturer's directions.
 - b. Carefully blend repaired areas into the original finish.
- B. Application Safety
1. Performed painting in accordance with recommendations of the following:
 - a. Paint manufacturer's instructions.
 - b. NACE contained in the publication, Manual for Painter Safety.
 - c. Federal, state, and local agencies having jurisdiction.
 2. Contractor will be solely and completely responsible for condition of the project site, including safety of all persons (including employees) and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. Safety provisions will conform to U.S. Department of Labor, Occupational Safety and Health Act, any equivalent state law, and all other applicable federal, state, county, and local laws, ordinances, and codes.
 3. Contractor will comply with all safety-training requirements promulgated or required for this project.
- C. Film Thickness:
1. Coverage is listed as either total minimum dry film thickness in mils (MDFT) or the spreading rate in square feet per gallon (SFPG). Per coat determinations are listed as MDFTPC or SFPGPC.
 2. Applied coating system film thickness per coat shall be applied at the specified coating thickness or the manufacturer's recommended minimum thickness, whichever is greater. Where the manufacturer has not specified a minimum coating thickness on the product data sheets, the minimum recommended coating application thickness shall apply.
 3. Maximum film build per coat shall not exceed the coating manufacturer's recommendations.
- D. Stripe Coats:

1. Surfaces that are subject to immersion, condensing environments, or where specifically specified shall be stripe coated on all angles, edges, corners, threads, welds, and similar type surfaces.
 2. Stripe coat shall be an extra coat of the intermediate coating material and shall be applied between the prime and intermediate coats.
 3. The stripe coat shall be a separate coat from coats specified under the coating system.
 4. Stripe coats shall be alternated in color like a full coat.
- E. Number of coats:
1. Apply specified number of coats, minimum, irrespective of the coating thickness.
 2. Additional coats may be required to obtain the minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
- F. Porous Surfaces, Such as Concrete, Masonry:
1. Prime Coat:
 - a. May be thinned to provide maximum penetration and adhesion.
 - b. Type and Amount of Thinning: Determined by the paint manufacturer and is dependent on surface density and type of coating.
 - c. Surfaces Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of the coating.
- G. Existing Coated Surfaces:
1. General:
 - a. Equipment or components with shop primer or shop finish coated surfaces shall be reviewed with the Engineer to determine coating damage, repair methods, surface preparation requirements, and conformance with color uniformity, where required.
 - b. All shop primed or finished coated surfaces shall be verified to be chemically compatible with field applied finish coats.
 - c. If a cured epoxy, polyurethane, or plural-component material is to be top coated, contact the coating manufacturer for additional surface preparation requirements. Existing coated surfaces shall be prepared as follows”
 - (1) Existing coated surfaces shall be brush-off blasted as specified herein to remove all gloss and provide a uniform profile on existing coating for adhesion of subsequent coats.
 - (2) Power or hand sanding will not be allowed as a surface preparation procedure for existing coatings, unless reviewed and approved by the Engineer.
 - (3) Where coating manufacturer surface preparation recommendations conflict with this section, the more stringent requirements shall apply.
 - (4) Profile shall be as specified for by the manufacturer or equivalent of 80 grit sandpaper; whichever is more stringent. Profile shall be visible and uniform over existing coated surfaces.
 - d. All existing coated surfaces, where demolition of equipment was specified or required, shall be surface prepared, touch-up coating repairs completed, and a cosmetic overcoat applied using the specified coating system on all existing coated surfaces associated with the demolition work, unless otherwise specified.

- e. Existing coatings on immersed equipment shall be removed to bare metal and recoated with the specified coating system where demolition work was specified.
 - f. Apply sealer/primer where recommended by coating manufacturer for coating compatibility.
2. To be Recoated or Final Coated:
 - a. Detergent wash and freshwater rinse.
 - b. Perform touch-up repairs of existing coating.
 - c. Asphaltic varnish coated ductile iron pipe will require an application of a seal coat prior to the application of a cosmetic finish coat.
 3. Touch-up Repairs:
 - a. Clean loose, abraded, or damaged coatings to substrate by Power Tool (SP 3).
 - b. Feather surrounding intact coating.
 - c. Apply one spot coat of the specified primer to bare areas overlapping the prepared existing coating.
 - d. Apply one full finish coat of the specified primer or finish coat(s) overall.
 4. Application of a Cosmetic Coat:
 - a. The exact nature of shop-applied coatings is not known in all cases.
 - b. Check compatibility by application to a small area prior to starting the coating.
 - c. If lifting or other problems occur, request disposition from the Engineer.
 - d. Cured epoxy, polyurethane, plural component materials or any other coating system that has exceeded its maximum recoat window shall be prepared as specified this section.
- H. Damaged Coatings, Pinholes, and Holidays:
1. Feather edges and repair in accordance with the recommendations of the paint manufacturer.
 2. Repair fusion bonded coatings as recommended by the original applicator. Applicator shall provide liquid repair kits for this purpose as recommended by the coating manufacturer.
 3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.
- I. Unsatisfactory Application:
1. If the item has an improper finish color, or insufficient film thickness, clean and topcoat surface with specified paint material to obtain the specified color and coverage. Obtain specific surface preparation information from the coating manufacturer.
 2. Hand or power sand visible areas of chipped, peeled, or abraded paint and feather the edges. Follow with primer and finish coat in accordance with the Specifications. Depending on the extent of repair and its appearance, a finish sanding and topcoat may be required.
 3. Evidence of runs, bridges, shiners, laps, or other imperfections shall be cause for rejection.
 4. Repair defects in coating system per written recommendations of coating manufacturer.
 5. Leave all staging up until the Engineer has inspected the surface or coating. Replace staging removed prior to approval by Engineer.

3.11 COATING INSPECTION

- A. General
 - 1. Film thickness measurements and electrical inspection of the coated surfaces:
 - 2. Perform with properly calibrated instruments.
 - 3. Recoat and repair as necessary for compliance with the Specifications.
 - 4. All coats will be subject to inspection by the Engineer and the coating manufacturer's representative.
 - 5. Visually inspect concrete, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
 - 6. Give particular attention to edges, angles, flanges, and other areas where insufficient film thicknesses are likely to be present and ensure proper milage in these areas.

- B. Coating Thickness Testing:
 - 1. Engineer shall conduct coating thickness testing as necessary and without limitation. Testing conformance to the requirements of SSPC PA-2 is specifically excluded from this specification.
 - 2. Measure coating thickness specified in mils with a magnetic type dry film thickness gauge as specified.
 - 3. Check each coat for the correct milage. Do not make measurement before a minimum of 8 hours after application of the coating.
 - 4. Tests for concrete coating thickness shall be with a Tooke Gauge, a destructive test. Contractor shall repair coating after thickness testing.

- C. Coating Continuity Testing
 - 1. Holiday detect coatings with high voltage units in accordance with NACE SP-0188. High voltage detector shall have adjustable voltages in 100 volt increments and shall be operated in accordance with the manufacturer's instructions and the specified standard.
 - 2. Use of an electrical holiday detector, low voltage, wet sponge type holiday detector will be permitted for coating systems less than 20 mils total dry film thickness and are not for immersion or condensing environments.
 - 3. Holiday detect coatings on pipe for buried application with high voltage spark tester in accordance with NACE RP0274.

3.12 CLEANUP

- A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroyed at the end of each day.

- B. Upon completion of the work, remove staging, scaffolding, and containers from the site or destroyed in a legal manner.

- C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

- D. Damages due to over spray on buildings, vehicles, trees, or other surfaces not specified to be painted would be the responsibility of the Contractor.

3.13 MANUFACTURER' SERVICES

- A. Furnish paint manufacturer's representative to visit jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these specifications, and as may be necessary to resolve field problems attributable to, or associated with, manufacturer's products furnished under this Contract.

3.14 PROTECTIVE COATING SYSTEMS AND APPLICATION SCHEDULE

- A. Unless otherwise shown or specified in these Specifications painted or coated the work in accordance with the following application schedule.
- B. In the event of discrepancies or omissions in the following, request clarification from the Engineer before starting the work in question.

System No.	Title
1	SUBMERGED METAL - IMMERSION
4	EXPOSED METAL - HIGHLY CORROSIVE
5	EXPOSED METAL - ATMOSPHERIC
8	BURIED METAL - MISCELLANEOUS
10	GALVANIZED METAL
21	EPOXY FLOOR, CONCRETE
27	ALUMINUM AND DISSIMILAR METAL INSULATION
29	FUSION BONDED COATING

- C. System No. 1 - Submerge Metal, Immersion

1. Surface Preparation and Coating System

Surface Prep.	Coating Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 5) Cement Mortar Prep: see Interior Linings, this section	Epoxy, NSF	3 coats, 16 MDFT

2. Application:

- a. All metal surfaces subject to immersion or contact with potable water.
- b. Use on the following areas:
 - (1) Interior lining of all pipe inside vaults, manways, or other structures.
 - (2) Coat the exposed portion of pipe ends at flexible pipe couplings with high solids epoxy lining, this section.
 - (3) Access manhole interior surfaces.
 - (4) All steel pipe without a cement mortar lining.

(5) Epoxy overcoat over mortar lining on each side of isolation flanges as specified.

3. Material Requirements:
 - a. Polyamide Epoxy: Amine or polyamine epoxy coating, two parts, suitable for immersion, application temperatures, and environmental exposures and conditions, 75% volume solids minimum, capable of 4 to 8 MDFT per coat.
 - b. Epoxy coating shall be NSF certified for potable water contact in conformance to ANSI/NSF Standard 60 and 61.
4. Special Requirements:
 - a. Epoxy coating applied to immersed surfaces that contact potable water shall be NSF certified for potable water contact.
 - b. NSF certified fusion bonded epoxy linings will be permitted as alternative lining for small diameter pipes, valves, and couplings. FBE coating to be applied as specified for FBE coatings this section and in accordance with the manufacturer's recommendations.
 - c. All welds, angles, edges, and bolted connections shall be stripe coated as specified this section.

D. System No. 4 - Exposed Metal, Highly Corrosive

1. Surface Preparation and Coating System

Surface Prep.	Coating Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Inorganic Zinc Rich Primer	1 coat, 3.0 to 4.0 DFT
	Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	2 coats, 6 to 8 DFT
	Or Polysiloxane	2 coats, 4 to 6 DFT

2. Application:
 - a. All exposed metal surfaces, new and existing, located inside of vaults or structures.
 - b. Use on the following areas:
 - (1) Exterior of all vault piping.
 - (2) Manways and miscellaneous exposed piping.
 - c. Contractor choice of topcoat material shall not be changed. Only one topcoat material will be permitted on the project.
3. Special Requirements:
 - a. Surface preparation and primer shall be shop applied to all surfaces prior to installation.
 - b. DFT thicknesses greater than manufacturer's recommendations shall be subject to rejection and removal.
 - c. Intermediate and topcoats shall be field applied after installation.
 - d. All shop primed or finish coated surfaces shall be prepared as an existing coated surface as specified herein and shall be top coated with intermediate and/or finish coats as required to provide color uniformity throughout the vault or structure.

- e. Color uniformity requirements shall apply to all components installed within the vault and visibly part of completed installation regardless of shop applied coating system.
- f. Buried dielectrically coated pipe and fittings passing through a concrete structure wall or floor shall be dielectrically coated for a minimum of 4-inches beyond the interior wall or floor surface before transitioning to Coating System No. 4.

E. System No. 5 - Exposed Metal, Atmospheric:

1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Inorganic Zinc Rich Primer	1 coat, 2.5 MDFT
	Polysiloxane	2 coats, 6 MDFT

2. Application:

- a. Exposed metal surfaces, new and existing, located outside of structures and exposed to weather and the following specific surfaces unless otherwise specified.
- b. Use on the following items or surfaces:
 - (1) Exposed surfaces of blowoff piping, unless hot dipped galvanized
 - (2) Exposed surfaces of air vent piping, unless hot dipped galvanized.

3. Special Requirements:

- a. All shop primed or finish coated surfaces shall be prepared as an existing coated surface as specified herein and shall be top coated with intermediate and/or finish coats as required to provide color uniformity.
- b. Color uniformity requirements shall apply to all components visibly part of the completed installation regardless of shop applied coating system.
- c. Galvanized steel surfaces shall be coated per the coating manufacturer's requirements.
- d. Polysiloxane coating to overlap buried pipe coating a minimum of 4 inches below top of concrete.
- e. Aliphatic polyurethane will not be allowed as a substitute for polysiloxane due to restrictive overcoat requirements.
- f. Dry film coating thickness of polysiloxane, including touch up repairs, shall not exceed the manufacturer's recommended maximum film thickness.

F. System No. 8 - Buried Metal, General:

1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast or Centrifugal Wheel Blast (SP 10)	Wax Tape Coating	Wax tape as specified in Section 09 90 10, Pipeline Coatings and Linings

2. Application:

- a. All buried miscellaneous pipe, joints, fittings, and other pipe appurtenances shall be coated as specified under Section 09 90 10, Pipeline Coatings and Linings.
 - b. All buried, below grade portions of steel items, except buried stainless steel or ductile iron, unless otherwise specified.
3. Special Requirements:
- a. Metallic air vent pipe, buried, may be coated with System No. 1 at Contractor's option.

G. System No. 10 - Galvanized Metal Conditioning:

1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1) Followed by Hand Tool (SP 2) or Power Tool (SP 3)	Wash Primer Finish Coats to Match Existing Paint	1 Coat, 0.4 MDFT As Required to Match Surrounding Area

2. Application:
- a. All galvanized surfaces requiring painting and the following specific surfaces unless otherwise specified.
3. Special Requirements:
- a. Sweep blast as specified this section, may be used in lieu of hand or power tool cleaning of galvanized surfaces provided Contractor can demonstrate that damage to the zinc coating will not result. Engineer approval of sweep blasting locations, methods, and surface cleanliness and profile results is required.
 - b. See applicable coating systems for finish coating system and coating requirements based on area and/or surface to be coated.

H. System No. 21 Epoxy Floor, Concrete:

1. Surface Preparation and Coating System

Surface Prep.	Paint Materials	Min. Coats, Cover
Concrete	Epoxy	1 st coat (thinned) 2 coats (unthinned) Total system 80 SFPG

2. Application:
- a. Use on the following areas:
 - (1) The floors of cast-in-place concrete vaults where indicated in the Drawings.
3. Special Requirements:
- a. Epoxy coating to be applied a minimum of 6-inches onto walls, pipe supports, and any other metallic component attached to the floor or wall within the 6-inch limit.

- b. All areas above the 6-inch limit shall be masked, provide a straight-line demarking coated versus uncoated areas.
- c. Abrasively blast miscellaneous metal surfaces to an SSPC SP-10, near white blast, as specified this section.
- d. Prime coat of epoxy shall be a thinned coat of the epoxy coating to fill and seal the concrete before the final coats applied, per the coating manufacturer's requirements.
- e. Apply non-skid aggregate between coats where specified or shown.

I. System No. 27 Aluminum and Dissimilar Metal Insulation:

1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1)	Wash Primer	1 coat, 0.4 MDFT
	Epoxy	1 coat, 8 MDFT

2. Application:

- a. Use on all non-submerged concrete embedded aluminum surfaces, and the following specific surfaces unless otherwise specified.
- b. Use on the following surfaces:
 - (1) All concrete embedded components of vault hatches
 - (2) All concrete embedded surfaces where electrical isolation from concrete reinforcement is required.

J. System No. 29 Fusion Bonded Coating:

1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10) or Acid Pickling (SP 8)	Fusion Bonded 100% solids Epoxy or Polyurethane	1 or 2 coats, 10 MDFT

2. Application:

- a. Use where specified.
- b. Use on the following items or surfaces:
 - (1) Concrete embedded anchor bolts, except threads.
 - (2) Removable handrail sleeves.

3. Special Requirements:

- a. System 1 may be used as alternative coating system at Contractor's option

(See PSDS form following this section)

PAINT SYSTEM DATA SHEET

Attached products' Technical Data Sheet (if applicable) to this sheet for each paint system submittal.

Paint System Number (from spec.):		
Paint System Title (from spec.):		
Coatings Manufacturer:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	Product Name/Number Proprietary)	Min. Coats, Coverage

Additional Information Required (check applicable items):

- ANSI/NSF Certification letter for each paint material listed above requiring ANSI/NSF Standard 60 and 61 approvals.
- Manufacturer's minimum and maximum recommended coating thickness per coat and for total coating system.
- Immersion coating cure requirements from minimum coating application temperature to 100 degrees in 15-degree temperature increments.

**SECTION 09 90 10
PIPELINE COATINGS AND LININGS**

PART 1 GENERAL

1.1 WORK RESULTS

- A. This section covers the work necessary to apply external coating and internal lining on steel pipe, field coating of joints, and shop and field repair of coating damage, complete.
- B. Exposed steel pipe will be shop coated as specified in Section 09 90 00, Protective Coatings and Linings.

1.2 RELATED SECTIONS:

- A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- B. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
- C. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - 1. Section 01 33 20 - Submittal Procedures
 - 2. Section 09 90 00 - Protective Coatings and Linings
 - 3. Section 13 11 40 - Corrosion Monitoring System

1.3 SUBMITTAL REQUIREMENTS

- A. Submit in accordance with Section 01 33 20 - Submittal Procedures and Section 09 90 00 - Protective Coatings and Linings.
- B. Shop Drawings: Catalog cuts and other information for all products proposed. Provide copy of approved coating system submittals to the coating applicator.
- C. Quality Control Submittals: Furnish the following:
 - 1. Applicator's Experience with list of references substantiating compliance.
 - 2. Coating manufacturer's certification stating the individual coating applicators have met the qualification certification requirements as specified this section.
 - 3. Coating manufacturer shall provide a copy of the manufacturer's coating application quality assurance manual.

If the manufacturer of field-applied coating differs from that of the shop applied primer, provide written confirmation from both manufacturers' that the two coating materials are compatible.

1.4 QUALITY ASSURANCE

- A. Coating Applicator's Experience and Certification:
1. Coating Application Company and coating application supervisor (Certified Applicator) shall have a minimum of 5 years' experience applying the specified coating system.
 2. Coating application personnel, who have direct coating application responsibility, shall have a minimum of 2 years practical experience in application of the indicated coating system.
 3. Coating applicator shall be certified by the coating manufacturer as an approved applicator.
- B. Coating and/or lining manufacturer technical representative shall be present for a minimum of three days technical assistance and instruction at the start of coating and/or lining operations within the shop. During this visit, the technical representative shall observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.
- C. Coating and/or lining manufacturers technical representative shall be onsite for three working days, minimum, at the start of each construction season to inspect coating application and procedures in the field. During this visit, the technical representative shall observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.
- D. Coating and/or lining manufacturer shall include 8 hours per month of field or shop coating technical support when requested by the Engineer.
- E. Technical representative shall provide a written report to the Engineer for each visit. Report shall include copies of test data collected, description of observations, and all recommended corrective actions. Report shall be submitted within 5 working days after the visit. When deemed necessary by the Engineer, work will not be permitted to proceed until the recommended corrective actions have been implemented. After all corrective recommendations have been completed; the manufacturer representative shall return and certify that the application complies with the manufacturer's coating application recommendations.
- F. Additional visits by the manufacturer's representative shall be made at sufficient intervals during surface preparation and coating or lining as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions, and as may be necessary to resolve problems attributable to, or associated with, manufacturer's products furnished for this project.

1.5 ABBREVIATIONS

ANSI	American National Standards Institute
AWWA	American Water Works Association
CSP	Concrete Surface Profile
MDFT	Minimum Dry Film Thickness

MDFTPC	Minimum Dry Film Thickness Per Coat
mil	Thousandths of an Inch
OSHA	Occupational Safety and Health Act
PSDS	Paint System Data Sheet
SFPG	Square Feet Per Gallon
SFPGPC	Square Feet Per Gallon Per Coat
SP	Surface Preparation
SSPC	Steel Structures Painting Council
TLCP	Toxicity Characteristic Leaching Procedure
VOCs	Volatile Organic Compounds

1.6 DEFINITIONS

- A. **MANUFACTURER'S REPRESENTATIVE:** Employee of coating manufacturer who is factory trained and knowledgeable in all technical aspects of their products and systems. Sales representatives are not acceptable as a technical representative unless written authorization from the coating manufacturer is provided which states the sales representative has full authority to act on the behalf of the coating manufacturer.
- B. **SPECIALS FITTINGS AND CONNECTIONS:** Defined as any joint of pipe with turnout, blowoff, fabricated tee, cross, wye, manhole, mitered angles or elbows, crotch plates, butt straps, or fabricated pipe that cannot be coated using through put or straight pipe coating application equipment and the following specific items:
 - 1. All pipe joint sections entering a structure.
 - 2. Pipe joints with weld lead pass through holes.
- C. **SHOP:** A shop is defined as a permanent, fully enclosed building with a concrete floor that can be power washed with a potable water supply and floor drains.

1.7 REFERENCE STANDARDS

- A. This specification recognizes AWWA, NACE, and SSPC standards as minimum industry standards and they are referenced for purpose of conformance, except where modified herein. The requirements of this specification section have been written to a higher design standard with the intent of achieving a long-term coating performance of 100 years.

AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4-inch and Larger- Shop Applied
AWWA C210	Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
AWWA C214	Tape Coatings for Steel Water Pipe
AWWA C215	Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines
AWWA C216	Heat-shrinkable Crosslinked Polyolefin Coatings for Steel Water Pipe and Fittings

AWWA C217	Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
NACE SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE RP-0274	High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
NACE RP0303	Field-Applied Heat-Shrinkable Sleeves for Pipelines: Application, Performance, and Quality Control
NACE SP0394	Application, Performance, and Quality Control of Plant-Applied Single-Layer Fusion-Bonded Epoxy External Pipe Coating
SSPC-SP-1	Solvent Cleaning Surface Preparation
SSPC-SP-2	Hand Tool Cleaning Surface Preparation
SSPC-SP-3	Power Tool Cleaning Surface Preparation
SSPC-SP-5	White Metal Abrasive Blast Surface Preparation
SSPC-SP-6	Commercial Abrasive Blast Surface Preparation
SSPC-SP-10	Near-White Metal Abrasive Blast Surface Preparation
SSPC-SP-11	Power Tool Cleaning to Bare Metal Surface Preparation

1.8 SPECIAL WARRANTY REQUIREMENTS

- A. The Contractor and coating applicator shall jointly and separately warrant to the Owner and guarantee the work under this section against defective workmanship and materials for a period of two (2) years commencing on the date of final acceptance of the work.

1.9 OBSERVATION OF WORK

- A. The Contractor shall give the Owner Representative notice a minimum of 14 days prior to start of work for scheduling shop or field observation.
- B. Provide Owner Representative a minimum 3 days' notice for actual start of surface preparation and coating application work.
- C. Provisions shall be made to allow Owner's representative full access to facilities and appropriate documentation regarding coating application.
- D. Observation by the Owner's representative or the waiver of observation of any portion of the work shall not be construed to relieve the Contractor of his responsibility to perform the work in accordance with these Specifications.
- E. Materials shall be subject to testing for conformance with this specification as the Owner's representative may elect, prior to or during incorporation into the work.
- F. Perform work in the presence of ENGINEER or Owner Representative, unless prior approval to perform such work is granted. Approval to perform work is limited to the current day unless specifically noted to extend beyond the completion of the workday.

PART 2 PRODUCTS

2.1 GENERAL

- A. Coatings and linings will be stored and handled per manufacturer's written directions.
- B. Exterior and interior pipe and fitting surfaces shall be prepared and coated in accordance with referenced standards, written instructions of the coating or lining manufacturer, and these specifications, whichever is more stringent.
- C. Coatings shall be the product of a single manufacturer. Product substitutions during the project will not be permitted without ENGINEER approval.

2.2 SHOP-APPLIED, BURIED PIPE COATINGS

A. General

- 1. Buried steel pipe, consisting of straight lengths of pipe, shall be coated with one of the following coating systems at the Contractors option, except where noted otherwise.
 - a. Polyethylene Tape Wrap and cement overcoat (AWWA C214 and C205)
 - b. Plural Component Epoxy and cement overcoat (AWWA C210 and C205)
- 2. Buried Steel pipe specials, fittings, and other complex shapes that are not suitable for machine applied tape wrap coating application and are below finished grade or concrete encased shall be coated with Plural Component Epoxy only (AWWA C210).
- 3. Vault or manhole piping and miscellaneous pipeline components, such as coupling plain ends, access manholes, blowoff piping, or piping less than 12-inches in diameter, shall be coated as specified under Shop Applied, Atmospheric and Immersion Coatings, this section.
- 4. Mortar over coat shall be provided over tape wrap coating system and where specified. Cement mortar overcoat shall be shop-applied and 1-inch thick, $\pm 1/4$ -inch, as specified herein.
- 5. Buried dielectrically coated pipe and fittings passing through a concrete structure wall or floor shall be dielectrically coated for a minimum of 4-inches beyond the interior wall or floor surface.
- 6. Exterior surfaces of all butt straps shall be prepared to SSPC-SP-5, white metal, and coated with inorganic zinc suitable for temperatures over 750 degrees as specified for holdback corrosion protection.

B. Polyethylene Tape Wrap:

- 1. General Coating Requirements:
 - a. Tape wrap coating system shall be machine applied. Hand applied tape coatings will not be permitted.
 - b. Tape width shall be 12-inches maximum. Wider tape will be conditionally allowed if the coating applicator can demonstrate that proper maintenance of tension and prevention of mechanical wrinkling throughout the coating application. If at any time during the pipe fabrication tape quality becomes inconsistent with wider tape, the Engineer can require the remainder of the pipe to be coated using the maximum specified tape width.
 - c. Tape layers shall have adhesive for the full width of the tape. Adhesive shall have the ability to stick to itself and to the proceeding tape layer or pipe.
 - d. Each layer shall be a different color or shade with the outer layer white.

- e. Outer wrap shall be white and have sufficient ultraviolet (UV) inhibitors to resist above grade exposure for a minimum of 12 months or the proposed storage and construction time, whichever is greater.
2. Steel Pipe:
- a. Surface Preparation:
 - 1) Comply with salt contamination and surface cleanliness (dust) requirements as specified for Quality Control testing.
 - 2) Steel Pipe: SSPC-SP5, White Metal blast, 2.5 mils blast profile, minimum.
 - b. Coating System
 - 1) Pipe shall be coated with an 80 mil (nominal), tape-coating systems applied in accordance with AWWA C214, except as modified herein.
 - 2) Steel pipe with cement mortar overcoat shall be coated with 50 mil (nominal), tape-coating systems applied in accordance with AWWA C214, except as modified herein.
 - 3) Primer: Polyken 1019, 1027, 1029, or as recommended by the coating manufacturer.
 - 4) Weld Stripe Tape: Polyken 931 (no backing), 25 mils nominal, 4-inches wide minimum.
 - 5) Inner Wrap: Polyken 989 YGIII, 20 mils nominal, corrosion protection layer.
 - 6) Outer Wrap: Polyken 956 YGIII, 30 mils nominal, mechanical protection layer.
 - 7) Mechanical Protection: Cement mortar overcoat in accordance with AWWA C205, except as modified herein.
- C. Plural Component Epoxy:
- 1. General:
 - a. Plural component, epoxy coating system shall be applied in accordance with AWWA C210, and as modified herein.
 - b. All steel pipe specials, fittings, complex shapes, and other surfaces that are not suitable for machine applied tape wrap coating application and are below finished grade or concrete encased shall be coated with this coating system. Plural component epoxy coating system is not suitable for interior of pipe or where contact with potable water may occur, see Section 09 90 00, Protective Coatings and Linings, for applicable protective coating systems.
 - 2. Shop Surface Preparation:
 - a. Steel pipe:
 - 1) Comply with salt contamination and surface cleanliness requirements as specified for Quality Control Testing.
 - 2) SSPC-SP5, White Metal blast, 3.00 mil profile, minimum, or as required by the manufacturer, whichever is greater.
 - 3. Shop Applied Coating Requirements:
 - a. Thickness: One coat, 35 mils total dry film thickness, minimum, or as required to meet limits specified for holiday and coating defects, this section.
 - b. Cement Mortar Overcoat:
 - 1) Mechanical Protection: Cement mortar overcoat in accordance with AWWA C205, except as modified herein.
 - 4. Product Acceptance:

- a. Self-priming, plural component, 100 percent solids, non-extended epoxy, suitable for burial or immersion, and meeting the requirements of AWWA C210 and the following, whichever is more stringent:
 - 1) Resistance to Water Immersion (ASTM D870) or Wet Adhesion
 - a) Acceptance criteria:
 - (1) Not greater than 10 percent loss of substrate adhesion when compared to substrate adhesion in an unexposed area of the same sample with adhesion tests completed within 12 to 24 hours after test termination. Average of three pulls per exposure area.
 - (2) No blistering or underfilm corrosion when viewed at 10x magnification.
 - b) Adhesion Testing:
 - (1) Method: ASTM D4541, Method E
 - (2) Equipment: Type V, Delfesko Automatic AT Positest
 - (3) Dollies: 20 mm and 14 mm, scored to metal substrate
 - (4) Test Speed: 100 psi per second (both 14 and 20 mm)
 - c) Test Duration: 30 and 60 days
 - 2) Cathodic Disbondment (ASTM G95)
 - a) Acceptance criteria: 8 mm, maximum
 - b) Potential: -3.00 volts
 - c) Test Duration: 28 days
 - d) Evaluation: Measured from original holiday radius to edge of staining on metal surface.
 - 3) Water Absorption (ASTM D570)
 - a) Acceptance Criteria: 1.80 percent, maximum
 - b) Test Duration: 30 day and 60 day
- b. Shall be one of the following products:
 - 1) Tnemec Series 431, Kansas City, MO
 - 2) Or Engineer approved equal

D. Cement Mortar Coating or Cement Mortar Overcoat

- 1. Apply cement mortar coating system on steel pipe, where specifically shown on the Drawings, in accordance with AWWA C205, except as modified herein.
- 2. Cement mortar overcoat shall be applied over dielectric coating system on all steel pipe and fittings in accordance with AWWA C205, except as modified herein. Holdback:
 - a. Mortar overcoat shall be held back of dielectric coating a minimum of 3 inches for overlap of field applied joint coating onto dielectric coating system.
 - b. Mortar overcoat shall not extend into structures unless otherwise noted.
- 3. Shop Applied Coating System:
 - a. Cement: Conform to ASTM C150, Type II.
 - b. Aggregate shall be silica sand or other aggregate that is not subject to leaching. Conform to ASTM C33.

- c. Cement mortar mixture shall consist of 1-part cement to not more than 3 parts aggregate.
 - d. Water for cement mortar: Clean and free from organic matter, strong alkalis, vegetable matter, and other impurities. Use no more than 4-1/2 gallons of water per sack of cement.
 - e. Cement mortar coating: Nominal 1-inch thick coating with permitted tolerance of $\pm 1/4$ -inch.
4. Joint Coating:
- a. Joints of cement mortar overcoat dielectrically coated pipe do not require field application of cement mortar overcoat when properly coated with heat shrink sleeve joint coating system.

2.3 SHOP-APPLIED INTERIOR LININGS

A. General

- 1. Clean and cement mortar line steel pipe and fittings 6-inches or greater in diameter in accordance with AWWA C205.
- 2. Apply liquid epoxy coating over cement mortar lining at insulating joints as specified this section.
- 3. Epoxy line pipe 12-inches diameter or smaller per System No. 1 or fusion bonded epoxy lining at contractor's option. Fusion bonded epoxy lining shall be NSF 61 certified.

B. Cement Mortar Lining:

- 1. Cement: Conform to ASTM C150, Type II.
- 2. Shop applied cement mortar lining shall be uniform in thickness over the full length of the pipe joint.
- 3. Aggregate shall be silica sand or other aggregate that is not subject to leaching. Conform to ASTM C33.
- 4. Water for cement mortar: Clean and free from organic matter, strong alkalis, vegetable matter, and other impurities.

C. Liquid Applied Epoxy Coating:

- 1. Epoxy Overcoat of Cement Mortar Lining:
 - a. Provide liquid epoxy primer and lining in all cement mortar lined metallic pipe at insulating joints for a minimum of one pipe diameters on each side of the insulated joint. If other side of joint is an existing pipe, apply epoxy lining for two pipe diameters in fabricated pipe only.
 - b. Epoxy lining shall be polyamine or polyamide cured, NSF approved for potable water contact in accordance with ANSI/NSF Standards 60 and 61, and capable of achieving full cure before placement in service or exposure to water.
 - c. Application:
 - 1) Apply in two coats at equivalent spread rate for 6 mils dry film thickness per coat.
 - 2) Epoxy shall be applied over the cement mortar lining where specified for the pipeline lining material.

- 3) Cement mortar shall be allowed to cure for a minimum of 15 days prior to surface preparation and coating application or 7 days with steam curing. Mortar lining shall be dry when epoxy lining is applied.
 - 4) Prepare the cement mortar lining by abrasive blasting to remove all laitance and provide a surface profile equivalent to 80 grit sandpaper.
- d. Acceptable manufacturers:
- 1) Carboline
 - 2) ICI Devoe
 - 3) Tnemec
 - 4) Sherwin Williams
 - 5) PPG
 - 6) Or approved equal

2.4 SHOP APPLIED, ATMOSPHERIC OR IMMERSION COATINGS

A. General

1. All atmospherically exposed or vault piping shall be shop primed and field coated with the applicable Exposed Metal coating system as specified in Section 09 90 00, Protective Coatings and Linings.
2. Interior of pipe or surfaces in contact with potable water shall be coated with System No. 1.
3. Shop applied inorganic zinc primer shall not be applied at thickness greater than recommended by manufacturer. Excess primer to be removed using method recommended by coating manufacturer.
4. Intermediate and finish coats shall be applied in the field after installation, except where metal surfaces will be concealed after installation.
5. All concealed surfaces of bolted or mechanically secured surfaces shall be finished coated in the shop.
6. Manufacturer of shop-applied primer shall be coordinated with field application to provide a completed system by a single manufacturer. Engineer approval of a coating system with two or more coating manufacturers' will require written approval from the topcoat manufacturer certifying compatibility.

2.5 FIELD APPLIED COATING SYSTEMS

A. General

1. Miscellaneous Metals
 - a. All buried miscellaneous metal components installed on the pipeline and that is supplied bare or with a shop coating system that is not equal to the specified pipeline coating shall be coated in the field with one of the following coating systems.
 - 1) Petrolatum or Wax Tape Coating
 - 2) Heat Shrink Sleeve
 - b. Miscellaneous metal components shall include, but not be limited too, all exposed metals surfaces, including bolts, couplings, flanges, valves, adapters, pipe spools, and other miscellaneous metal components.

- c. Coating system applied shall conform to the manufacturer's requirements and shall be applied in accordance with the application requirements of the coating system.
 - d. Filler material shall be applied for all field applied coating systems to provide sufficient transition at welds and other dimensional changes to prevent all tenting or voids under the applied coating, regardless of manufacturer's recommendations.
2. Pipe Joints General:
- a. Pipe joints shall be field coated after pipe assembly with one of the following coating systems as specified.
 - 1) Petrolatum or wax tape coating system
 - 2) Heat Shrink Sleeves.
 - b. Steel pipe joints shall be coated with a heat shrink coating, unless specified otherwise.
 - c. Joints of cement mortar overcoated tape wrap steel pipe shall be cement mortar overcoated after application of the specified field applied joint coating, unless specified otherwise.
 - d. Flanges, couplings, ductile iron pipe joints, and all bolted or threaded joints are classified as complex shapes and shall be wax tape coated with filler material to ensure completed encapsulation and filling of all bolts, crevices, gaps, and dimensional transitions as required to prevent tenting of the finished coating.
- B. Petroleum or Wax Tape Coating:
- 1. Application:
 - a. Coating shall be applied in accordance with AWWA C217, except as modified herein.
 - b. Wax tape coatings shall be field applied on all buried couplings, thrust restraint rods and brackets, valves, and on joints, fittings, or irregular shapes or complex configurations that could cause tenting of heat shrink coating system.
 - c. Provide wax filler material for all complex shapes, bolts, flanges, gaps, and dimensional transitions to completely fill and encapsulate the metal surfaces and prevent tenting of the applied tape coating.
 - d. Buried wax tape coated surfaces shall be overcoated with plastic shrink film as recommended by the manufacturer.
 - e. Do not use wax tape coating systems on vault piping, atmospherically exposed piping and appurtenances, or where subject to UV exposures.
 - f. Use sand backfill to protect wax coating from damage.
 - 2. Surface Preparation: SSPC-SP11 or SSPC-SP10.
 - 3. Coating System:
 - a. Primer: Wax tape primer consisting of microcrystalline waxes and corrosion inhibitors with no clay fillers. Primer shall be manufactured by the same manufacturer as the wax tape.
 - b. Filler Material:
 - 1) Filler materials shall be petroleum or petrolatum wax sealer/filler with closed cell plastic filler
 - 2) Provide filler material to fill and smooth all irregular surfaces, such that no tenting or voids remain under the applied wax tape.

- c. Wax Tape: Non-firming anti-corrosion wrap consisting of a microcrystalline wax blend saturated into a non-woven bonded synthetic fabric, forming a tape wrapper. Shall contain no siliceous mineral fibers and be intended for belowground use.
 - d. Wrap: Multi-layered plastic wrap. Shall be manufactured by the same manufacturer as the wax tape.
 - e. Polyethylene Encasement: Wax tape coated couplings, fittings, elbows, restraints, valves, etc. shall be encased in 8-mil polyethylene sheeting installed in accordance with manufacturer's recommendations. Loose polyethylene sheeting shall be secured with PVC pipe wrap tape. Install encasement as otherwise indicated in these Specifications.
4. Manufacturers: Wax tape coating system shall be as manufactured by:
- a. Denso North American
 - b. Trenton
 - c. Or approved equal.

C. Heat Shrink Sleeves:

- 1. Application:
 - a. Heat shrink sleeves are restricted to pipeline joints and couplings under buried or concrete encased applications only.
 - b. Application inside vaults or where exposed to the weather will not be allowed.
 - c. Provide filler material for all welded joints, rolled or Carnegie joints, and at all dimensional changes that could result in tenting or voids under the applied heat shrink sleeve.
 - d. Pipe joints that have been shop prepared as specified for heat shrink sleeves and shop coated with holdback primer as specified this section, shall be field prepared in accordance with SSPC-SP1 and SSPC-SP3 to remove all dirt, mud, oil, and grease prior to application of heat shrink sleeve.
 - e. Filler material shall be applied in a manner and of sufficient thickness that no tenting or voids remain under the heat shrink sleeve.
 - f. Contractor to consider sleeve shrinkage and joint profile in determining sleeve width required. Overlapping of two or more heat shrink sleeves to achieve the necessary width on pipe joints will not be permitted without Engineer approval.
- 2. Surface preparation: As specified for pipe joint surface preparation.
- 3. Coating System:
 - a. Filler Material:
 - 1) Filler material shall adhere to the pipe and heat shrink sleeve. Size and type shall be as recommended by the sleeve manufacturer for type of pipe and joint.
 - 2) Filler materials shall be applied as necessary to prevent all tenting or voids under the applied heat shrink sleeve, regardless of manufacturer's written recommendations.
 - 3) Filler mastic for joints subject to weld after backfill shall have a melt temperature exceeding 500 degrees F.
 - b. Heat Shrink Sleeve:

- 1) Heat shrink, cross-linked polyolefin sleeve with a mastic sealant, 85-mil nominal thickness or greater, suitable for pipeline operating temperature, as recommended by the manufacturer.
 - 2) Provide standard recovery sleeve for welded or bell and spigot steel pipe joints. High recovery sleeves shall be provided for mechanical or bell and spigot ductile iron pipe, flange joints, and coupling style joints.
 - 3) Width of heat shrink sleeves shall be sufficient to overlap existing coating 2-inches minimum, except extruded polyolefin coated pipe shall have a minimum overlap of 3-inches. Overlap on tape coated steel pipe shall be based on a sequential 2-inch wide step from outer wrap to middle wrap to inner wrap.
 - 4) Sleeve shall meet requirements for "Well After Backfill" when procedure is allowed and approved by Engineer.
4. Coating Manufacturer's:
- a. Canusa,
 - b. Raychem-Covalence,
 - c. Or equal.
- D. Epoxy Coating:
1. Application:
 - a. Epoxy coatings shall be NSF approved and suitable for water contact in accordance with ANSI/NSF Standards 60 and 61, unless otherwise approved by the Engineer.
 - b. Contractor shall ensure that epoxy coating selected is suitable for the application temperatures anticipated and that project schedule will allow adequate cure time before backfilling or immersion based on surface temperatures at the time of application.
 - c. Epoxy coating shall be used to coat concrete embedded pipe penetrations for 6 inches outside of interior and exterior surfaces of concrete walls or floors. Epoxy coating at concrete penetrations shall be a minimum of 16 mils dry film thickness.
 - d. Buried transitions from epoxy to tape wrap coating systems shall be coated with Heat Shrink Sleeve as specified below. Heat shrink sleeves shall be buried within 72-hours of application to prevent thermal creep of sleeve. Sleeves subject wrinkling due to thermal exposure shall be removed and replaced by the Contractor.
 2. Surface Preparation: SSPC-SP11 or SSPC-SP10
 3. Coating System:
 - a. Primer: As required by the coating manufacturer.
 - b. High Build Epoxy Coating:
 - 1) Two component, high build polyamide or polyamine cured epoxy coating, suitable for direct burial or immersion, dries to touch in 2 or more hours, suitable for immersion or burial after full cure of coating.
 - 2) Acceptable manufacturers:
 - a) ICI Devoe
 - b) Sherwin Williams
 - c) Carboline

- d) Or approved equal
 - c. Fast Cure Epoxy Coating:
 - 1) Two components, 100% solids by volume, fast cure epoxy coating suitable for direct burial or immersion, dry to touch in less than 1 hour at 72 degrees, capable of curing while immersed or buried.
 - 4. Manufacturers:
 - a. TC 7010, Tapecoat Inc
 - b. Protal 7125 or Protal 7200, North American Denso
 - c. Or approved equal.
- E. Cement Mortar Coating or Overcoat:
- 1. Joints of cement mortar coated or cement mortar overcoated steel pipe shall be mortar coated as specified herein after application of the specified joint coating materials, where applicable.
 - 2. Polyethylene foam-lined fabric with steel strapping of sufficient strength to hold the fresh mortar, resist rodding of the mortar and allow excess water to escape.
 - a. 100 percent closed-cell
 - b. Chemically inert, insoluble in water, resistant to acids, alkalis, and solvents.
 - c. Manufacturer and Product: Dow Chemical Company; Ethafoam 222.
 - 3. Fabric Backing:
 - a. Cut and sewn into strips wide enough to overlap shop-coated areas by 4 inches on either side.
 - b. Strips shall have slots for steel strapping on outer edges.
 - 4. Joint Coating:
 - a. Joints of cement mortar overcoat dielectrically coated pipe do not require field application of cement mortar overcoat when properly coated with heat shrink sleeve or wax tape joint coating system.

2.6 FIELD APPLIED INTERIOR JOINT LINING

- A. Epoxy Lining:
- 1. Surface preparation and field lining of pipe joints shall be with the same coating system as the shop-applied lining.
 - 2. Field application shall be performed by a qualified contractor with equipment that meets the application requirements of the coating system and personnel trained and certified by the coating system manufacturer on the proper application of the coating system. Qualified field applicator shall have completed at least three other projects of similar size and magnitude within the last three years using the same or similar coating system.
 - 3. Coating applicator that does not meet the qualifications requirements can be rejected by the Engineer.
 - 4. Field coating application requirements shall be the same as the shop-applied coating requirements. Provide heating and/or dehumidification equipment as required to meet the environmental conditions necessary for proper coating application.
- B. Mortar Lining:
- 1. After the backfill has been completed to final grade, the interior joint recess shall be filled with grout. The grout shall be tightly packed into the joint recess and trowelled flush with the interior surface. Excess shall be removed.

2. At no point shall there be an indentation or projection of the mortar exceeding 1/16-inch.
3. With pipe smaller than 24-inches in diameter, before the spigot is inserted into the bell, the bell shall be daubed with grout. The joint shall be completed and excess mortar on the inside of the joint shall be swabbed out.

2.7 REPAIR OF COATINGS AND LININGS

A. General

1. Coating or lining repair materials shall be compatible with the shop-applied coating or lining system and shall be approved by the coating or lining manufacturer.
2. Coating repair materials shall be as required for the coating system and repair classification as defined this section.

B. Coating Repair Materials

1. Heat Shrink Sleeves (major repair):
 - a. Filler Mastic: Provide mastic filler to fill tape void as required.
 - b. Shrink Sleeve: See Field Applied Coatings, Heat Shrink Sleeves, this section.
2. Heat-Applied Patches (minor repair)
 - a. Heat applied adhesive, polyolefin backed, mastic coated tape, 12-inches maximum size.
 - b. Patch shall provide a minimum of 2 inches overlap onto intact pipe coating; except for extruded polyolefin coated pipe shall have a minimum overlap of 3-inches in the circumferential direction.
 - c. CRP patch as manufactured by Canusa, PERP patch as manufactured by Raychem (Polyken), or equal.
3. Plural Component Epoxy Coating or Lining
 - a. Major Repairs:
 - 1) Shop repairs shall be completed using the same material as the pipe coating. Coating shall be reapplied using plural component spray equipment in accordance with manufacturer's written requirements.
 - 2) Field repairs shall be completed using heat shrink sleeves as specified for field applied coatings, this section.
 - 3) Shop or field major repairs to NSF linings shall be with single use kits matching the existing lining.
 - b. Minor Repairs:
 - 1) Shop minor repairs shall be single use kits matching the existing coating. Pinholes, holidays, or adhesion test repairs are classified as minor repairs.
 - 2) Field minor repairs shall be with fast cure epoxy, such as Protal 7125 as manufactured by North American Denso, Inc.
 - 3) Shop or field minor repairs to NSF linings shall be with single use kits matching the existing lining.

2.8 HOLDBACK CORROSION PROTECTION

- A. Primer for corrosion protection of cutbacks or holdbacks shall be compatible with the specified joint coating system and high heat resistant or weld after backfill requirements, where applicable.

- B. Approved holdback primers are:
 - 1. Tnemec Omnithane – Suitable for all joints, except joints subject to high heat resistant or weld after backfill
 - 2. Tnemec 90E-92 Ethyl Silicate Inorganic Zinc Primer – suitable for all joints, including high heat resistant or weld after backfill joints.
 - 3. ICI Devoe Cathacoat 304V Ethyl Silicate Inorganic Zinc Primer – suitable for all joints including high heat resistant or weld after backfill joints.
 - 4. Polyken Tape Primers – Not allowed
- C. Primer shall not result in running or melting of the coating or cause toxic fumes when heated during welding of “weld after backfill” joints.
- D. Application and thickness of holding primer shall be in accordance with the coating manufacturer’s recommendations but shall not impair the clearances required for proper joint installation.
- E. Holdback requirements shall be as specified this section.

PART 3 EXECUTION

3.1 ENVIRONMENTAL LIMITATIONS

- A. General
 - 1. Products shall comply with federal, state, and local requirements limiting the emission of volatile organic compounds and worker exposure.
 - 2. Comply with applicable federal, state, and local, air pollution and environmental control regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, and coating application.
 - 3. Do not perform abrasive blast cleaning whenever the relative humidity exceeds 85 percent, whenever surface temperature is less than 5 degrees above the dew point of the ambient air.
 - 4. Do not apply coatings when:
 - a. Surface and ambient temperatures exceed the maximum or minimum temperatures recommended by the coating manufacturer or these specifications,
 - b. In dust or smoke-laden atmosphere, blowing dust or debris, damp or humid weather, or under conditions that could cause icing on the metal surface.
 - c. When it expected that surface temperatures would drop below 5 degrees above dew point within 4 hours after application of coating.
 - d. Whenever relative humidity exceeds 85 percent.
 - 5. Where weather conditions or project requirements dictate, Contractor shall provide and operate heaters and/or dehumidification equipment to allow pipe surfaces to be abrasive blasted and coated as specified and in accordance with the manufacturers coating application recommendations.
 - 6. Work activities can be restricted by the Engineer until adequate temperature and humidity controls are in place and functioning within the environmental limits specified.

7. Coating applicator shall provide a monitoring system approved by the coating manufacturer that constantly records pipe and coating conditions during coating application. Recorded monitoring parameters shall include pipe temperature, line speed, holiday test and other parameters applicable to the type of coating.
- B. Temperature Control
1. In cold weather or if moisture collects on the pipe, preheat pipe to a temperature between 45 and 90 degrees or 5 degrees above dew point, whichever is greater.
 2. When temperatures are above or below the coating manufacturers recommended application temperatures, the Contractor will provide temperature controls as necessary to permit work to precede within the manufacturer's temperature limitations.
 3. Provide tenting, insulating blankets, baffles, or bulkheads as required to zone and control heating or cooling effectiveness.
 4. Heating shall be with indirect fired heaters that do not increase humidity levels within the work area. Heaters shall be sized for the area to be heated.
- C. Dehumidification
1. Contractor shall provide and operate desiccant dehumidification equipment to maintain environmental conditions during abrasive blasting and coating application and cure. Liquid, granular, or loose lithium chloride drying systems will not be acceptable.
 2. Contractor shall provide dehumidification equipment sized to maintain dew point temperature 17 degrees or more below surface temperature of metal surfaces to be cleaned and coated. System shall provide ventilation within the environmentally controlled areas to meet the following requirements:
 - a. Two air exchanges per hour, minimum,
 - b. Maintenance of personnel exposure limits (PEL) at 50 percent of OSHA PEL limits for all chemicals used in the performance of the work, and
 - c. Maintenance of lower explosive limits (LEL) to less than 50 percent of the most volatile solvent used in the performance of the work.
 3. Dehumidification equipment type, size, air flow, and power requirements shall be designed by a qualified company knowledgeable in dehumidification equipment, and its operation based on project requirements and anticipated seasonal weather conditions for the project schedule. Design to include evaluation of existing conditions, humidity, and temperature, proper air exchange requirements, ventilation requirements, ducting requirements for adequate air flow, and any other issues necessary to achieve the specified performance and environmental conditions throughout the duration of the project.
 4. Contractor to submit written recommendations from dehumidification subcontractor for enclosure work area size, bulkhead venting, duct work for each bulkhead section, any secondary ventilation requirements for coating cure, dust collection equipment CFM requirements, and drying requirements for blast hose compressed air necessary to maintain environmental control as specified herein.
 5. Dehumidification subcontractor shall either operate the equipment or provide training to Contractor on the proper operation and setup of dehumidification equipment. Dehumidification subcontractor shall provide a technical representative on site for a minimum of two 8-hour days to ensure proper operation of the

equipment, achievement of desired environmental control, and to insure Contractor can properly setup, operate, monitor, and maintain the equipment.

6. Dehumidification shall be operated in a manner that prevents all condensation or icing throughout surface preparation, coating application, and coating cure.
7. Reblasting of flash rusted metal surfaces or removal of damaged coatings, because of equipment malfunction, shutdown, or other events that result in the loss of environmental control, will be at the sole expense of the Contractor. Cleaned metal surfaces subject to flash rusting shall be cleaned to the same cleanliness as prior to the flash rust formation and shall be approved by the Engineer.
8. Contractor shall monitor ambient temperature, humidity, dew point temperature, and pipe surface temperature (work area only) both outdoors and within the work area at the start, midpoint, and end of each work shift, minimum, but not greater than 5 hours between measurements.
9. Daily environmental condition monitoring and maintenance of the equipment shall be documented in writing and provided to the Engineer.

3.2 SURFACE PREPARATION

A. General

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of coating manufacturer whose product is to be applied.
2. Visible oil, grease, dirt, and contamination shall be removed in accordance with SSPC-SP1, solvent cleaning.
3. Surface imperfections such as metal slivers, burrs, weld splatter, gouges, or delaminations in the metal shall be removed by filing or grinding prior to abrasive surface preparation.
4. Protect prepared pipe from humidity, moisture, and rain. All flash rust, imperfections, or contamination on cleaned pipe surface shall be removed by blasting.
5. Priming and coating of pipe shall be completed the same day as surface preparation.

B. Weld Surface Preparation

1. Requirements:
 - a. Spray applied coating systems do not require weld grinding.
 - b. Grind welds flush on extruded polyolefin coated pipe as specified herein.
 - c. Welds on tape wrap coated pipe shall be either ground flush or a weld stripe tape applied over the weld, at the pipe fabricator's option, unless otherwise specified.
2. Weld Grinding:
 - a. Under the weld grinding option, welds higher than 1/32 inch above pipe surface shall be ground to a tolerance of +1/32 inch to 0-inch above the pipe surface as measured on the lowest side of the weld.
3. Weld Stripe Tape:
 - a. Weld stripe tape will be applied to primed metal.
 - b. Tape will either have no polyethylene backing or will be double sided adhesive tape to permit adhesion of the inner corrosion protection layer to the weld stripe tape.

- c. Apply tape with a pressure roller to fully conform the tape to the weld surface.
- d. Adhesion of the weld stripe tape shall be as specified for the coating system.

C. Salt Contamination Removal

- 1. All bare or shop coated or primed surfaces that will be coated in the field shall be pressure washed with potable water not greater than 8 hours before coating application, including pipeline joints.
- 2. Residual soluble salt contamination (SSC) shall be tested as specified under Quality Control testing.
- 3. Surfaces to be Abrasive Blasted:
 - a. Surfaces that fail the soluble salt contamination test prior to abrasive blasting shall be cleaned by pressure washing and/or abrasive blasting and retested.
 - b. Surfaces that fail the SSC test after surface preparation shall be recleaned and/or abrasive blasting and retested.
 - c. Surfaces which still exceed the specified SSC level after recleaning shall be subject to determination by the Engineer if additional work will be required.
 - d. Contractor shall remove all surface rust caused by SSC testing in accordance with SP-11, Power Tool to Bare Metal or abrasive blasting to the specified cleanliness.
- 4. Existing or Shop Primed Surfaces:
 - a. All previously coated surfaces shall be tested for SCC prior to application of additional coats.
 - b. Surfaces exceeding the specified SSC level after pressure washing shall be subject to additional cleaning as determined by the Engineer.
 - c. Any coating applied before SCC testing is completed and accepted by the Engineer will be rejected and removed.

D. Steel Surface Preparation

- 1. Surface preparation of steel pipe shall be in accordance with SSPC surface preparation standards utilizing the degree of cleanliness specified for the coating system to be applied or as specified herein, whichever is more stringent.
- 2. Grit and/or shot abrasive mixture and gradation shall be as required to achieve the degree of cleanliness and coating adhesion specified.
- 3. Pipe cleaned by abrasive blasting with recyclable steel grit and/or shot or other abrasive shall be cleaned of debris and spent abrasive in an air wash separator.
- 4. Epoxy coated steel shall have a sharp angular surface profile of the minimum depth specified.
- 5. After abrasive blasting surfaces and before coating application, the metal surface shall be cleaned of residual dust to a minimum of Grade 2 per ISO Standard 8502-3, Test for the Assessment of Surface Cleanliness.
- 6. Work shall be performed in a manner that does not permit the cleaned metal surface to rust back or flash rust.
- 7. Rust back or flash rust shall be fully removed with the steel surface cleanliness equal to the metal surface cleanliness prior to rust back or flash rusting. Determination of the equivalent surface cleanliness shall be at the Engineer's sole discretion.

- E. Concrete Surface Preparation:
1. Cement Mortar or Concrete Cure:
 - a. Cement mortar linings shall be allowed to cure for a minimum of 15 days prior to surface preparation and coating application or 7 days with steam curing.
 - b. Concrete surfaces shall be cured 30 days.
 2. Preparation Requirements:
 - a. Remove grease, oil, dirt, salts or other chemicals, loose materials or other foreign matter by solvent, detergent, or other suitable cleaning methods.
 - b. Clean concrete using mechanical or chemical methods for the degree of cleaning specified for the coating system in accordance with SSPC SP-13, Surface preparation of Concrete.
 - c. Abrasive blast to remove all laitance and provide a surface profile equivalent to 80 grit sandpaper.
 - d. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to coating.
 3. Inspection:
 - a. Concrete Soundness: Determined using scratching or hammer impact methods as defined in SSPC SP-13.
 - b. Moisture Content: Moisture shall be tested as Specified in SSPC SP-13 and shall not exceed the moisture content recommended by the coating manufacturer.

3.3 SHOP -APPLIED COATING APPLICATION

- A. Tape Wrap Coating
1. Applicator shall provide a monitoring system approved by the tape manufacturer that constantly records pipe and tape conditions during coating application. Recorded monitoring parameters shall include, but not be limited too, pipe temperature; line speed, primer and tape roll body temperature, and tape tension.
 2. Pipe surface temperature shall be between 45 and 120 degrees and 5 degrees above dew point, whichever is greater.
 3. Tape roll temperature shall be in accordance with the manufacturer's recommendations, but shall not be less than 55 degrees for the inner wrap and 65 degrees for the outer wraps.
 4. Apply a uniform coat of primer as recommended by the manufacturer without skips, runs, or sags. Allow to properly dry prior to applying the tape as required by the tape manufacturer and as necessary to achieve maximum tape adhesion. Rug type application will not be allowed.
 5. If welds are not ground flush, apply a weld stripe tape to longitudinal or spiral pipe welds prior to application of the inner wrap.
 6. Tape layers shall be applied continuously with the use of hydro-tension tape stands. Tension shall be maintained between the manufacturer's minimum and maximum tension recommendations or as required to achieve approximately 2.0 percent reduction in tape width.
 7. Inner tape wrap shall adhere tightly to the pipe surface. Coating shall be 100 percent adhering to the metal surface and shall not have any visible damage, wrinkles, voids, disbondment, contamination, or holidays.

8. Tape coating adhesion testing shall be performed on the pipe as specified this section.
9. Holidays testing shall be conducted on the inner layer tape prior to proceeding with subsequent tape layers. All holidays detected shall be primed and patch using coating repair procedures specified herein.
10. Perform coating and lining repairs as specified in this section.

B. Plural Component Epoxy Coating

1. Applicator Qualifications:
 - a. Equipment will be certified by the coating manufacturer to meet the requirements for material mixing, temperature control, application rate, and ratio control for multi-part coatings.
 - b. Equipment not meeting the written requirements of the coating manufacturer shall be rejected for coating application until repairs or replacement of the equipment is made to the satisfaction of the Engineer.
 - c. Personnel responsible for the application of the coating system shall have certification of attendance at the coating manufacturer's training class within the last three years. The certified applicator shall be present during all coating application work and shall have responsibility for controlling all aspects of the coating application.
2. Pipe surface temperature shall be between 50 and 100 degrees or 5 degrees above dew point, whichever is greater.
3. Coating application shall be performed in an environmentally controlled shop area that meets or exceeds the written environmental application requirements of the coating manufacturer. Application in outdoor conditions will not be acceptable without adequate environmental shelter, environmental controls, and/or dehumidification.
4. Coating adhesion and holidays testing shall be tested as specified this section except adhesion testing is not required on overcoated CCP.
5. Coating manufacturer shall provide to the Engineer a copy of the manufacturer's coating application quality assurance manual prior to beginning coating application. Strict conformance to the requirements of the manual will be required. Deviation from the requirements of the manual will be grounds for the Engineer to reject the applied coating.
6. Unacceptable Coating Application
 - a. Coating applied under improper environmental conditions will be rejected.
 - b. Pipes that exceed the allowable quantity of coating defects, regardless of size or cause, shall be rejected.
 - c. Coating which fails the adhesion or holiday testing as specified this section shall be rejected.
 - d. Pipe coating that is subject to off ratio application, blistering, or is not applied in conformance with the coating manufacturer's written instructions or recommendations shall be rejected.
7. Rejected coating shall be removed from the full length of the pipe to bare metal and reapplied using proper application methods in accordance with the coating manufacturer's written instruction and the requirements of these specifications.
8. Perform coating and lining repairs as specified in this section.

C. Cement Mortar Coatings

1. Steel pipe shall have a cement mortar coating applied in accordance with AWWA C205, except as modified herein.
2. Tape wrap coated steel pipe shall have a cement mortar overcoat applied over the tape wrap or epoxy coating in accordance with AWWA C205, except as modified herein.
3. Cement Mortar Coating:
 - a. Reinforcement:
 - 1) For pipe and specials smaller than 48 inches in diameter, reinforce coating with spirally-wound No. 12 gage steel wire spaced at 1-inch centers or with No. 14 gage steel wire at 1/2-inch centers positioned approximately in center of mortar coating.
 - 2) For pipe and specials 48 inches in diameter and larger, reinforce coating with 2 layers of spirally-wound No. 12 gage wire spaced at 1-inch centers or with No. 14 gage steel wire spaced at 1/2-inch centers positioned at the third points of mortar coating.
 - 3) Lap ends of reinforcement strips 4 inches and tie or loop free ends to assure continuity of reinforcement.
 - 4) All steel wire reinforcement placed in the mortar coating shall be electrically isolated from the pipe. Electrical isolation will be tested using high voltage spark test by the manufacturer prior to shipment to the project site. Provide certification that electrical isolation of reinforcement wire from steel pipe.
 - b. Special Fittings:
 - 1) Coating for steel plate specials may be reinforced with 2-inch by 4-inch No. 13 gage welded wire mesh in lieu of reinforcing specified above.
 - 2) One layer of mesh shall be positioned approximately in center of coating for specials smaller than 48 inches in diameter; 2 layers of mesh shall be positioned at the third points of coating for specials 48 inches in diameter and larger.
 - c. Coating Defects:
 - 1) Coating defects shall be repaired as specified in AWWA C205, except as specified this section.
4. Cement Mortar Overcoat:
 - a. Cement mortar overcoat tape wrapped coated steel pipe as specified in AWWA C205, except mortar coating shall be applied over exterior pipe coating.
 - b. Mortar coating shall be held back 3 inches, minimum, behind dielectric coating system cut back at joints.
 - c. Cement mortar overcoat holdback shall be increased with extruded polyethylene coating as required to for coating shrinkage and as required to maintain the minimum overlap specified for joint coating application.
 - d. Coating Defects:
 - 1) Cracking in the mortar "armor" coat less than 1/8-inch in width will be acceptable.
 - 2) Disbondment of the cement coating over a dielectric coating system should be anticipated and will not be grounds for repair or rejection of the pipe.

- 3) Losses of cement mortar coating due to impact, movement, or shipping damage shall be repaired in accordance with C205.
- e. Joint Coating:
 - 1) Joints of cement mortar overcoat dielectrically coated pipe do not require field application of cement mortar overcoat when properly coated with heat shrink sleeve joint coating system.

3.4 SHOP-APPLIED LINING APPLICATION

A. Shop-applied Cement Mortar Lining:

- 1. Place mortar lining used in steel piping and steel plate specials in pipe to thickness below.

Pipe Diameter, Inches	Lining Thickness, Inches	Tolerances, Inches
4 through 10	3/8	-1/16, +1/8
11 through 24	5/16	-1/16, +1/8
24 through 36	3/8	-1/16, +1/8
Greater than 36	1/2	-1/16, +3/16

- 2. Centrifugally line straight sections of pipe. Lining of special pieces or fittings shall be by mechanical, pneumatic, or hand placement. Provide cement mortar lining of uniform thickness. Finish to a smooth dense surface.
 - a. Steel plate specials larger than 16 inches in diameter shall have lining reinforced with 2-inch by 4-inch No. 13-gage welded steel wire mesh.
 - b. Brace and support pipe during lining application to minimize pipe distortion or vibration. Bracing and supports shall not damage the pipe, coating, or lining.
 - c. Tightly close ends of pipe and fittings with plastic sheet caps. Plastic end caps shall be of sufficient thickness and strength to resist shipping, handling, and storage stresses.
 - d. Damage to the cement mortar lining, including disbondment, cracking, or blistering, caused by improper curing, shipping, handling, or installation shall be repaired in accordance with AWWA specifications and to the satisfaction of the Engineer.
- 3. Other requirements of mortar lining materials and processes: As specified in AWWA C205.

B. Liquid Epoxy Lining:

- 1. Pipe Lining, Direct to Metal
 - a. Where epoxy lining on steel pipe is specified or shown on drawings or where the pipe is not cement mortar lined, an epoxy lining shall be applied directly to the steel surface as specified in Section 09 90 00, Protective Coatings and Linings.
 - b. Immersion System specified in Section 09 90 00, shall be modified to three coats, minimum, at a total coating thickness of 20 mils dry film thickness.

2. Pipe Lining, Insulating Joints:
 - a. Coating applied over cement mortar lining shall be applied in a manner that will minimize gassing and pinholes in the completed lining.
 - b. Clean and coat the interior of cement mortar lined pipe at insulating joints with two coats of epoxy coating.
 - c. Epoxy coating applied at insulating joints shall be applied to both sides of the insulating joint for a minimum of one pipe diameter. If only one side of the joint can be coated the coating shall be applied for a minimum of two pipe diameters.
 - d. Mortar lining shall be allowed to cure 15 days or steam cured not less than 7 days prior to surface preparation of the mortar and epoxy coating application. Hand applied mortar lining shall be allowed to cure a minimum of 15 days or as required to meet the coating manufacturer's requirements for application on cement or concrete, whichever is greater.
 - e. Prepared mortar lining by abrasive blasting to remove all laitance and create a suitable anchor profile
 - f. Mortar lining shall be dry during epoxy lining application.

3.5 COATING AND LINING HOLDBACK

- A. All coating and lining holdback areas shall be prepared as specified for the pipeline coating and protected from corrosion during storage and installation with a specified holdback coating system.
- B. Internal holdback for cement mortar lined pipe shall be left unprepared and unprimed.
- C. Internal holdbacks for dielectrically lined pipe shall be left bare and prepared and lined in the field as specified for field lining of joints after joint assembly.
- D. External holdbacks shall be as listed below with all dimensions based on end of bell or spigot. Pipe manufacturer may adjust holdback limits as required for special joint assemblies, and with consideration for the joint coating provided and joint welding requirements. All dimensions from end of pipe.

Tape wrap coating	
Push-on joint, spigot	1-inch, minimum after centerline of gasket.
Push-on, bell	Flush with bell end
Welded, spigot	1 inches, minimum
Welded, Bell	Stab Depth + 2-inches, minimum
Epoxy coating	
Push-on joint, spigot	1-inch after centerline of gasket
Push-on, bell	Flush with bell end
Welded, spigot	3 inches, minimum

Welded, Bell	Stab Depth + 2-inches, minimum
Extruded polyolefin	
Welded joints, spigot	3-inch Minimum
Welded joints, Bell	Stab Depth + 2-inches, Minimum
Push-on joints	Not applied to bell or spigot

- E. Coating holdbacks shall be straight and cut through the full thickness of the coating.
- F. Cutbacks shall be completed in a manner that permits field coating of joints in accordance with the manufacturer's recommendations and as specified herein.

3.6 FIELD COATING JOINTS

A. General:

1. Joint bonds shall be installed before application of joint coating as specified in Section 13 11 40, Corrosion Monitoring System.
2. Joint bonds shall be low profile bonds and all gaps and crevices around the bonds shall be filled with filler mastic.
3. Filler mastic shall be placed under copper strap bonds and extended ½ inch minimum beyond edges of bond to allow for sealing with heat shrink sleeve.
4. Contractor to electrically test completed joint coating for holidays with high voltage spark tester at Engineer's direction or if damage to the joint coating occurs.

B. Field Surface Preparation:

1. Pipe joints with hold back corrosion protection:
 - a. Perform salt contamination removal as specified under Surface Preparation.
 - b. Field prepare joint in accordance with SSPC-SP1, solvent cleaning, and SP3, Power tool cleaning, to remove all dirt, mud, oil, and grease prior to application of heat shrink sleeve.
 - c. Any visible rusting areas shall be spot prepared in accordance with SP-11, power tool to bare metal.
2. Pipe joints without hold back corrosion protection:
 - a. Perform salt contamination removal as specified under Surface Preparation.
 - b. Abrasively blast joint in field in accordance with SSPC-SP5, white metal blast.
 - c. Sweep blast epoxy coating for 2-inches for 80-grit sandpaper equivalent profile for coating adhesion.
3. All loose or damage coating shall be removed and repaired per specified coating repair procedures.

C. Weld After Backfill' Joint Requirements:

1. Post-welded or 'Weld after Backfill' joints are defined as welded pipe joints that have been coated and backfilled prior to completing interior welds.
2. Post welded joints shall be coated and protected as follows:
 - a. Joint coating shall be heat shrink joint sleeves only with a minimum coating thickness over the weld heat affected zone of not less than 120 mils before welding. Tape wrapped joints or heat resistant tape will not be acceptable.

- b. Manufacturer's recommendations for heat shrink sleeves selection and application and this specification shall govern WAB joints. If a conflict occurs, the more stringent requirement shall apply.
 - c. Hold back primer shall be suitable for post weld conditions as specified this section and shall not exhibit any binder breakdown in the heat affected zone that causes loss of joint coating adhesion to the holdback primer.
 - d. Filler mastic materials shall be high temperature material with 500 degree F melting point.
 - e. Joints shall be fully buried prior to welding, with not less than 12-inch soil cover or flowable fill material on all sides. Sand or flowable fill backfill is preferred for weld after backfill joints. Crush rock or angular gravel backfill can be detrimental to the heat shrink sleeve when using WAB procedures.
 - f. Heat shrink sleeves after WAB shall exhibit no holidays, burn through of coating, creasing, carbonization of the sleeve adhesive, or disbondment of the sleeve or holdback primer.
3. Welding of the joints shall be in conformance with Section 33 11 11, Steel Pipe, and as modified herein:
- a. All welding shall be with two or more weld passes as required to meet the specified AWS qualified welding procedures and maximum coating temperature limitations. 'Weld after Backfill' procedures on wall thicknesses of ¼ inch or less must be approved by the Engineer based on field testing demonstrating the welding procedures can comply with the requirements of this specification.
 - b. Welding speed, amperage, and voltage shall be as required to maintain a maximum heat input of 23,000 joules or a maximum surface temperature at the coating/steel interface of 750 degrees F, whichever is least.
 - c. Maximum weld temperature and duration shall not result in carbonization of the joint coating adhesive. Carbonization is defined as the loss of volatile organic compounds that result in loss of tackiness, adhesion to the steel, and corrosion protection properties.
 - d. Finished joint coating shall not have any visual creases or folds in the joint coating backing material that extends through both the inner protective layer and outer joint sleeve.
4. If Contractor elects to post-weld any joints, Contractor shall demonstrate that the joint welding procedures will not significantly damage the coating by fully excavating the first two joints for evaluation of the joint coating condition. Engineer will randomly select up to three additional post-welded joints for excavation by Contractor for evaluation of joint coating condition. Joint coating will be destructively evaluated by the Engineer. Contractor will remove and replace joint heat shrink sleeve upon completion of the evaluation.
5. If any excavated post welded joint exhibits any heat related damage as defined herein, Contractor shall modify and test a new post welding procedure prior to completing any additional post-welded joints. Contractor shall demonstrate that the revised joint welding procedure will not significantly damage the coating by repeating the weld after backfill evaluation requirements defined this Section, including excavation of the three additional randomly selected joints for destructive evaluation.

D. Heat Shrink Sleeve Joint Coating:

1. Store, handle, and apply field heat shrink sleeve coatings in accordance with AWWA C216 and these specifications.
2. Store sleeves in shipping box until use is required. Keep dry and sheltered from exposure to direct sunlight. Store off the ground or concrete floors and maintain at a temperature between 60 and 100 degrees as recommended by the sleeve manufacturer.
3. Joint shall be prepared as specified in Pipe Joint Surface Preparation.
4. Preheat pipe uniformly as recommended by the sleeve manufacturer. Monitor pipe temperature using a surface temperature gauge, infrared thermometer, or color changing crayons. Protect preheated pipe from rain, snow, frost, or moisture with tenting or shields and do not permit the joint to cool.
5. Apply filler material as specified in Field Applied Coating Systems.
6. Apply heat shrink sleeve when sleeve has a minimum temperature of 60 degrees and while maintaining the pipe temperature above the preheat temperature specified. Apply sleeve in accordance with the manufacturer's instructions and center the sleeve over the joint to provide a minimum 2-inch overlap onto the existing pipe coating.
7. Acceptable joint sleeve installations shall meet the following requirements:
 - a. Shall be fully bonded to the pipe and existing coating surface without tenting or voids.
 - b. Mastic beading shall be visible along the full circumference of the sleeve.
 - c. There shall be no wrinkling or excessive burns on the sleeves.
8. Sleeves that do not meet these requirements shall be removed and the joint recoated as directed by the Engineer. Minor repairs may be repaired using heat applied patch material specified for minor coating repairs.
9. Allow the sleeve to cool before backfilling. Water quenching will be allowed if permitted by the sleeve manufacturer.
10. Heat shrink joint coatings which have become wrinkled or disbonded because of prolonged exposure to UV light or thermal cycling shall be removed and replaced.
11. Double coating of defective or damaged heat shrink coatings will not be permitted. Any double coated heat shrink sleeves shall be immediately rejected and Contractor shall remove the existing coating and recoat the joint.

E. Cement Mortar Overcoat Coating:

1. Joints of cement mortar coated pipe shall be cement mortar coated in accordance with AWWA C205.
2. Polyethylene Foam Joint Diapers:
 - a. Cut into strips wide enough to match uncoated field joint area.
 - b. Slit to thickness of 1/4 inch that will expose a hollow or open cell surface on one side.
 - c. Foam liner shall be attached to fabric backing with open or hollow cells facing towards pipe.
 - d. Foam strip shall cover full interior circumference of grout band with sufficient length to permit 8-inch overlap of foam at or near top of joint.
 - e. Splices to provide continuity of material will be permitted.
 - f. Protect polyethylene foam material from direct sunlight.
3. Field repair cement mortar coating in accordance with AWWA C205.

3.7 FIELD APPLIED INTERIOR JOINT LINING

- A. Mortar Lining:
1. After backfilling pipe, interior joint recess shall be filled with grout.
 2. The grout shall be tightly packed into the joint recess and troweled flush with the interior surface. Excess material shall be removed from pipe.
 3. At no point shall there be an indentation or projection of the mortar exceeding 1/16-inch.
 4. On pipe smaller than 24-inches in diameter, bell shall be daubed with grout before the spigot is inserted into the bell. The joint shall be completed and excess mortar on the inside of the joint shall be swabbed.

3.8 REPAIR OF COATING AND LININGS

- A. General:
1. All areas where holidays are detected or coating is visually damaged, such as blisters, tears, rips, bubbles, wrinkles, cuts, or other defects, shall be repaired. Areas where no holidays are detected, but are visually damaged shall also be repaired.
 2. Maximum defects allowable shall be as specified herein for the coating system.
- B. Tape Wrap Coating Repairs:
1. General:
 - a. No more than five repairs per joint of pipe will be permitted with tape wrap coating, excluding adhesion test damage. The coating on any pipe with more than five coating repairs or with more than two areas of coating damage greater than five square feet will be rejected.
 - b. Pipes exceeding the maximum number or size of coating defects shall be stripped, reblasted, and recoated.
 - c. Pipe arriving in the field with defects or repairs exceeding the maximum number or size of coating defects will be returned to the shop for recoating at the Contractor's expense.
 - d. The number of layers and total thickness of the tape repair coating shall be the same as the shop-applied coating; unless heat applied coating materials is used.
 - e. Wipe the area to be repaired with solvent for a minimum distance of 4 inches outside the damaged area.
 2. Defect Size:
 - a. Minor repairs - repairs that are less than 8 inches in the greatest dimension, measured after cutout of damaged tape layers. Damage to the inner tape layer will be considered minor only if repairs are made using heat applied patch materials.
 - b. Major repairs - repairs that exceed 8-inches in the greatest dimension or where damage to the inner tape layer has occurred and hand applied tape repairs will be used.
 3. Minor Repairs:
 - a. Complete minor repairs using a heat applied coating patch material.
 - b. Cut patch material to overlap onto the undamaged coating a minimum of 2 inches on all sides with 1-inch radius on each corner of the patch.
 - c. Carefully remove damaged layers by cutting the coating with a sharp knife without cutting or damaging the inner wrap.

- d. Cut middle and outer layers in stepped fashion to expose 1-inch or more of the underlying tape layer for the circumference of the repair.
 - 4. Major Repairs (Over 24-inches Diameter):
 - a. Cigarette wrap coating repairs shall be with heat shrink sleeves as specified for joints.
 - b. Carefully remove damaged layers by cutting the coating with a sharp knife without cutting or damaging the inner wrap.
 - c. Holiday test the inner wrap and if a holiday is detected cut outer layers back to fully exposed the holiday(s) and retest for holidays.
 - d. Cut middle and outer layers in stepped fashion to expose 1-inch or more of the underlying tape layer for the circumference of the repair.
 - e. Width of sleeve shall be the width of the damaged area plus 4-inch overlap. Multiple sleeves may be used for larger repairs, but must be overlapped a minimum of 2 inches.
 - 5. Major Repairs (24-inch Diameter or Less)
 - a. Cigarette wrap repairs on pipe less than 24-inches with either hand applied tape wrap or heat shrink sleeves as specified at the Contractor's option.
 - b. Carefully remove damaged layers by cutting the coating with a sharp knife without cutting or damaging the inner wrap.
 - c. Holiday test the inner wrap and if a holiday is detected apply one extra layer of repair tape.
 - d. Clean surfaces by solvent wiping and applying primer over the inner tape layer for a minimum of 6-inches onto the outer wrap in all directions.
 - e. Apply first layer of repair coating, over lapping 1-inch or more onto undamaged coating in all directions. On larger areas, lap the repair tape within a minimum of 1-inch overlap, offsetting the overlap from the previous layer overlap, until the area is properly covered.
 - f. Repeat for each tape layer damaged with each succeeding layer applied at 90 degrees to the preceding layers and overlapping onto the undamaged coating a minimum of 2-inches.
 - g. Apply the last tape layer, use the cigarette wrap method for the full pipeline circumference covering all previous repair layers and overlapping a minimum of 2-inches onto undamaged coating. The ends of the cigarette wrap shall be pointed downward.
- C. Epoxy Coating or Lining Repairs
- 1. General
 - a. Complete coating or lining repairs in accordance with the coating manufacturers written instructions and these specifications, whichever is stricter.
 - 2. Defect Size:
 - a. Minor repairs - repairs that are less than 8-inches in the greatest dimension.
 - b. Major repairs - repairs that exceed 8-inches in the greatest dimension.
 - 3. Maximum Quantity of Defects Allowed:
 - a. Coating or lining repairs on any joint of pipe shall not exceed 1.5 per 100 square feet of surface area.
 - 1) Two or more minor repairs within a 8-inches diameter circle will be considered a single repair.

- 2) Repairs for adhesion testing will not be included in the total number of repairs.
 - b. Major repairs shall not exceed three per pipe joint and the combined area shall not be greater than 30 percent of the pipe.
 - c. Pipes exceeding the maximum number or size of coating defects shall be stripped of coating, reblasted, and recoated.
 - d. Pipe arriving in the field with defects or repairs exceeding the maximum number or size of coating defects will be returned to the shop for recoating at the contractor's expense.
4. Minor Repairs:
- a. Minor repairs
 - 1) Surface Preparation: Clean and feather the defect by power tool sanding with 80 grit or coarser sandpaper to roughen the existing coat and feather the edges of the defect for a minimum of 2-inches around the defect.
 - 2) Shop repair Materials:
 - a) Single use coating kits to match the pipe coating.
 - b) Two component, fast cure epoxy coating, in controlled mix ratio packaging.
 - (1) Protal 7125, North American Denso Inc, or equal
 - (2) Or equal.
 - c) Coating Manufacturer's coating repair products are subject to Engineer approval.
 - 3) Field Repair Materials:
 - a) Heat applied coating materials; CRP Patch, Canusa; PERP Patch, Tyco Adhesives, or approved equal.
 - b) Two component, fast cure epoxy coating, in controlled mix ratio packaging.
 - (1) Protal 7125, North American Denso, Inc,
 - (2) Or equal.
 - c) Single use coating kits to match pipe coating.
 - d) Coating Manufacturer's coating repair products are subject to Engineer approval.
 - 4) Clean and feather the defect by power tool sanding with 80 grit or coarser sandpaper to roughen the existing coating and feather defect edges minimum of 2-inches.
 - 5) Apply a single coat of the specified patch coating material at the specified coating thickness.
 - 6) Repair coating adhesion shall be 50 percent of the specified coating adhesion.
5. Major Repairs:
- a. Major repairs:
 - 1) Surface Preparation:
 - a) The metal surface and surrounding coating shall be abrasively blasted in accordance with SSPC-SP10, near white metal, or to equal in cleanliness and profile as the original surface preparation.
 - b) Existing coating shall be feathered and roughened to the equivalent of 40 grit sandpaper.

- 2) Shop Repair Materials:
 - a) Same material as the pipeline coating or lining and shall be applied by using plural component spray equipment.
- 3) Field Repair Materials:
 - a) Same material as the pipeline coating or lining and shall be applied by using plural component spray equipment.
 - b) Heat shrink sleeves as specified for pipeline joints.
- b. One coat of the specified original coating material shall be applied over the repaired surface at the specified thickness.
- c. Repair adhesion shall be equal to the specified coating adhesion.

D. Cement Mortar Coating

- 1. Cement mortar coating that is cracked or disbonded shall be repaired in accordance with AWWA C205, except for mortar overcoat on tape wrapped steel.
- 2. Disbonded mortar coating shall be removed and patched.
- 3. Mortar coating with disbondment greater than 25 percent of the pipe surface shall be rejected and recoated.
- 4. Cracks in mortar coating shall be repaired in accordance with AWWA C205.

3.9 QUALITY CONTROL TESTING AND INSPECTION

A. General

- 1. Applicator shall inspect and test the coating system in accordance with referenced standards and these specifications, whichever is more stringent.
- 2. Quality control testing as specified in AWWA standards are minimum industry standards and it is the intent of this specification to provide a higher level of quality control for the objective of achieving maximum coating performance. If any conflict between this specification and referenced standards occurs, the more stringent requirement shall apply and any interpretation of this requirement or results shall be with the objective of achieving maximum coating performance.
- 3. The frequency of the testing shall be determined by the applicator, but shall not be less than the requirements of this specification.

B. Soluble Salt Contamination (SSC) Testing

- 1. Residual soluble salt contamination (SSC) shall be verified using an Elcometer Model E130-TC Salt Contamination Meter before and after surface preparation.
- 2. Testing after blasting is not required if the preblast test passes the maximum soluble salt contamination criteria.
- 3. Maximum soluble salt contamination levels shall be:
 - a. 2.0 $\mu\text{g}/\text{cm}^2$ – Immersion or buried
 - b. 5.0 $\mu\text{g}/\text{cm}^2$ – non-immersion
- 4. Compliance with SSC limits shall be based on the average of three tests at three locations, which can be on multiple pipes or components at the Engineer's discretion.

C. Surface Profile Testing

- 1. Surface profile of abrasive blasted surfaces to be tested with "Press-O-Film" tester tape or equivalent in accordance with NACE RP287.
- 2. Tester tape shall be suitable for the intended profile height.

3. Profile shall be measured to a minimum tolerance of 0.1 mils, maximum.
4. Electronic surface profilometer shall be used, where deemed necessary, to verify tester tape measurements.

D. Adhesion Testing

1. General

- a. Adhesion testing shall be conducted at the shop prior to shipment. Pipe shipped without adhesion testing will be field-tested. Pipe rejected in the field will be returned to the shop for repair at the sole expense of the Contractor.
- b. Coating adhesion testing shall be conducted on each pipe lot coated. The quantity of coating adhesion tests shall be the greater of the following:
 - 1) Two pipes will be tested for the first 3,000 square feet of coating application plus one additional pipe for each increment of 2,000 square feet of coating application in excess of the first 3,000 square feet.
 - 2) Not less than 33 percent of each pipe produced within a lot.
- c. A pipe lot is defined as the quantity of pipe that is coated by a single crew within a 12 hour or less work shift.
- d. The pipe coating applicator shall repair all coating damage from shop adhesion testing. Contractor shall be responsible for coating repairs for all field adhesion testing.
- e. Adhesion tests will be performed not less than 24 hours after coating application. Tests conducted prior to 24-hours will be acceptable only if the test meets or exceeds the adhesion criteria specified and the test was requested by the pipe fabricator.
- f. Pipe will be randomly selected for adhesion testing.
- g. Owner or the Owner's Representative has the right to conduct additional adhesion testing as deemed necessary to assure the pipe meets or exceeds the requirements of this specification at any time and location.
- h. Prior to beginning any QA/QC testing, the pipe fabricator, coating manufacturer, and Engineer shall review dolly attachment procedures, adhesion test procedures, and data recording requirements for the project and ensure that test personnel are qualified and capable of performing the testing in accordance with required test standards and these specifications.

2. Rejection of Pipeline Coating or Lining

- a. Each pipe that fails the adhesion criteria, as defined this section, shall be rejected.
- b. If any pipe within a lot that fails to meet the adhesion criteria specified for the coating type, the pipe coating will be rejected and all pipes within the lot will be classified as rejected. Each remaining pipe within the rejected pipe lot will then be individually tested and rejected on a pipe-by-pipe basis in conformance with the test procedures and criteria specific to the coating type.
- c. All rejected pipe shall have the coating fully removed from the pipe and the pipe abrasive blasted and recoated.

3. Tape Coating Adhesion Testing:

- a. Adhesion Acceptance Criteria:

- 1) Inner tape coating shall have an adhesion to substrate of 20 pounds per inch width, minimum, for steel pipe when tape is pulled in a continuous manner at an angle of 180 degrees to the pipe surface.
 - 2) Inner tape coating shall have an adhesion to substrate of 15 pounds per inch width, minimum, for ductile iron pipe when tape is pulled in a continuous manner at an angle of 180 degrees to the pipe surface.
 - 3) extruded polyolefin coating shall have an adhesion to substrate of 30 pounds per inch width, minimum, when coating is pulled in a continuous manner at an angle of 180 degrees to the pipe surface. Adhesion testing for extruded polyolefin shall be performed as specified for tape wrap coating.
- b. Test Procedures
- 1) Adhesion testing shall be conducted prior to application of the cement mortar overcoat, where applicable. Pipe that has been mortar coated prior to adhesion testing shall have the mortar coating removed by the Contractor as directed by the Engineer and of sufficient dimensional area to permit the adhesion test to be conducted.
 - 2) Adhesion tests shall be conducted at temperatures above 60 degrees and less than 75 degrees.
 - 3) Pulling tension shall be continuous, without stopping, and monitored throughout the length of the pull, which shall be not less than 12-inches in length.
 - 4) Adhesion test shall be prepared by making two parallel cuts through the coating, 1-inch apart, of sufficient length for the test pull. Peel the coating back at one end and attach the tension scale to the coating with a suitable clamp. Mark the coating at one (1) inch increments from 0 to 12-inches.
 - 5) The pull tension shall be recorded for each inch of pull. The two highest and two lowest readings shall be discarded and the remaining values averaged. Pull speed shall be not less than 5 seconds per inch or greater than 10 seconds per inch. If significant elongation of the tape backing occurs, pull speeds may exceed 10 seconds per inch provided the minimum adhesion rating can still be achieved.
- c. Adhesion Pull Records and Evaluation
- 1) Failure shall be by cohesive failure of the adhesive only. Delamination failure, defined as separation of the adhesive from the backing material, will result in rejection of the tape lot.
 - 2) Intermittent skip failures will be counted as zero pounds of adhesion and included in the calculations for average coating adhesion.
 - 3) Adhesive failure, defined as separation of the adhesive from the metal substrate, will be rejected.
 - 4) Pipe that fails the test by delamination will be retested on two other pipes within the same lot of coated pipe. Failure of any two pipes within the lot will result in rejection of all pipes coated with the rejected tape lot.
4. Plural Component Epoxy Adhesion Testing:

- a. Adhesion testing shall be performed in accordance with this specification section. Adhesion testing procedures and evaluations per AWWA C210 or C222 are specifically excluded under this specification.
- b. Test Procedures
 - 1) Coating adhesion testing shall be with self-aligning pneumatic pull off equipment, such as the Delfesko Positest AT-A, and test procedures in accordance with ASTM D4541, except as modified in this section.
 - a) All adhesion tests shall be performed at an applied load rate of 100 psi per second, plus or minus 10 psi. Automatic adhesion test equipment shall be used.
 - b) Tests shall be performed to coating or glue failure or maximum test load, whichever is greater.
 - c) Adhesion tests shall be based on the ASTM D4541 using standard 20 mm dollies.
 - d) Adhesion testing shall be based on three tests. All three tests shall be conducted by the same person, test equipment, and test procedure, and must be completed within a 30 minute period.
 - e) All adhesion tests shall be conducted within an area not to exceed 6-inches by 6-inches.
 - f) All coatings with more than 10 percent elongation or 25 mils thick shall be scored around dolly to metal substrate using manual methods and tools, normal to the pipe surface, and in a manner that does not stress or over heat the coating.
 - g) All adhesion tests shall be performed to coating or glue failure or test termination, whichever comes first.
 - 2) Dollies for adhesion testing shall attached to the coating surface using an two part epoxy or cyanoacrylate glue and allowed to cure for a minimum of 12 hours before testing or until full cure, whichever is greater. Glue type used shall be determined by the pipe fabricator and coating manufacturer for the pipe diameter, temperatures, and environmental conditions.
 - 3) Adhesion testing shall be performed at temperatures between 55 and 90 degrees F or at temperatures as recommended by the coating manufacturer. Testing up to 115 degrees F or below 55 degrees will be permitted if tests can demonstrate no statistically detectable effect on test results and with coating manufacturer and Engineer approval.
- c. Epoxy Coating and Lining Adhesion Criteria
 - 1) Coating is acceptable if first dolly pull test exceeds 1,750 psi, minimum.
 - 2) If first dolly pull is less than 1,750 psi, two additional tests shall be performed with acceptance based on "Best of Three" evaluation method as defined herein.
- d. Pipe Lot Performance Criteria:
 - 1) Each lot of coated pipe shall be evaluated for general coating application based on a median value for all coating or lining

adhesion tests performed on a lot of pipe, which shall be greater than 2,000 psi.

- 2) Any pipe lot failing the Pipe Lot Performance Criteria shall be classified as rejected until 100 percent of the pipe within the pipe lot has been tested for adhesion. Each pipe that fails the coating adhesion criteria shall be rejected.

e. Adhesion Test Evaluation and Records

- 1) The "Best of three" evaluation method shall be defined as two of three test values less than the Acceptance Criteria, which shall result in rejection of the pipe coating.
- 2) All adhesion tests shall be considered as valid and suitable for acceptance or rejection of the coating, except where retesting is allowed.
- 3) Adhesion test failure shall be by adhesive or substrate and cohesive failure as defined below:
 - a) Adhesive or substrate failure is defined as a percentage of separation of the coating from the steel substrate or between distinct coating layers.
 - b) Cohesive failure is defined as a percentage of failure within the coating, resulting in coating remaining both on the steel substrate and test dolly.
- 4) Retesting of coating adhesion tests will be allowed when any test is glue failure at 25 percent or more of dolly surface area and the test value is less than the Acceptance Criteria or the Minimum Criteria.
- 5) All coating adhesion retesting shall be within the same 6-inch by 6-inch test area as the original adhesion testing.
- 6) Disputed adhesion tests shall be retested as defined for adhesion retesting. Dolly attachment and adhesion retesting shall be witnessed by the Owner's representative.
- 7) Adhesion tests will be conducted on pipe coating and lining independently and will be accepted or rejected independently.
- 8) Records of all adhesion tests shall be maintained in an electronic spreadsheet that includes the following information:
 - a) Pipe identification,
 - b) Pipe coating date,
 - c) Adhesion test date,
 - d) Surface tested (interior or exterior),
 - e) Surface temperature at time of test,
 - f) Coating thickness,
 - g) tensile force applied,
 - h) Applied load rate per second,
 - i) Mode of failure, and
 - j) Percentage of failure types, previously defined, relative to dolly surface area,
 - k) Dolly size and attachment glue used.
 - l) If different coatings are tested, the records shall include coating manufacturer and product number.

f. Adhesion Test Repairs

- 1) Fabricator or contractor to complete adhesion repairs as specified this section.
- 2) Repair patches on epoxy coating shall be randomly selected for adhesion testing in a manner as described herein and at the discretion of the coating inspector conducting the adhesion tests. Adhesion of repairs shall be as specified for the type of repair.

E. Holiday Testing

1. Holiday test the inner layer of tape wrap coatings after application and prior to subsequent tape layer in accordance with AWWA C214 and NACE RP-0274.
2. Holiday test extruded polyolefin coating after application in accordance with AWWA C215 and NACE Standard RP-0274, whichever is more stringent.
3. Holiday tests on epoxy coatings or linings over 15 mils DFT shall be conducted on the completed coating or lining after cure or 24-hours, whichever is less, using a high voltage spark test in accordance with NACE SP0274 and these specifications.
4. Holiday testing on epoxy coatings or linings less than 15 mils DFT shall be high voltage spark tested in accordance with NACE SP0188, except as modified herein.
5. High voltage setting shall be the average measured coating thickness in mils times 125 volts, minimum.
6. Wet sponge or low voltage holiday testing will not be permitted.

F. Dry Film Thickness Testing

1. Coatings shall be tested for dry film thickness using a properly calibrated magnetic pull off, eddy current, or ultrasonic equipment.
2. Coating thickness measurements shall be conducted as necessary and without limitation. Testing conformance to the requirements of SSPC PA-2 is specifically excluded from this specification.

3.10 HANDLING, TRANSPORTATION, AND STORAGE

- A. Pipe shall be handled in such a manner as to protect the pipe and coating from damage.
- B. Coated pipe shall not be shipped or installed until coating has developed full adhesion and cure.
- C. During coating application, storage, loading, transportation, unloading, laying and installation, every precaution shall be taken to protect and prevent damage to pipe, lining, and coating. Forklift equipment shall have all bearing surfaces padded with suitable padding material. Lift pipe with web slings a minimum of 12-inch wide and of a type that will not damage the coating. Metal chains, cable, tongs, forklifts or other equipment likely to damage the coating will not be permitted. Dragging or skidding of pipe on grade or in the trench will not be permitted.
- D. Provide transportation vehicles with padded bolsters between each layer of pipe and heavy padding under load ties. Bolsters shall be curved to fit the outside of the pipe and 12 inches wide, minimum. All pipe contact locations shall be heavily padded with carpet and strips of the outer tape wrap material (adhesive side against the carpet) during shipment to the project site and from the storage yard to the point of installation.

- E. Pipe shall not be stored on rocks, gravel, or other hard materials that might damage the coating. Provide padded 12-inch wide skids and chucks, sand bags, select loamy or sand berms, or suspended from cutback ends, where possible, to minimize coating damage. Pipe shall not be laid on asphalt without suitable padding at all contact points.
- F. Pipe shall be inspected by the Contractor at the project site for damage. Any damage to the pipe, lining, or coating shall be repaired as directed if, in the opinion of the Engineer, a satisfactory repair can be made; otherwise, the damaged section shall be replaced at the sole expense to the Contractor.
- G. No metal tools or heavy objects shall be permitted to come into contact unnecessarily with the finished coating. Workmen shall not be permitted to walk on the coating except when necessary and approved by the Engineer. When permitted, shoes with rubber or composition soles and heels or other suitable footwear that will not damage coating shall be used.
- H. Long-term Exposure:
 - 1. Pipe shall either be provided with UV inhibitor for lengthy of above grade exposure or covered to prevent UV degradation of outer wrap.
 - 2. Amount of UV stabilizers required will depend on the project location, laying schedule, anticipated length of exposure, and type of coating.
 - 3. Manufacturer shall be consulted for recommended UV inhibitors requirements.
 - 4. Protective covering can be colored plastic sheeting, canvas, or other UV blocking material. Clear plastic sheets are not acceptable.
 - 5. Areas of coating that display UV degradation shall be removed and repaired at sole cost of the Contractor.

END OF SECTION

DIVISION 13
SPECIAL CONSTRUCTION

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SECTION 13 11 40
CORROSION MONITORING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. This section covers the work necessary to furnish and install a corrosion monitoring system, including test stations, galvanic anode groundbeds, electrical isolation, and pipe joint bonds for electrical continuity, complete.
- B. Contractor to have Corrosion Expert to train and/or perform required quality control testing as defined in this section.

1.2 REFERENCE STANDARDS

- A. This specification recognizes AWWA, NACE, and SSPC standards as minimum industry standards and they are referenced for purpose of conformance, except where modified herein. The requirements of this specification section have been written to a higher design standard.

NACE SP-0169 Control of External Corrosion on Underground or Submerged
Metallic Piping Systems

NACE SP-0177 Mitigation of Alternating Current and Lightning Effects on Metallic
Structures and Corrosion Control Systems

1.3 QUALITY CONTROL

- A. All Contractor specified testing shall be performed by a Corrosion Expert who holds a current NACE accreditation as a Cathodic Protection Specialist (CP-4) or Cathodic Protection Technologist (CP-3), and/or a registered professional Engineer with verifiable expertise in corrosion control and cathodic protection.
- B. Contractor performed quality control testing shall include the following tests, which shall be performed as defined in this section.
 - 1. Joint Bond Resistance test
 - 2. Casing Isolation testing (before and after casing fill)
 - 3. Insulating Joint Testing
- C. Connection of galvanic anodes, energizing and testing of cathodic protection system, and other tests as defined under "System Tests and Inspections" shall be performed by the Engineer unless specifically stated otherwise this section.

1.4 DEFINITIONS

- A. Foreign-Owned: Buried pipe or cable not specifically owned or operated by the OWNER.
- B. Electrically Continuous Pipeline: A pipeline which has a linear electrical resistance equal to

or less than the sum of the resistance of the pipe plus the maximum allowable joint bond resistance for each bonded pipe joint as specified in this section.

- C. Electrical Isolation: The condition of being electrically isolated from other metallic structures (including, but not limited to, piping, reinforcement, casings) and the environment as defined in NACE Recommended Practice SP0169.

1.5 SUBMITTALS:

- A. Shop Drawings: Catalog cuts and other information for products proposed for use.
- B. Quality Assurance Submittals:
 - 1. Manufacturers' Certificates of Compliance.
 - 2. Field Test Reports.
 - 3. Qualifications of NACE Accredited Testing Personnel.

PART 2 - MATERIALS

2.1 GENERAL:

- A. Like items of materials provided hereunder shall be the product of one manufacturer to achieve standardization for appearance, maintenance, and replacement.
- B. Materials and workmanship as specified in this section shall be installed concurrently with pipe installation.

2.2 SUPPLIERS:

- A. Alternate suppliers will be considered, subject to approval of the Engineer. Address given is that of the general office; contact these offices for information regarding the location of their representative nearest the project site.

- 1. Corrpro, Inc., Chicago, IL www.corrpro.com
- 2. Farwest Corrosion Control, Gardena, CA www.farwestcorrosion.com
- 3. Hoff Company, Inc., Denver, CO www.pipelinesupplies.com
- 4. MESA Products, Tulsa, OK www.mesaproducts.com
- 5. Northtown Products, Huntington Beach, CA www.northtownproducts.com

2.3 PREPACKAGED GALVANIC ANODES

- A. High-Potential Magnesium Alloy:

- 1. Composition:
 - a. Aluminum: 0.01 percent maximum.
 - b. Manganese: 0.5 to 1.3 percent.
 - c. Silicon: 0.05 percent maximum
 - d. Copper: 0.02 percent maximum.
 - e. Nickel: 0.001 percent maximum.
 - f. Iron: 0.03 percent maximum.
 - g. Total Others: 0.05 percent each or 0.3 percent maximum.
 - h. Magnesium: Remainder.

2. Dimensions:
 - a. Length: 25 inches minimum.
 - b. Bare Weight: 17 pounds minimum.
3. Manufacturers and Products:
 - a. Dow; Galvomag.
 - b. Amax; Maxmag.

B. Anode Wire:

1. Wire: Furnish each anode with No. 12 AWG solid copper wire with THWN insulation, 10 feet long.
2. Wire-to-Anode Connection: Manufacturer's standard. The anode connection shall be stronger than the wire.

C. Backfill:

1. Composition:
 - a. Ground Hydrated Gypsum: 75 percent.
 - b. Powdered Wyoming Bentonite: 20 percent.
 - c. Anhydrous Sodium Sulfate: 5 percent.
2. Grain Size: 100 percent passing through a 20-mesh screen and 50 percent retained by a 100-mesh screen.
3. Mixture: Thoroughly mixed and firmly packaged around the galvanic anode within the cloth bag or cardboard tube by means of adequate vibration.
4. The quantity of backfill shall be sufficient to cover surfaces of the anode to a depth of 1 inch.

2.3 JOINT BONDS

A. General:

1. All joint bonds provided by pipe manufacturer or Contractor shall meet the following minimum requirements:
 - a. All connections shall be welded or soldered.
 - b. Mechanical or compression type connections will not be permitted.
 - c. Bonds and welds shall exhibit sufficient strength and flexibility to allow thermal movement of the pipe after pipe backfill without cracking or breakage.
 - d. Bond connections to pipe shall be with an Engineer approved welding method.
2. All installed bonds shall be insulated or coated copper with all exposed copper field coated to prevent galvanic corrosion of pipe.

B. Ductile or Cast Iron Pipe, External Bonds:

1. Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE insulation, 18 inches long, with formed copper sleeve on each end of the wire.
2. Quantity of joint bonds per pipe joint by pipe diameter shall be as defined below:

Bond Type	Two Bonds	Three Bonds	Four Bonds
#2 AWG Wire	16" or less	42" or less	Over 42"

3. Connection of wire joint bonds to pipe shall be with the thermite weld method using

molds and cartridges as recommended by the welder manufacturer for bond type used.

4. Bonds shall be manufactured by Erico Products, Continental Industries, or approved equal. Third party manufactured bonds shall be approved by the Engineer for conformance with the requirements of this specification and proper thermite welding.

C. Coated Steel Pipe, External Bonds:

1. Rolled joint or Carnegie joint bonds shall be one of the following types at the Contractor's option:
 - a. Wire Bond: Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE or THWN-2 insulation, 18 inches long, with a formed copper sleeve on each end of the wire.
 - b. Strap Bond:
 - (1) Solid copper strap, 1-1/4-inch wide by 1/16-inch thick, equivalent to 1/0 AWG wire, with two punched holes for thermite welding to the pipe. Strap holes shall be sized for the thermite weld mold and shall provide for physical centering of the mold over the hole.
 - (2) Strap bond shall be 12-inches long with dielectric coating applied to the center 8-inches of the strap bond. Strap bonds provided without a dielectric coating shall be coated prior to installation with filler mastic as specified for heat shrink sleeves in Section 09 90 10, Pipeline Coating and Lining.
 - (3) Strap bonds shall be as manufactured by Erico Products, Continental Industries, Hoff Company, or approved equal. Third party manufactured strap bonds shall be approved by the Engineer for conformance with the requirements of this specification and proper thermite welding.
 - c. Use of manufactured steel bonding clips will not be permitted with heat shrink sleeve coated joints.

D. Flange joints:

1. Flanged joint bonds shall be one of the following types at the Contractor's option:
 - a. Steel rod, 5/8-inch diameter, length as required, arc welded to flange. Steel rod bonds will not be allowed where welding to the flange is not approved by the Engineer.
 - b. Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE insulation, 18 inches long, with a formed copper sleeve on each end of the wire.
2. Quantity of joint bonds per pipe joint shall be as defined below:

Bond Type	Two Bonds	Three Bonds	Four Bonds
Steel Rod	36" or less	72" or less	Over 72"
#2 AWG Wire	NA	30" or less	Under 60"

3. Connection of wire joint bonds to pipe shall be with the thermite weld method using molds and cartridges as recommended by the welder manufacturer for bond type used.
4. Coat steel rod bonds with fast curing epoxy after welding to joint as specified in

this Section, except when pipe is specified to be coated in accordance with Section 09900, PAINTING.

E. Sleeve Coupling, Flanged Coupling Adapter, and Other Non-standard Joints:

1. Ductile Iron Pipe:
 - a. Bond: No. 2 AWG wires, 24 inches long, HMWPE insulation, with two 12-inch long THWN-2 insulated No. 12 AWG wire pigtails,
 - b. Manufacturer: Erico Products Inc. (Cadweld), Cleveland, OH, Hoff Company, Denver, Colorado, or equal.
2. Steel Pipe:
 - a. Solid copper strap, 1-1/4-inch wide by 1/16-inch thick, equivalent to 1/0 AWG wire, with five punched holes for thermite welding to the coupling follower rings, middle, ring, and pipe. Strap bond shall be fabricated for the length of the coupling with sufficient additional length for 1 inch of joint movement. Strap holes shall be sized for the thermite weld mold and shall provide for physical centering of the mold over the hole.
 - b. Strap bond shall be as manufactured by Erico Products, Continental Industries, Hoff Company, or approved equal. Third party manufactured copper strap bonds shall be approved by the Engineer for conformance with the requirements of this specification and proper thermite welding.
3. Bond Quantity per Joint: Provide the quantity of bonds per pipe diameter as defined below:

Bond Type	Two Bonds	Three Bonds	Four Bonds
Copper Strap	NA	54" or less	Over 54"
No. 2 Wire Bond	NA	54" or less	Over 54"

4. Connection of wire or copper strap joint bonds to pipe shall be with the thermite weld method using molds and cartridges as recommended by the welder manufacturer for the bond type used.

F. Insulated Sleeve Coupling Joints:

1. Ductile Iron Pipe:
 - a. No. 8 AWG wire, 18-inch long, with one 12-inch long THWN-2 insulated No. 12 AWG wire pigtail.
 - b. Manufacturer: Erico Products Inc. (Cadweld), Cleveland, OH, Hoff Company, Denver, Colorado, or equal.
2. Steel Pipe:
 - a. Solid copper strap, 1-1/4-inch wide by 1/16-inch thick, equivalent to 1/0 AWG wire, with four punched holes for thermite welding to the coupling and pipe. Strap bond shall be fabricated for the length of the coupling with sufficient additional length for 1 inch of joint movement. . Strap holes shall be sized for the thermite weld mold and shall provide for physical centering of the mold over the hole.
 - b. Strap bond shall be as manufactured by Erico Products, Continental Industries, Hoff Company, or approved equal. Third party manufactured bonds shall be approved by the Engineer for conformance with the requirements of this specification and proper thermite welding.
3. Bond Quality per Joint: Provide the quantity of bonds per pipe diameter as defined

below:

Bond Type	One Bonds	Two Bonds	Three Bonds
Copper Strap	Up to 36"	36" to 60"	Over 60"
No. 2 Wire Bond	Up to 36"	36" to 60"	Over 60"

2.4 CATHODIC PROTECTION TEST STATIONS

A. Post Style, Steel Conduit:

1. Test Box:
 - a. Cast aluminum with thread hub suitable for mounting to a 2-inch x 3-inch reducer. Reducing bushings will not be permitted.
 - b. Manufacturer and Product:
 - (1) Type T, C, and I Stations: Gerome Manufacturing, Testox 700 series (rectangle) with 2-inch threaded hub.
 - (2) Type F and A Stations: Gerome Manufacturing, Testox 2000 series (rectangle) with 2 or 3-inch threaded hub.
2. Street Reducer:
 - a. Hot dipped galvanized 2-inch x 3-inch reducer and close nipple. Not required with 3-inch threaded hub.
3. Terminal Block:
 - a. Plastic or glass-reinforced laminated, 1/4-inch thick with seven terminals for Type T, C, and I test stations.
 - b. Plastic or glass-reinforced laminated, 1/4-inch thick with eleven terminals for Type F, and A test stations.
 - c. Terminal heads shall have special heads to keep them from turning or shall be easily accessible from both sides of the terminal block without requiring its removal.
 - d. Terminal studs, washers, and nuts shall be stainless steel.
4. Mounting Structure:
 - a. Rigid hot dipped galvanized steel conduit 3-inches diameter, threaded at one end (minimum), 5-feet long or as required for installation requirements.
 - b. PVC long radius sweep elbow, 1-inch diameter, for wire protection as shown on Drawings.

2.5 REFERENCE ELECTRODES:

A. Prepackaged Copper-Copper Sulfate Reference Electrodes:

1. Material: Permanent type, copper-copper sulfate reference electrode suitable for direct burial with a minimum design life of 25 years.
2. Lead Wire:
 - a. As specified under wire, this section,
 - b. Length of 25 feet or as required for splice free installation.
3. Backfill: As recommended by the reference electrode manufacturer.

2.6 CORROSION COUPON

- ### A. Application: Provide at all remote monitoring capable test stations, Type F test stations, and where shown on the Drawings.

- B. Coupon:
 1. Steel corrosion coupon with IR drop free measurement capability.
 2. Exposed steel area to be 0.01 square feet.
 3. Provide with two #12 or #14 AWG stranded copper wires leads, green insulation.
- C. Switch:
 1. Magnetic reed switch, normally closed, with connecting leads and terminals.
 2. EDI Model UI-MS, board or adjustable mount as required, with activating magnet.
- D. Manufacturers:
 1. Cott Manufacturing,
 2. M. C. Miller,
 3. Or equal.

2.7 WIRE:

- A. Pipe and Test Lead Wires:
 1. Pipe Test Wires: No. 10 AWG wire, single-conductor, stranded copper with 600-volt, THWN-2 or HMWPE insulation. Color coded insulation as specified.
 2. Insulation Color: Color shall indicate the function of each test wire and shall be as follows:

a. Pipe:	White
b. Reference electrodes:	Yellow
c. Casings:	Orange
d. Foreign Pipe:	Blue (Water) or Red (Gas or Oil)
e. Insulating Joints:	White and Green as shown on
f. Corrosion Coupons:	Green
 3. Reference Electrode Wires: No. 14 or 12 AWG wire single-conductor, stranded copper with 600-volt, THWN-2 or HMWPE insulation. Color code insulation as specified. Wire length of 25 feet or as required for splice free installation.
- B. Temporary Groundbed Header Wires:
 1. No. 8 AWG wire, single-conductor, stranded copper with 600-volt, THWN-2 or HMWPE insulation. Color coded insulation as specified.

2.8 CONDUIT, LOCKNUTS, AND STRAPS:

- A. Outdoors, Exposed Conduit
 1. Rigid conduit shall be rigid galvanized steel.
 2. Fittings, junction boxes, pull boxes, and outlet bodies shall be hot-dipped galvanized iron.
 3. Locknuts, conduit clamps, and other miscellaneous hardware shall be hot dipped galvanized steel. Galvanized items shall be hot-dipped galvanized in accordance with ASTM A153.
 4. Conduit clamps shall be two piece, malleable iron, one hole, strap and clamp back spacer, O. Z. Gedney 14-100G and 143G or similar, for mounting to surfaces with either lag bolts or concrete wedge anchors, as shown on the Drawings.
- B. Buried Conduit:
 1. Conduit and fittings shall be rigid electrical grade, schedule 40 gray PVC or PVC

coated rigid steel as shown on the Drawings.

2.9 WIRE SPLICE INSULATING KIT:

- A. Tap Splice: Tap splice insulating kit for the connection of the anode wire to the anode header wire shall be 3M Company Scotchcast 90-B1; Hexcel Kit No. 7K53; Raychem Corp. Thermofit No. ASE-4, or equal.
- B. In-Line Splice: In-line splice insulating kit for the connection of the anode wire to the anode header wire shall be 3M Company Scotchcast 82-A2; Hexcel Kit No. 7K32; Raychem Corp. Thermofit No. ASE-4, or equal.

2.10 THERMITE WELD MATERIALS:

- A. General:
 - 1. Thermite weld materials consist of wire sleeves, welders, and weld cartridges according to the weld manufacturer's recommendations for each wire size and pipe or fitting size and material.
 - 2. Welding materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers is not acceptable.
- B. Molds: Graphite, as recommended by the manufacturer for pipe and wire size.
- C. Adapter Sleeves:
 - 1. For No. 12 AWG and No. 2 AWG wires.
 - 2. Prefabricated factory sleeve joint bonds or bond wires with formed sleeves made in the field are acceptable. Attach field-formed joint bonds sleeves with the appropriate size and type of hammer die furnished by the thermite weld manufacturer.
 - 3. Extend wire conductor 1/8 inch beyond the end of the adapter sleeve.
- D. Cartridges:
 - 1. Steel: 32 grams, maximum.
 - 2. Cast and Ductile Iron: 45 grams, maximum, XF-19 Alloy
- E. Welders and Cartridges: For attaching copper wire to pipe material:

Pipe Material	Weld Type	Cartridge Size, Max.
No. 6 AWG Wire & Smaller		
Steel	HA, VS, HC	15 gm
Ductile or Cast Iron	HB, VH, HE	25 gm
No. 2 Wire Joint Bonds		
Steel	FS	32 gm
Ductile or Cast Iron	FC	45 gm
Copper Strap Joint Bonds		

Steel	M-128	15 gm
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- F. Welding Materials Manufacturers:
1. Erico Products Inc. (Cadweld), Cleveland, OH.
 2. Continental Industries, Inc. (Thermo-Weld), Tulsa, OK.

2.11 COATING REPAIR MATERIAL FOR PIPE AND FITTINGS

- A. General:
1. Complete coating repairs in accordance with recommendations of the pipe or fitting manufacturer.
- B. Coating Requirements:
1. Steel Pipes:
 - a. Coal tar based coatings: Koppers Bitumastic 50 or Denso or Tapecoat wax tape coatings; or equal, 20 mils dry film thickness, minimum.
 - b. Polyurethane or Epoxy Coatings: Fast cure epoxy, 20 mils dry film thickness, minimum
 - c. Tape Wrap Coating: Thermite Weld Cap, Canusa CRP Patch, or Raychem PERP patch, or equal
 2. Ductile iron Pipe:
 - a. Fast cure epoxy
 - b. Thermite weld cap
- C. Coating Materials:
1. Thermite Weld Caps:
 - a. Royston Laboratories Handi-Cap IP, prefabricated primerless thermite weld cap and coating system.
 - b. Provide primer unless specifically stated in product data sheet that no primer is required.
 2. Fast Cure Epoxy Coating:
 - a. 100 percent solids, fast curing epoxy suitable for submerged or buried conditions.
 - b. Acceptable products or equal:
 - (1) Denso Protal 7125 (low temperature) or Protal 7300
 - (2) Tapecoat TC 7010
 - (3) 3M ScotchKote 323

2.12 INSULATING JOINTS

- A. General: Insulating joints shall be dielectric unions, flanges, or couplings. The complete assembly shall have an ANSI rating equal to or higher than that of the joint and pipeline. All materials shall be resistant for the intended exposure, operating temperatures, and products in the pipeline.
- B. Insulating Flanges:
1. Flange:
 - a. As specified in applicable pipe sections or in conformance with AWWA C207, whichever is more stringent.
 - b. Bolt holes may be oversized not more 1/4 inch over nominal bolt diameter where required for insulating flange assembly.

2. Gaskets:
 - a. Full-face, fiberglass (G10) with O-ring seal gasket. Buried insulating flanges shall be full face gaskets only.
 - b. Complete assembly shall have an ANSI rating equal to the flanged joint.
 - c. Gasket materials shall be resistant to intended chemical exposure, operating temperatures, and pressures in the pipeline.
 3. Insulating Sleeves: Full-length Mylar or fiberglass reinforced epoxy (NEMA G-10 grade).
 4. Insulating Washers: Fiberglass reinforced epoxy (NEMA G-10 grade).
 5. Steel Washers: Plated, hot-rolled steel, 1/8-inch thick.
 6. Manufacturers:
 - a. GPT Industries, Houston, Texas
 - b. Advanced Products and Systems, Scott, LA
 - c. Central Plastics Co., Shawnee, OK.
- C. Insulating Unions: O-ring sealed with molded and bonded insulating bushing to union body, as manufactured by Central Plastics Company, Shawnee, OK; or equal.

2.14 OTHER MISCELLANEOUS MATERIALS

- A. Test Station Wire Terminations: One-piece, tin-plated crimp-on ring tongue connector as manufactured by Burndy Co. or Thomas and Betts.
- B. Shunts: Shunts shall be 0.01-ohm Holloway Type RS.
- C. Compression Connectors:
 1. Compression connectors for in-line and tap splices shall be "C" taps made of conductive wrought copper, sized to fit the wires being spliced.
 2. Compression connectors shall be applied with the crimp tool and die recommended by the manufacturer for the wire and tap connector size. Connectors shall be Burndy Type "YC", or equal.
- D. Electrical Tape:
 1. Linerless rubber high-voltage splicing tape and vinyl electrical tape suitable for moist and wet environments.
 2. Use Scotch 130 C and Scotch 88 as manufactured by 3M Products.

PART 3 - WORKMANSHIP

3.1 GENERAL:

- A. The installation of the facilities herein specified and described shall conform to the latest applicable NEC rules.
- B. The workmanship shall be of the highest grade and shall be in strict accordance with material manufacturer's instructions. Equipment or materials damaged in shipment or during installation shall be replaced.
- C. The Contractor shall examine all Drawings and coordinate his work to avoid conflicts, errors, delays, and unnecessary interference with the construction of the facilities and to avoid

duplication of the work such as excavation, filling, etc. In the event of any conflicts in the Specifications, the Engineer shall be consulted.

3.2 STORAGE AND HANDLING:

- A. Store all prepackaged anodes off the ground and keep them dry until after installation. Protect against weather, condensation, and mechanical damage.
- B. Immediately remove from the project site all mechanically damaged anodes.
- C. Galvanic anodes shall not be lifted or held by the lead wire.
- D. Anode backfill material that has become wet prior to installation shall not be acceptable.

3.3 PIPE JOINT BONDING, NEW PIPE

- A. To form an electrically continuous pipeline and associated appurtenances, all metallic pipe joints shall be electrically bonded; including buried, vault, and manhole pipe, fittings, and restrained joints; except threaded, welded, or insulated joints.
- B. All buried pipe shall be electrically continuous from test station to test station and from test station to fire hydrant or blowoff. Contractor shall locate and repair any joint that is found to be discontinuous during Engineer performed electrical continuity testing.
- C. Install the quantity of joint bonds at each joint required to be bonded as specified this section or shown on the Drawings. Should the specifications and drawings conflict, the larger quantity shall apply.
- D. Electrical connection of bonds to pipe and fittings shall be by thermite or arc welding process. Bolted, compression, or mechanical connections will not be permitted.
- E. Contractor shall test each bonded joint for electrical resistance as specified under Contractor QUALITY CONTROL TESTING, this section.

3.4 TEST STATION INSTALLATION

- A. General:
 - 1. Test station location, type, and style shall be as shown on the Drawings.
 - 2. Contractor may relocate test station up to ± 25 feet for site conditions without Engineer approval. Relocation greater than ± 25 feet must be approved by the Engineer.
 - 3. Contractor shall maintain records showing actual pipeline stationing of test station wire connections to the pipe.
 - 4. Records of actual pipeline stationing shall be provided to Engineer prior to electrical continuity testing by Engineer.
 - 5. Test stations shall be generally located as follows:
 - a. Install Type T test stations or other type test stations as required or at 1/4 mile intervals, but not greater than 1,500 feet.
 - b. Install a Type F test station where pipe crosses a foreign-owned metallic pipeline under cathodic protection.

- c. Install a Type C test station at both end of cased crossings, unless shown otherwise on the Drawings.
 - d. Install a Type I test station at all buried insulated joints.
 - 6. Locate post-mounted test stations directly over the pipe and, where possible, at protected locations such as structures, fences, manholes, power poles, or edges of cultivated land.
 - 7. Locate flush mounted test stations directly over the pipeline, except in areas of heavy traffic conditions. When heavy traffic conditions exist, offset the test stations to the side of the street.
 - 8. All offset test stations shall protect the test wires with PVC coated rigid steel conduit from pipeline centerline to within 6-inches of test station as shown on the Drawings. Do not connect rigid steel conduit to test station.
- B. Style:
 - 1. Test station style shall be as shown on the Drawings and as follows:
 - 2. Post mount style test stations shall be steel conduit style as shown on the Drawings.
 - 3. Flush mount style test stations shall be as shown on the Drawings and used where directed by the Engineer.
- C. Installation:
 - 1. Post mounted test station:
 - a. Height shall be between 36 to 42 inches above finish grade.
 - b. Buried steel posts shall be concrete encased as shown on the Drawings.
 - 2. Flush Mounted Test Stations
 - a. Place in concrete pad or sidewalk with cast iron cover as shown on Drawings.
 - b. Place concrete box on top of 3-inch base of compacted sand.
 - c. In unimproved areas provide blue "Carsonite" utility marker with yellow reflector on each side 1 foot from test box or as directed by the Engineer.
- D. Test Wires:
 - 1. Wires shall be attached to the pipe as specified under WIRE CONNECTIONS, this section.
 - 2. Wire connections shall be an individual connection with not less than 6-inches separation from other connections. Common connections will not be allowed. Where a steel tab is welded to pipe for test wire connections, a separate tab shall be provided for each wire connection.
 - 3. Wires to foreign-owned pipelines shall be connected to the pipe by the Contractor unless the foreign pipeline owner has indicated otherwise in writing. The Contractor shall coordinate this work with the owner of the foreign pipeline.
 - 4. Where foreign owners refuse test wire installation to their pipe, the Bidder shall obtain a written refusal from the field representative and install a Type T test station.
 - 5. Wires shall be buried a minimum of 24 inches below finished grade, except in undeveloped or cultivated areas where test wires shall be a minimum of 30-inches below finished grade.
 - 6. Wires shall be direct buried except where test station offset is required. Offset wires shall be installed in PVC coated rigid steel conduit from the centerline of the pipeline to 6-inches from test station. Rigid conduit shall not be connected to the test station.
 - 7. Provide 12-inch diameter loop in wires at the pipeline connection, at each end of rigid conduit when required, and below post mounted test stations to prevent wires

- from being stressed or broken.
8. Maintain sufficient slack in flush mount test wires to permit extension of terminal block 18-inches above test station. Connect all wires to a terminal board as specified.
 9. Make wire connections to test station terminals with crimp-on ring tongue terminals, except where solid wire is specified.

3.5 REFERENCE ELECTRODE INSTALLATION

- A. Remove plastic or paper wrapper and place reference electrode within the pipeline trench excavation inches from pipe in a vertical position and activate reference electrode per manufacturer's written instructions.
- B. Install reference electrode centered between foreign pipelines and OWNER's pipeline at pipe crossing location as shown on Drawings.
- C. Backfill hole with select native material in 6-inch layers and hand tamp each layer around anode. Use only native soil for backfill; do not use sand or flowable fill. Exercise care not to strike reference cell or lead wire with tamper.
- D. Terminate reference electrode wire in test station on separate terminal.

3.6 CORROSION COUPON INSTALLATION

- A. Place corrosion coupons within 6-inches of pipe and reference electrode.
- B. Install reference electrode centered between foreign pipelines and OWNER's pipeline at pipe crossing locations.
- C. Terminate corrosion coupon lead wires in test station on separate terminals.
- D. Connect coupon to pipeline with magnetic switch as specified and shown on drawings.

3.7 THERMITE WELD WIRE CONNECTIONS:

- A. Use thermite weld method for electrical connection of copper wire to steel, ductile iron, and cast iron surfaces. Observe proper safety precautions, welding procedures, thermite weld material selection, and surface preparation as recommended by the material manufacturer. Assure that pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the pipe or fitting wall's integrity or damage the lining in any way.
- B. Before the connection is made, the surface shall be cleaned to bare metal by making a 2-inch by 2-inch window in the coating, and then filing or grinding the surface with a vitrified wheel to produce a bright metal finish. Wire sleeves shall be installed on the ends of the wire before welding to the metal surface.
- C. After the weld connection is cooled, remove slag, visually inspect, and physically test wire connection by hitting with a hammer. Remove and replace any defective connections.
- D. Make wire connections to concrete cylinder pipe by thermite welding to the shop welded

steel plates provided on the pipe for this purpose.

- E. Coat each completed wire connection as specified, this section. If lining is damaged by welding, repaired in accordance with the lining applicator's recommendations.

3.8 TRENCHING AND BACKFILL

A. General

1. Complete excavations and trenching regardless of the type, nature, or condition of materials encountered, and as required to accomplish specified construction to lines and grades shown.
2. Contractor shall complete all utility notifications prior to performing trenching and excavations work.
3. Take care to avoid damage to existing structures and utilities during excavating and trenching process. Contractor may modify location, where approved by the Engineer, to minimize possible damage to existing structures. Trench shall be of uniform depth and width, level, smooth, and free of sharp objects.

B. Trench Depths:

1. Trench depths vary for conditions and requirements. Trench depths provided are minimum requirements. Contractor to meet minimum requirements or that required by local utilities, ordinances, or regulations, whichever is more stringent.
2. Minimum depths for cathodic protection or corrosion monitoring work shall be as defined herein or shown on the Drawings. If in conflict, the more stringent shall apply.
 - a. Pipeline Test wires, undeveloped 24-inches (direct bury)
 - b. Pipeline Test wires, roadways 30-inches (conduit)
 - c. All other 30-inches

C. Safety

1. Slope, shore, or brace excavations and trenches in accordance with OSHA regulations as necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public.
2. Contractor shall have sole responsibility for ensuring safety of trenches and conformance to OSHA trench safety requirements.

D. Backfill and Compaction

1. Backfill trench with excavated backfill materials, unless otherwise specified.
2. Compaction requirements shall be as specified for the pipeline or 90 percent compaction, whichever is more stringent. Backfill within 5 feet of roadways, paved areas, or other traffic areas shall be compacted to 95 percent.
3. Do not use backfill material of frozen or consolidated debris. Leave the trench with the excess backfill material neatly mounded, but not more than 4 inches above the existing ground level, for the entire width of the trench in undeveloped areas.
4. Replace topsoil in developed, landscaped, or cultivated areas.

3.9 SURFACE RESTORATION:

- A. Contractor shall restore all existing surface improvements within the pipeline easement

removed in the performance of this work.

- B. Contractor to complete surface restoration as specified and shown on the Drawings.

3.10 CONCRETE:

- A. Concrete used for slabs shall conform to the requirements for concrete in Section CONCRETE.
- B. Contractor shall finish all concrete work to a smooth trowel finish with radius edges.
- C. Concrete flatwork shall be sloped to drain water away from conduits and posts.
- D. All forms shall be removed from concrete work prior to final acceptance and removed from the project site.

3.11 WIRE INSULATION REPAIR

- A. Underground splicing of wire will not be permitted, except where specifically shown on the drawings and approved by the Engineer.
- B. Where splicing is approved by the Engineer, splices shall mechanically secure and soldered with rosin cored 50/50 solder. Compression connectors will not be permitted.
- C. Splices or insulation damage to test station wires shall be spirally wrapped with two coats of high-voltage self-vulcanizing rubber splice tape and two layers of vinyl electrical tape.

3.12 INSULATED JOINTS

- A. Install insulated joints to electrically isolate the pipeline from other pipes or structures where shown on the Drawings.
- B. Install insulated joints as shown on the Drawings.
- C. Align and install insulating joints according to the manufacturer's recommendations to avoid damaging insulating materials.
- D. Install a Type I test station at each buried insulated joint.
- E. Provide a DC blocking device on all insulating joints, except buried joints, as specified herein and shown on the Drawings.
- F. The Contractor shall test each insulated joint for electrical insulation as specified this section. Defective insulating joints shall be repaired by the Contractor at his sole expense. All damaged or defective insulation parts shall be replaced.

3.13 QUALITY CONTROL TESTING

- A. General:
 - 1. Contractor shall correct all construction defects identified during testing.
 - 2. Provide Engineer with 7 days advance notice of completion for Engineer

- acceptance testing.
3. Contractor required testing as defined herein shall be performed by a Corrosion Expert, with qualifications as specified in this section, whom is an employee or subcontractor to the Contractor.
- B. Joint Bond Resistance Test:
1. General
 - a. The Contractor shall test completed joint bonds for electrical continuity using a digital low resistance ohmmeter.
 - b. Joint bond quality control test shall be performed on all bonded joints after the bonds are installed but before backfilling of the pipe.
 - c. Furnish all equipment and materials as required for test.
 2. Digital Low Resistance Ohmmeter Test Method:
 - a. Required Equipment and Materials:
 - (1) One AVO Model DLRO10, digital low resistance ohmmeter or equivalent instrument.
 - (2) Two duplex, helical spring point leads with current and potential points, AVO Model No. 242011-7, or equivalent wire lead set.
 - b. Test Procedure:
 - (1) Measure the resistance of joint bonds with the low resistance ohmmeter in accordance with the manufacturer's written instructions.
 - (2) Use the helical handspikes to contact the pipe on each side of the joint, without touching the thermite weld or the bond. The contact area shall be cleaned to bright metal by filing or grinding and without any surface rusting or oxidation.
 - (3) Record the measured joint bond resistance on the test form described herein.
 - (4) Repair any damaged pipe coating in accordance with Wire Connections, this section.
 3. Joint Bond Acceptance:
 - a. Joint bond resistance shall be less than or equal to the maximum allowable bond resistance values shown below.

Joint Type	Max. Allowable Resistance (micro-ohms)		
	Two Bonds/Joint	Three Bonds/Joint	Four Bonds/Joint
No. 2 AWG wire (Steel)	162	108	81
No. 2 AWG wire (DIP)	185	123	93
Copper Strap (12-inch)	64	43	32
Copper Strap (9-inch)	48	32	24
Coupling, 24" No. 2 AWG	212	142	106
Coupling, 24" Copper Strap	128	85	64

- b. For bond quantities greater than shown above. Obtain maximum allowable bond resistance from the Engineer.
 - c. The Contractor shall remove and replace all joint bonds on a joint that exceeds the maximum allowable resistance. Replacement joint bonds shall be retested for compliance with the specified bond resistance.
 - d. Any defective joint bond discovered during System Tests and Inspection shall be located, excavated, repaired, and backfilled by the Contractor.
 4. Test Records: Records shall be made of each bonded pipeline during the test and submitted to the Engineer. These records shall include:
 - a. Description and location of the pipeline tested.
 - b. Starting location and direction of test.
 - c. Date of test.
 - d. Joint type.
 - e. Measured joint bond resistance
 5. Report: Contractor shall submit a QC report upon completion of joint bond resistance testing which includes the information listed above.
- C. Insulated Joint Isolation Test:
1. Contractor shall provide a Corrosion Expert to test each insulating joint after assembly with a GAS Electronics Model 601 insulator tester or equivalent instrument in accordance with the manufacturer's written instructions.
 2. The Corrosion Expert shall conduct additional insulating joint testing as required to insure that insulating flanges are not electrically shorted by other equipment or incidental contact with concrete reinforcement.
 3. Conduct test before burial and coating of buried insulating flanges.
 4. Contractor to replace damaged or defective insulation parts identified during testing.
 5. Electrical Isolation is defined as a condition of being electrically isolated from other metallic structures (including, but not limited to, other piping, concrete reinforcement, casings, and other structures not intended to be cathodically protected) and the environment as defined in NACE Recommended Practice RP0169-83.
 6. Contractor shall submit a report prepared by the Corrosion Expert certifying insulating joint testing isolation, test method(s), test data, and any corrective action

required.

- D. Casing Isolation Testing:
1. Contractor to test each casing and carrier pipe after assembly for electrical isolation before and after filling of casing with the specified fill material.
 2. An electrical isolation test method and evaluation criterion to be utilized by Corrosion Expert is to be submitted in writing for approval by Engineer prior to beginning field testing.
 3. Electrical Isolation is defined as a condition of being electrically isolated from other metallic structures (including, but not limited to, other piping, concrete reinforcement, casings, and other structures not intended to be cathodically protected) and the environment as defined in NACE Recommended Practice RP0169-83.
 4. Contractor to conduct any and all remedial actions necessary to clear all electrical contacts between the carrier pipe and casing before filling of the casing shall be permitted.
 5. Contractor shall submit a written report prepared by the Corrosion Expert certifying casing isolation, testing method(s), test data, and any corrective action required.

3.14 SYSTEM TESTS AND INSPECTION

- A. General
1. All testing specified herein shall be performed by the Engineer and shall include:
 - a. Preliminary electrical continuity testing of the full pipeline.
 2. Contractor shall correct all construction defects identified during testing.
 3. Provide Engineer with one week advance notice of completion of corrosion monitoring system work.
- B. Electrical Continuity Testing:
1. Preliminary Continuity Test by Engineer
 - a. After the pipeline construction is completed and all test stations have been installed, the Engineer shall test all pipelines with joint bonds for electrical continuity using the four-wire lineal pipe resistance test method.
 - b. Test will be conducted with a minimum test current of 15 amperes using a portable rectifier or dc welder.
 - c. An electrically continuous pipeline will be defined as a pipe or section of pipe that has a linear electrical resistance equal to or less than the sum of the resistance of the pipe plus the maximum allowable joint bond resistance for each joint as specified in this section.
 - d. The Contractor shall locate electrically discontinuous joints at his sole expense as specified herein.
 - e. Each discontinuous section of pipe shall be retested by the Engineer after all continuity repairs are completed to demonstrate that the pipeline is electrically continuous. Engineer retesting costs shall be at the Contractor's expense.
 - f. Electrical continuity testing requires two electrically continuous wires connected to pipeline at each test station. Any pipe section with one or more broken test wire(s) cannot be tested for continuity and will be classified as electrically discontinuous.
 2. Electrical Discontinuity Location:

- a. Contractor shall be solely responsible for location and repair of all discontinuous or high resistance joints bonds using a test method determined by the Contractor. Regardless of test method used to locate discontinuous joints, final acceptance of discontinuous sections shall be determined by the lineal pipe resistance method.
- b. After all discontinuous or high resistance joint bonds are repaired, the repaired section shall have a resistance less than or equal to the calculated allowable lineal pipe resistance as determined by the initial final continuity testing.
- c. Existing joint bonds damaged during excavation of the pipe for repairs or temporary wire connections shall be repaired by the Contractor.
- d. Existing test stations shall be protected from damage. When damage occurs Contractor shall complete repairs while the excavation is open. Undisclosed test station damage that requires repairs to be made after backfilling the excavation will be repaired at the Contractor sole expense.
- e. Upon completion of continuity repairs, the Engineer shall retest the continuity of repaired sections at the Contractor's expense in accordance with the General Conditions.

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DIVISION 26
ELECTRICAL

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**SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS**

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide electrical and appurtenant Work necessary for a complete and operable electrical system, in accordance with the Contract Documents.
- B. Make all field connections and terminations to all motors, switchgear, panels, control equipment and devices, instruments, and to all vendor-furnished packaged equipment. The requirements of this Section shall apply to all electrical items indicated in the various Sections of Division 26 unless otherwise indicated.
- C. Provide all materials and incidentals required to complete the electrical work. Typical materials which may be incidentals are terminal lugs not furnished with vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and all control wires required by vendor-furnished equipment to interconnect with other equipment all specifically indicated on the Contract Documents.
- D. All concrete work required for encasement, installation, or construction of the Work specified in the various Sections of Division 26 shall be 4,000-psi concrete, and the following requirements shall apply:
 - 1. Consolidation of encasement concrete around duct banks shall be by hand puddling, and no mechanical vibration shall be permitted.
 - 2. A workability admixture shall be used in encasement concrete, which shall be a hydroxylated carboxylic acid type in liquid form. Admixtures containing calcium chloride shall not be used.
 - 3. Concrete used to encase conduits shall be made with gravel containing rocks $\frac{3}{4}$ inch in size or less. It shall be wet enough to flow easily into the spaces around the conduits, but not so fluid as to float the conduits.
 - 4. Concrete for encasement of conduit or duct banks shall contain an integral red-oxide coloring pigment in the proportion of 8 pounds per cubic yard of concrete.

1.2 INTERFACE TO EQUIPMENT, INSTRUMENTS, AND OTHER COMPONENTS:

- A. The contract drawings, specifications, and overall design are based on non-certified information furnished by various equipment manufacturers. This "equipment" includes, but not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.
- B. The electrical specifications, ladder logic diagrams, and installation details are based on non-certified vendor information and indicate minimum scope of supply from Manufacturers.
- C. Include all labor, material, and others costs in the bid to add additional instrument, wiring, control system inputs/outputs, controls, conduit, interlocks, electrical hardware, etc., into the Work based on the Equipment Manufacturer's final certified Drawings.

- D. Revise or produce new loop diagrams to meet the Equipment Manufacturer’s wiring requirements.
- E. Incorporate such changes to Instrumentation and Electrical Work at no additional cost to the Owner in light of the Contractor’s knowledge that non-certified vendor information has been used in the design, and due to the fact that the final selection of the vendor may have been by the Contractor.
- F. Submit all such changes and additions to the Engineer for acceptance before starting field installation Work.
- G. The Contractor is responsible for providing all material and labor needed to install the actual equipment furnished, as such the Contractor’s bid includes all costs to add any additional conduit, wiring, terminals, or other electrical hardware to the design, which may be necessary to make a complete, functional installation based on the actual equipment furnished:
 - 1. Make all changes necessary to meet the Manufacturer’s wiring requirements.
 - 2. Incorporate such changes to the electrical installation into the final “As-Built” Drawings.
- H. Review the complete set of Drawings and Specifications in order to ensure that all items related to the electrical power and control systems are completely accounted for. Include any such items that appears on Drawings or Specifications from another discipline in the scope of Work and any costs for these items.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Codes and Standards

NEC	National Electrical Code, latest edition
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B. Government Standards

FS W-C-596E/GEN(1)	Connector, Plug, Receptacle and Cable Outlet, Electrical Power
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FS W-S-896E/GEN(1)	Switches, Toggle (Toggle and Lode), Flush Mounted (ac)
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FS WW-C-581D, E	Conduit, Metal, Rigid, And Intermediate; And Coupling, Elbow, and Nipple, Electrical Conduit: Steel, Zinc Coated
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OSHA	Safety and Health Standards, 29 CFR 1910 and 29 CFR 1926 as applicable
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C. Commercial Standards

ANSI C80.1	Zinc Coated, Rigid Steel Conduit, Specification for
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ANSI C80.4	Fittings for Rigid Metal Conduit and Electrical Metallic Tubing, Specifications for
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ANSI/UL 467	Grounding and Bonding Equipment, Safety Standard for
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ASTM B 3	Soft or Annealed Copper Wire
ASTM B 8	Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, and Soft
ASTM B 33	Specification for Timed Soft or Annealed Cooper Wire for Electrical Purposes
ICEA S-61-402	Thermoplastic - Insulated Wire and Cable
ICEA S-68-516, NEMA WC8	Ethylene Propylene Rubber Insulated Wire and Cable
NEMA 250	Enclosures for Electrical Equipment (1,000 volts maximum)
NEMA PB-1	Panelboards
UL 6	Rigid Metal Electrical Conduit
UL 514	Electrical Outlet Boxes and Fittings

- D. All equipment furnished by the CONTRACTOR shall be listed by and shall bear the label of Underwriters' Laboratories, Incorporated, (UL) or an independent testing laboratory acceptable to the local Code-enforcement agency having jurisdiction.
- E. The construction and installation of all electrical equipment and materials shall comply with all applicable provisions of the OSHA Safety and Health Standards (29CFR1910 and 29CFR1926, as applicable), State Building Standards, and applicable local codes and regulations.

1.4 PUBLIC UTILITIES REQUIREMENTS

- A. Contact the serving agency, Rocky Mountain Power Co., and verify compliance with their requirements before construction.
- B. Electrical service shall be as indicated by the Contract Documents.
- C. Verify, furnish, and install all service conduits, fittings, transformer pad, grounding devices, and all service wires not furnished by the serving utility.
- D. Verify with the utility the exact location of each service point and type of service.

1.5 PERMITS AND INSPECTION

- A. Permits shall be obtained and inspection fees shall be paid for as required by the Authority Having Jurisdiction.

1.6 CONTRACTOR SUBMITTALS

- A. Shop Drawings and Catalog Data: Submit shop drawings and catalog data submittals in accordance with Section 01 33 20 – Submittal Procedures

- B. Submit complete material lists for the Work of this Section. Such lists shall state manufacturer and brand name of each item or class of material. Submit shop drawings for all grounding work not specifically indicated.
- C. Shop drawings are required for materials and equipment listed in other sections. Shop drawings shall provide sufficient information to evaluate the suitability of the proposed material or equipment for the intended use, and for compliance with these Specifications. The following shall be included:
1. Front, side, rear elevations and top views with dimensional data.
 2. Location of conduit entrances and access plates.
 3. Component data.
 4. Connection diagrams, terminal numbers, wire numbers, internal wiring diagrams, conductor size, and cable numbers.
 5. Method of anchoring, seismic requirement; weight.
 6. Types of materials and finish.
 7. Nameplates.
 8. Temperature limitations, as applicable.
 9. Voltage requirement, as applicable.
 10. Front and rear access requirements.
- D. Catalog data shall be submitted to supplement all shop drawings. Catalog cuts, bulletins, brochures, or the like or photocopies of applicable pages thereof shall be submitted for mass produced, noncustom manufactured material. These catalog data sheets shall be stamped to indicate the project name, applicable Specification section and paragraph, model number, and options. This information shall be marked in spaces designated for such data in the stamp.
- E. Materials and Equipment Schedules: Furnish within 30 days, a complete list of all materials, equipment, apparatus, and fixtures proposed for use. The list shall include type, sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.
- F. Conduit Layout: Provide drawings for underground and concealed conduits, including but not limited to ductbanks, under floor slabs, concealed in floor slabs, and concealed in walls. Provide plan and section showing arrangement and location of conduit and duct bank required for: 1) low and medium voltage feeder and branch circuits, instrumentation and control systems, communication systems, empty conduit for future use. Layouts shall be of a reproducible scale not greater than 1 inch equals 20 feet.
- G. O&M Manuals: Furnish manuals as part of the shop drawing submittals under "Operation and Maintenance Manuals" in Section 01 33 20 – Submittal Procedures.
- H. Record Drawings: In addition to the record drawings as a part of the record drawing requirements specified in Section 01 33 20 – Submittal Procedures, show depths and routing of all duct bank concealed below grade electrical installations. Said set of record drawings shall be available to the ENGINEER during construction. After final inspection, transfer all record drawing information using a red pen to a set of drawings which shall then be delivered to the ENGINEER. In addition, the record drawings shall show all variations between the Work as actually constructed and as originally shown on the Drawings, based upon information supplied by the CONTRACTOR.

1.7 QUALITY ASSURANCE

- A. Field Control of Location and Arrangement: The Drawings diagrammatically indicate the desired location and arrangement of outlets, conduit runs, equipment, and other items. Determine exact locations in the field based on the physical size and arrangement of equipment, finished elevations, and other obstructions. Locations shown on the Drawings, however, shall be adhered to as closely as possible.
- B. All conduit and equipment shall be installed in such a manner as to avoid all obstructions and to preserve head room and keep openings and passageways clear. Lighting fixtures, switches, convenience outlets, and similar items shall be located within finished rooms, as shown. Where the Drawings do not indicate exact locations, such locations shall be obtained from the ENGINEER. Where equipment is installed without instruction and must be moved, it shall be moved without additional cost to the OWNER.
- C. Workmanship: All materials and equipment shall be installed in accordance with printed recommendations of the manufacturer which have been reviewed by the ENGINEER. The installation shall be accomplished by workmen skilled in this type of work and installation shall be coordinated in the field with other trades so that interferences are avoided.
- D. All Work, including installation, connection, calibration, testing, adjustment, and paint touchup, shall be accomplished by qualified, experienced personnel working under continuous, competent supervision. The completed installation shall display competent work, reflecting adherence to prevailing industrial standards and methods.
- E. Protection of Equipment and Materials: Furnish adequate means for and fully protect all finished parts of the materials and equipment against damage from any cause during the progress of the Work and until acceptable by the ENGINEER.
- F. All materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. All moving parts shall be kept clean and dry.
- G. Replace or have refinished by the manufacturer, all damaged materials or equipment, including face plates of panels and switchboard sections, at no expense to the OWNER.
- H. Tests: Perform all tests required by the Engineer or other authorities having jurisdictions. All such tests shall be performed in the presence of the Engineer. Furnish all necessary testing equipment and pay all costs of tests, including all replacement parts and labor necessary due to damage resulting from damaged equipment or from test and correction of faulty installation. The following testing shall be accomplished:
 - 1. Insulation resistance tests under "Wire and Cable," below.
 - 2. Operational testing of all equipment furnished and/or connected in other Sections of Division 26, including furnishing of support labor for testing.
- I. Standard test reports for mass-produced equipment shall be submitted along with the shop drawing for such equipment. Test reports on testing specifically required for individual pieces of equipment shall be submitted for review prior to final acceptance of the project.

- J. Any test failure shall be corrected in accordance with the industry practices and in a manner satisfactory to the Engineer.
- K. Regulatory Requirements:
1. Perform all Work to meet the requirements of all legally constituted authorities having jurisdiction.
 2. Perform all Electrical Work, whether needed for the power, control system, process, HVAC, telephone, security, etc. in accordance with all codes and standards required by Division 26.
 3. Perform all Work so as to comply with the accepted editions, amendments, practices, and rulings of the applicable codes and standards, except where the Drawings and Specifications are more stringent.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Acceptance of material and equipment Furnished By Others (F.B.O.):
1. Where equipment or materials are to be F.B.O. to the Contractor for installation and connection, the Contractor must:
 - a. Upon receiving such equipment or materials, make a complete check of all items and provide a transfer of materials document.
 - b. Provide the transfer of materials document as a receipt detailing the products received and the condition of the products delivered to the Contractor.
 - c. After Receiving and accepting the material, assume full responsibility for the safe keeping, handling, and the installation of the materials and equipment, until completed installation and final acceptance by the Engineer.
 2. Failure to issue said receipt assumes that all equipment and materials were then delivered to the Contractor in the proper quantities and in perfect condition.
- B. Storage and Protection:
1. Provide for the safe storage and delivery of materials, whether furnished by the Contractor or by others.
 2. Replace all equipment or material, damaged before final acceptance by the Engineer in a manner acceptable to the Engineer.
 3. Meet all storage requirements of the Manufacturer and provide for the safe storage of all materials and equipment as recommended by the Manufacturer.
 4. Protect electrical Work at all times from damage, defacement, or deterioration from any cause whatever:
 - a. Provide proper storage facilities and conduct operations to this effect.
 - b. Perform electrical Work in a manner as to protect the Work of other trades.

1.9 AREA DESIGNATIONS

- A. General: For purposes of delineating electrical enclosure and electrical installation requirements of this project, certain areas have been classified in the Contract Documents as defined below. Electrical installations within these areas shall conform to the referenced code requirements for the area involved.
- B. General Purpose Indoor Locations: Electrical work installed in areas which are not otherwise specifically classified shall be "General Purpose." Workmanship and enclosures shall comply

with the general requirements of these Specifications. Electrical enclosures shall be NEMA Type 12.

- C. Outdoor and Damp Locations: In outdoor locations, raceway shall be rigid galvanized steel (GRS) conduit; entrances shall be threaded; and fittings shall have gasketed covers. Provisions shall be made to drain the fitting or conduit system. Threaded fastening hardware shall be stainless steel. Raceway supports such as hanger rods, clamps, and brackets shall be galvanized. Attachments or welded assemblies shall be galvanized after fabrication. Instruments and control cabinets shall be NEMA Type 4X. Switchboards, motor control centers, and panel enclosures shall be weatherproof NEMA Type 3R. Enclosures shall be mounted, on strut, 1 inch from walls to provide an air space. Locations which are indoors and 2 feet below grade elevation or which are classified as damp locations on the Drawings shall have electrical installations which conform to the requirements for outdoor locations. "Damp locations" shall include pipe galleries, tunnels, vaults, and basements. All rooms housing liquid handling equipment are also classified as damp locations regardless of grade elevation.
- D. Vaults with forced air ventilation are not considered "damp locations." NEMA Type 12 panels will be required in these areas.
- E. Splash Locations: Areas shown as splashproof shall have electrical installations as described for "outdoor locations."

1.10 CLEANUP

- A. In addition to the requirements of "Cleanup" in Section 01 77 00 Project Closeout, all parts of the materials and equipment shall be thoroughly cleaned. Exposed parts shall be thoroughly clean of cement, plaster, and other materials. All oil and grease spots shall be removed with a nonflammable cleaning solvent. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Paint touchup shall be applied to all scratches on panels and cabinets. Electrical cabinets or enclosures shall be vacuum cleaned before final acceptance.
- B. During the progress of the Work, clean the premises and leave the premises and all portions of the site free of debris.

1.11 DEMOLITION AND RELATED WORK

- A. The CONTRACTOR shall perform all electrical demolition work as indicated.
 - 1. Electrical equipment and components, terminal and relay cabinets, MCCs, shall be returned to the OWNER in an orderly fashion to a designated location on the site.
 - 2. Wire, conduit, junction boxes, fittings, supports and miscellaneous hardware removed a part of the demolition work shall not be reused and shall be returned to the OWNER for their salvage use.
 - 3. Wires and/or conduits which need to be extended shall be terminated in a new terminal box with terminal strips. Terminal box shall be properly sized by the CONTRACTOR unless specified on drawings. Wires and terminals shall be properly identified before disconnection and after reconnection.
 - 4. Wiring in conduits located in or under slabs shall be removed. The conduit shall be plugged level with the floor where practical. In other cases, the conduit shall be cut three inches below the finished floor and the area shall be resurfaced.

5. Openings in walls and platforms created by the removal of conduit or electrical equipment shall be patched with materials similar to those in surrounding work areas or as required to provide proper sealed conditions as reviewed and accepted by the ENGINEER.
 6. Electrical demolition work shall be as shown on the Drawings or as required by the Specifications.
 7. Exercise due care in the removal of the equipment made surplus by this project so as not to impair its resale value or reuse. The OWNER has the right to salvage any wire or other electrical equipment removed from the project.
 8. Contractor shall be responsible for properly disposing of all electrical demolition materials, except those items to be salvaged to the OWNER as directed by the ENGINEER.
- B. Installation of New Equipment in Existing Structures
1. Certain new equipment and devices' installation are required in existing structures. Under this phase of the Work the CONTRACTOR shall be required to remove existing equipment or devices, install new equipment as indicated, remove existing conductors from existing raceway, and pull new conductors in existing raceway, reconnect existing conductors or furnish and install new conduit and wires.
 2. Visit the site before bidding and carefully examine existing installation so that its proposal will reflect all the Work necessary to provide a complete installation so that the resulting installation will function as required. Include in the bid price all costs of labor and materials necessary to complete installations.
- C. Installation of Temporary Equipment
1. To facilitate continuous operation of existing equipment, provide temporary equipment indicated. Submit installation and connection details for review and acceptance. All costs associated with these temporary installations shall be part of the original Bid Documents, and without additional cost to the OWNER.
 2. All cables, conduits, and fittings used in temporary connections shall not be reused to install permanent connections. Return the salvage items to the OWNER.
- D. Facility Monitoring Power and Control Shutdowns
1. Continuance of facility operation during this demolition and expansion process is important. Therefore, carefully examine all Work to be done in, on, or adjacent to existing equipment. Work shall be scheduled, subject to OWNER'S approval, to minimize required plant shutdown time. Submit a written request, including sequence and duration of activities to be performed during plant shutdown.
 2. Perform all switching and safety tagging required for plant shutdown or to isolate existing equipment. In no case shall the CONTRACTOR begin any Work in, on, or adjacent to existing equipment without written authorization.
- E. Modifications to Existing Electrical Facilities
1. Provide all modifications or alterations to existing electrical facilities required to successfully install and integrate the new electrical equipment. All modifications to existing equipment, panels, or cabinets shall be made in a professional manner with all coatings repaired to match existing. The total costs for all modifications to existing electrical facilities required for a complete and operating system shall be included in the original bid amount and no additional payment for this Work shall be authorized. Extreme caution shall be exercised in digging trenches in order not to damage existing

underground utilities. Cost of repairs of damages caused during construction shall be the CONTRACTOR's responsibility.

2. The CONTRACTOR shall be responsible for verifying all available existing circuit breakers in lighting panels for their intended use as required by the Drawings. It shall also be responsible for verifying the available space in substation switchboards to integrate new power circuit breakers. Expenses in time for all of this Work shall be included in the original bid amount.

1.12 PROJECT OR SITE CONDITIONS

A. Site Conditions:

1. Provide an electrical, instrumentation and control system, including all equipment, raceways and any other components required for a complete installation that meets the Environmental conditions for the Site as specified in the General Requirements and below.
2. Seismic Classification:
 - a. Provide all electrical equipment and construction techniques suitable for the seismic requirements for the Site, as specified in section 01 81 10.
3. Wind:
 - a. Provide all electrical equipment and construction techniques suitable for the Site wind loading criteria, as specified 01 81 10.
4. Altitude:
 - a. The site is located at approximately 4,300 feet above mean sea level. Provide all electrical components and equipment fully rated for continuous operation at this altitude, with no additional derating factors applied.
5. Humidity:
 - a. The facility is located in an area where the relative humidity is 90 percent non-condensing. Furnish all components and equipment fully rated for continuous operation at this relative humidity level.
6. Temperature:
 - a. The facility is located in an area where the temperature will vary from a minimum of -20 degrees Fahrenheit to a maximum of 100 degrees Fahrenheit.
 - b. Provide additional temperature conditioning equipment to maintain all equipment in non-conditioned spaces subject to these ambient temperatures 10 degrees Fahrenheit above the minimum operating temperature and 10 degrees Fahrenheit below maximum operating temperature as determined by the equipment Manufacturer's guidelines.
7. Outdoor installations:
 - a. Provide all electrical, instrumentation and control equipment installed outdoors that are suitable for operation in the ambient conditions where the equipment is located.
 - b. Provide heating, cooling, and de-humidifying devices incorporated into and included with electrical equipment, instrumentation and control panels located outdoors in order to maintain the enclosures within the rated environmental operating ranges as specified in this Paragraph for the equipment:
 - 1) Provide all wiring necessary to power these devices.
8. Site Security:
 - a. Abide by all security and safety rules concerning the Work on the Site

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and materials shall be new, shall be listed by UL, and shall bear the UL label, where UL requirements apply. All equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the project shall be products of the same manufacturer. All equipment and materials shall be of industrial grade and standard of construction; shall be of sturdy design and manufacture; and shall be capable of reliable, trouble-free service.

2.2 GROUNDING

- A. General: All components of the grounding electrode system shall be manufactured in accordance with UL 467 and shall conform to the applicable requirements of National Electrical Code Article 250.
- B. Grounding cable shall be copper. Bare copper wire shall be annealed, No. 8 AWG minimum, if not called out in the Drawings.
- C. Ground rods shall conform to ANSI/UL 467 and shall be 8 foot $\frac{3}{4}$ -inch diameter copper-clad steel, sectional type, joined by threaded copper alloy couplings.
 - 1. Grounding connectors shall be high-strength copper alloy suitable for direct burial.
 - 2. Wire connections shall be exothermic weld by Cadweld of Erico Products.
 - a. Manufacturers of grounding materials shall be Copperweld, Blackburn, Burndy, or equal.

2.3 UNDERGROUND DUCTS AND MANHOLES

- A. General: Where an underground distribution system is required, it shall be comprised of multiple runs of single bore nonmetallic ducts, with underground manholes and pullboxes. When nonmetallic ducts are required, they shall be rigid Schedule 40 PVC for concrete encasement.
 - 1. Manholes and pullboxes shall be of precast concrete. Concrete construction shall be designed for traffic loading.
- B. Covers shall be traffic type, except as shown otherwise. Manholes and pullbox covers shall be labeled as shown on drawings. All covers shall be watertight after installation.
- C. Manholes and pullboxes shall be equipped with pulling-in irons opposite and below each ductway entrance.
- D. Manholes shall have concrete covers with 30--inch diameters lids. All covers and lids shall be bolted to cast-in-place steel frames with corrosion resistant hardware. Frames shall be factory-primed; covers shall be cast-iron and shall have pick holes or lifting handles.
 - 1. Manholes and pullboxes shall have cable supports so that each cable is supported at 3-foot intervals within the manhole or pullbox. Cable supports and racks shall be fastened with galvanized bolts and shall be fabricated of fiberglass or galvanized steel. Porcelain insulators for cable racks shall be provided.
 - 2. Manholes and pullboxes shall be Brooks, Quikset, U.S. Precast, or equal.

- E. The concrete envelope shall have a compression strength of 3,000 psi in accordance with the requirements of Section 03 30 00 Cast In Place Concrete.

2.4 RACEWAYS

- A. General: Raceway shall be manufactured in accordance with UL and ANSI standards and shall bear UL label as applicable.
- B. Galvanized Rigid Steel (GRS) Conduit
 1. Rigid steel conduits and fittings shall be full weight, mild steel, hot-dip galvanized and zinc bichromate coated inside and outside after galvanizing.
 2. Rigid steel conduit shall be manufactured in accordance with UL Standard No. 6 and ANSI 80-1.
 3. Rigid steel conduit shall be manufactured by Triangle PWC, Republic Steel, or equal.
- C. Rigid nonmetallic conduit shall be Schedule 40 PVC.
 1. Nonmetallic conduits and fittings shall be UL listed, sunlight-resistant, and rated for use with 90 degrees C conductors.
 2. Nonmetallic conduits and fittings shall be manufactured by Carlon, Condux, or equal.
- D. Flexible metallic conduit shall be fabricated from galvanized interlocked steel strip. Liquid-tight flexible metallic conduit shall have an extruded PVC covering over the flexible steel conduit. For conduit sizes 3/4 inch through 1-1/4 inches, flexible conduits shall have continuous built in copper ground conductor. Flexible conduit shall be American Brass, Anaconda, Electroflex, or equal.
- E. PVC-coated raceway system shall conform to Federal Specification WW-C-581E, ANSI C80.1, and to Underwriter's Laboratories specifications.
 1. The zinc surfaces of the conduits and fittings shall remain intact and undisturbed on both the inside and the outside of the conduit through the preparation and application processing.
 2. A PVC coating shall be bonded to the galvanized outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic.
 3. The thickness of the PVC coating shall be a minimum of 40 mils.
 4. A PVC jacketed coupling shall be furnished with each length of conduit. A PVC sleeve equal to the OD of the conduit shall extend 1-1/2 inches from each end of coupling.
 5. PVC-coated conduits shall be as manufactured by Robroy, Occidental (OCCAL), or equal.

2.5 WIRE AND CABLE

- A. General: All conductors, including ground conductors, shall be copper. Insulation shall bear UL label and the manufacturer's trademark, type, voltage and temperature rating, and conductor size. Wire and cable shall be products of American, BICC/General, Rome Cable, Okonite, or equal.
- B. Control Cables: All control cables shall be rated for 600 volts and shall meet the following requirements:

1. Control wires shall consist of No. 14 gauge stranded copper conductors and shall be THWN/THWN-2 rated for 90 degrees C at dry locations and 75 degrees C at wet locations.
 2. Control wires at panels and cabinets shall be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations.
- C. Instrumentation Cables: Shielded instrumentation cables shall be rated at 600 volts and shall comply with the following requirements:
1. Individual shielded cable shall consist of twisted 2 or 3 No. 18 gauge, stranded, color coded, tinned-coated copper in accordance with ASTM B 33 Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes and B8 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, and Soft. Color coding shall be black-clear, or black-red-clear.
 2. Insulation thickness shall be 32 mils of polyethylene, insulated with 2.3 mils 100 percent aluminum foil/polyester shield and No. 18 stranded tinned copper drain wire, all under a 32 mil PVC jacket. The shield shall be continuous and shall be grounded only at the receiving end, or as indicated.
 3. Multi-individual shielded pair or triad instrumentation cable shall consist of individual shielded and twisted pair copper conductors with an ethylene-propylene insulation, and No. 18 AWG tinned stranded copper drain wire, an overall aluminum mylar shield and an overall chloro-sulfonated polyethylene compound jacket. The cables shall be suitable for cable tray installation and shall be flame retardant.
- D. Building Wire and Cable: Building wires and cables shall be rated at 600 volts and shall meet the following requirements:
1. Building wire shall be single conductor copper cable listed by UL as dual rated Type THHN/THWN-2 rated 90 degrees C in wet locations and rated 90 degrees C in dry locations.
 2. Building wire; all conductors shall be stranded.
 3. No wire smaller than No. 12 AWG shall be used unless specifically indicated.
- E. Cable Terminations: Cable terminations shall be in accordance with the following:
1. Compression connectors shall be Burndy "Hi Lug", Thomas & Betts "Shure Stake", or equal. Threaded connectors shall be split bolt type of high strength copper alloy.
 2. Spring connectors (wire nuts) shall be 3M "Scotch Lok," "Ideal Wing Nuts", or equal.
 3. Preinsulated fork tongue lugs shall be "Thomas & Betts" RC Series, Burndy, or equal.
 4. General purpose insulating tape shall be Scotch No. 33, Plymouth "Slip knot", or equal. High temperature tape shall be polyvinyl by Plymouth, 3M, or equal.
 5. Epoxy resin splicing kits shall be 3M Scotchcoat 82 Series, Burndy Hy Seal, or equal.
 6. Motor load termination kits shall be 3M.

2.6 PULL AND JUNCTION BOXES

- A. Outlet, switch, pull and junction boxes for flush-mounting in general purpose locations shall be one-piece, galvanized, pressed steel. Ceiling boxes for flush-mounting in concrete shall be galvanized, pressed steel.
- B. Outlet, switch, pull and junction boxes where surface mounted in exposed locations shall be cast ferrous boxes with mounting lugs, zinc or cadmium plating, and enamel finish. Surface mounted boxes in concealed locations may be pressed steel.

- C. Control station, pull and junction boxes, including covers, for installation in corrosive locations shall meet the NEMA 4X requirements and shall be stainless steel or fiber glass-reinforced polyester and shall be furnished with mounting lugs.
- D. All cast boxes and pressed steel boxes for flush mounting in concrete shall be fitted with cast, malleable box covers and gaskets. Covers for pressed steel boxes shall be one-piece pressed steel, cadmium plated, except that boxes for installation in plastered areas and finished rooms shall be stainless steel over plaster rings. Stainless steel plates shall be Sierra S-line, Hubbell, or equal. Cast boxes shall be as manufactured by Crouse-Hinds, Appleton, or equal.

2.7 CONDUIT FITTINGS

- A. General: Fittings shall comply with the same requirements as the raceway with which they will be used. Fittings for use with rigid steel conduit, shall be cast or malleable ferrous metal. Such fittings larger than one inch shall be "mogul size." Fittings shall be of the gland ring compression type. Covers of fittings, unless in "dry" locations, shall be closed with gaskets. Surface-mounted cast fittings, housing wiring devices in outdoor and damp locations, shall have mounting lugs.
- B. Insulated bushings shall be molded plastic or malleable iron with insulating ring, similar to O-Z Type A and B, equivalent types by Thomas & Betts, Steel City, Appleton, O-Z/Gedney, or equal.
- C. Insulated grounding bushings shall be malleable iron with insulating ring and with ground lug, - by T & B, - no substitutions.
- D. Crouse Hinds UNF or UNY unions shall be used at all points of union between ends of rigid steel conduits which cannot be coupled. Running threads and threadless couplings shall not be used.
- E. Liquid-tight fittings shall be - manufactured by T & B, no substitutions.
- F. Hubs for threaded attachment of steel conduit to sheet metal enclosures shall be similar to Appleton Type HUB, equivalent types such as manufactured by T & B, Myers Scrutite, or equal.
- G. Transition fittings to mate steel to PVC conduit, and PVC access fitting, shall be as furnished or recommended by the manufacturer of the PVC conduit.
- H. Conduit sealant shall be Chico, or equal.
- I. Expansion fittings shall be installed wherever a raceway crosses a structural expansion joint. Such fittings shall be expansion and deflection type and shall accommodate lateral and transverse movement. Fittings shall be O-Z/Gedney Type "DX," Crouse Hinds "XD," or equal. These fittings are required in metallic and nonmetallic raceway installations. When the installation is in a nonmetallic run, a 3-foot length of rigid conduit shall be used to connect the nonmetallic conduit to the fitting.

2.8 WIRING DEVICES

- A. All wiring devices shall be a product of a single manufacturer and shall conform to applicable NEMA Standards and be UL listed. Devices shall be as manufactured by Hubbell, Sierra, Pass & Seymour, or equal. General purpose duplex receptacles and toggle switch handles shall be white. Special purpose receptacles shall have a body color as shown. Receptacles and switches shall conform to Federal Specifications W C 596E and W S 896E, respectively.
 - 1. Receptacles
 - a. General purpose duplex receptacles shall be grounding type, 125-volt, ac, 20-amperes, **backwired** NEMA Configuration 5-20R, such as Hubbell 5362, or equal.

- B. Convenience receptacles for installation in outdoor and corrosive areas shall be NEMA 5-20R configured and shall have stainless steel or nickel plated parts and plastic parts of Melamine.
 - 1. Receptacles at outdoor locations shall be UL-approved for weatherproof locations with plug inserted. These shall be Crouse-Hinds, Hubbell, Pin and Sleeve Series, or equal.
 - 2. Receptacles at damp or dry locations shall be Crouse-Hinds DS 23G, Pyle National N 1, or equal.
 - 3. Receptacles at corrosive locations shall be Hubbell 52CM62 15 ampere, 53CM62 20 ampere, or equal.

- C. Ground fault interrupter (GFI) receptacles shall be NEMA 5-20R configured and shall mount in a standard outlet box. Units shall trip at 5 milliamperes of ground current and shall comply with NEMA WD 1 1.10 and UL 943. GFI receptacles shall be capable of individual as well as "downstream" operation. GFI receptacles shall be Hubbell GF 5252, or equal.

- D. Switches
 - a. Switches at outdoor locations shall be Crouse-Hinds DS 128, Mackworth Rees Style 3845, Joy Flexitite, or equal.
 - b. Switches at damp locations shall be Mackworth Rees Style 3496, Joy Flexitite, or equal.
 - c. Switches at dry locations shall be Crouse-Hinds DS 32G, Pyle National SCT 10k, or equal.

- E. Toggle switches shall be suitable for backwiring and shall conform to the following table, or equal:

	Hubbell No.	Bryant No.	Hubbell No.	Bryant No.
Single Pole	1221 (white)	4901 (white)	1221W (white)	4901W (white)
Three Way	1223	4903	1223W	4903W
Momentary	1556	4821	1556W	4821W
Four Way	1224		1224W	

2.9 CABINETS AND ENCLOSURES

- A. General: All electrical cabinets and enclosures housing control relays and terminal blocks shall be manufactured in accordance with NEMA Publications 250, UL Standards 50 and 508.

1. Relay or control, and terminal cabinets or outdoor cabinets shall be NEMA 4 enclosures. Sizes shown on the Drawings are minimum. Provide sufficient terminal blocks to terminate 25 percent more conductors than are shown. Interiors of cabinets shall be finished white including internal back mounting plate.
 2. Floor standing NEMA 12 construction shall have three-point latching mechanism operated by oiltight key-locking handle, and shall have gasketed overlapping doors. Steel construction shall be 12-gauge. Construction for wall-mounted type shall be 14-gauge steel. Exterior finish shall be ANSI 61 light gray, or equal.
- B. Wiring of terminal cabinets, control or relay cabinets shall be accomplished with stranded copper conductor rated for 600-volts and UL listed as Type MTW. Wires for annunciator and indication circuits shall be No. 16 AWG. All others shall be No. 14 AWG. Color coding shall be as specified elsewhere in this Section. Incoming wires to terminal or relay cabinets shall be terminated on a master set of terminal blocks. All wiring from the master terminals to internal components shall be factory-installed and shall be contained in plastic wireways having removable covers. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.
- C. All terminal block requirements shall be as manufactured by Entrelec with cage clamp, Phoenix, or equal.
- D. Engraving shall be as shown or as directed by the ENGINEER. Characters shall be uniform block style not smaller than 1/8-inch. Nameplates shall be secured using cadmium plated steel or other corrosion resistant screws. Adhesive alone is not acceptable.
- E. Each relay or control and terminal cabinets shall be completed, assembled, wired, and tested at the factory. Test shall be in accordance with the latest UL and NEMA Standards. All cabinets shall bear UL label, as applicable.

2.10 DISCONNECT SWITCHES

- A. Unfused and fused disconnect switches shall be externally operated with quick-make/quick-break mechanisms. The handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be padlockable in the "off" position. Switches shall have nameplates stating manufacturer, rating, and catalog number. Heavy-duty switches shall have arc suppressors, pin hinges, and shall be horsepower rated at 600-volts. All switches rated at 100 amperes or larger shall have auxiliary contact for remote status indication. Heavy-duty switches shall be provided for all motor circuits above 3 horsepower. In smaller motor circuits switches shall be general duty.
- B. Switch rating shall match the horsepower requirements of the load at the particular voltage if not otherwise shown.
- C. Switch enclosure shall be NEMA 1 and shall be as manufactured by Square D, Cutler-Hammer, or equal.

2.11 ELECTRICAL IDENTIFICATION

- A. Nameplates: Nameplates shall be fabricated from white-letter, black-face laminated plastic engraving stock, Formica type ES-1, or equal. Each shall be fastened securely, using fasteners of brass, cadmium plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style of adequate size to be read easily at a distance of 6 feet with no characters smaller than 1/8-inch high.
- B. Conductor and Equipment Identification: Conductor and equipment identification devices shall be either imprinted plastic-coated cloth marking devices such as manufactured by Brady, Thomas & Betts, or equal, or shall be heat-shrink plastic tubing, imprinted split-sleeve markers cemented in place, or equal.
- C. Identification Tape: Identification tape for protection of buried electrical installation shall be a 6-inch wide red polyethylene tape imprinted "CAUTION - ELECTRIC UTILITIES BELOW."

2.12 LIGHTING AND POWER PANELBOARDS

- A. General: Panelboards shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1 as well as the provisions of UL 50 and 67. Panelboards used for service equipment shall be UL labeled for such use.
 - 1. Enclosure as shown on Drawings.
 - 2. Interiors shall have solderless, anti-turn connectors and shall be constructed so that branch circuit breaker can be replaced without disturbing adjacent units or resorting to field drilling and tapping. Bus bars and connecting drops shall be copper. Neutral bar shall be full-sized and shall have one terminal screw for each branch circuit; main bus bar shall be full-sized for entire length. Spaces shown shall have cross connections for the maximum sized device that can be fitted.
 - 3. Panelboard box shall be galvanized code grade steel with knockouts, and shall have removable end walls. All boxes or panelboard enclosures shall have gray baked enamel finish.
 - 4. All circuit breakers shall be bolt-in type.
 - 5. Cabinets for building panels shall be 20-inch wide minimum, with 4-inch minimum side gutters and 5-inch minimum top and bottom gutters. Panelboard trim shall be the same size as cabinet on surface-mounted panels and 3/4-inch larger all around than cabinet of flush-mounted panels. Bus bars shall be copper. Doors in trim shall have typed circuit directory and pocket with protective clear plastic sheet. All trim and cabinets of surface-mounted panels in general purpose areas shall be phosphate treated, primed and finished with baked enamel, panels of flush mounted panels shall be finished to match surrounding wall color.
 - 6. The number of circuit breakers and the ampere ratings shall be in accordance with panel schedules. Main circuit breaker or main lugs only shall be provided as indicated. The panelboard circuit breakers shall be group mounted and shall be molded case with 3- or 2-pole main breakers as required and branch circuit breakers with a minimum of 10,000 AIC or higher as shown on Drawings.
 - 7. Provide control enclosures under common panel trim. All panelboard doors shall be keyed alike.

2.13 CONTROL STATIONS

- A. Control stations shall comply with NEMA Standards ICS2-216. All control stations shall be industrial type, heavy duty, oil-tight, with legend plates.
- B. Control stations shall be as follows:
 - 1. Pushbutton Switch: Pushbutton switches shall be momentary type with round or square button plate. All emergency-stop pushbuttons shall have red button plates. Lock-out stop shall be momentary pushbutton with locking mechanism.
 - 2. Selector Switches: Selector switches shall be rated 10 amperes at 600 volts and shall be rotary type with number of position and poles as indicated.
 - 3. Indicating Lights: Pilot lights shall be LED type and with plastic color caps: green color for running, yellow for ready, white for power status, and red for failure status.
 - 4. Control station enclosures shall be NEMA 4X in corrosive, below grade, or wet areas.
- C. Manufacturers shall be Square D, Class 9001, or equal.

PART 3 - EXECUTION

3.1 GROUNDING

- A. General: Grounding cable shall be sized in accordance with code requirements when sizes are not indicated on the Drawings.
- B. Equipment Ground: Ground continuity throughout the facility shall be maintained by installing a grounding conductor in all raceways.
 - 1. Metallic raceway shall be installed with double lock nuts or hubs at enclosures. Nonmetallic raceway containing dc conductors operating at more than 50 volts to ground, or any ac conductors, shall contain a copper-grounding conductor insulated green. Such conductor shall be bonded to terminal and intermediate metallic enclosures.
 - 2. Metal equipment platforms which support any electrical equipment shall be bonded to the nearest ground bus or to the nearest switchgear ground bus. This grounding requirement is in addition to the raceway grounding required in the preceding paragraph herein.
- C. Grounding Electrode System: Install the grounding electrode system with all required components in accordance with National Electrical Code Article 250.
 - 1. Connection to ground electrodes and ground conductors shall be exothermic welded where concealed and shall be bolted pressure type where exposed. Bolted connectors shall be assembled wrench-tight.
 - 2. Insulated grounding bushings shall be employed for all grounding connections to steel conduits in switchboards, in motor control centers, in pullboxes, and elsewhere where conduits do not terminate at a hub or a sheet metal enclosure. Where insulated bushings are required, they shall be installed in addition to double lock-nuts.
 - 3. Copper bonding jumpers shall be used to obtain a continuous metallic ground.
- D. Shield Grounding

1. Shielded power cable shall have its shield grounded at each termination in a manner recommended by the cable manufacturer.
2. Shielded instrumentation cable shall be grounded at one end only; this shall be at the RTU or otherwise at the "receiving" end of the signal carried by the cable, unless shop drawings indicate that the shield shall be grounded at both ends.
3. Termination of each shield drain wire shall be on its own terminal screw. All of these terminal screws in one rack shall be jumpered with No. 16 solid tinned bare copper wire; connection to ground shall be accomplished with a No. 12 green insulated conductor to the main ground bus.

3.2 UNDERGROUND DUCTS AND MANHOLES

- A. The underground duct bank shall be installed in accordance with the criteria below:
 1. Duct shall be assembled using high impact nonmetallic spacers and saddles to provide conduits with vertical and horizontal separation. Plastic spacers shall be set every 5 feet.
 2. The duct shall be laid on a grade line of at least 4 inches per 100 feet, sloping towards pullboxes or manholes. Duct shall be installed and pullbox and manhole depths adjusted so that the top of the duct is a minimum of 24 inches below grade.
 3. Changes in direction of the duct envelope by more than 10 degrees horizontally or vertically shall be accomplished using bends with a minimum radius 24 times the duct diameter.
 4. Couplings shall be staggered at least 6 inches vertically. Bottom of trench shall be of select backfill or sand. The duct array shall be anchored every 4 feet to prevent movement during placement of backfill.
 5. Each bore of the completed duct bank shall be cleaned by drawing through it a standard flexible mandrel one foot long and 1/4-inch smaller than the nominal size of the duct through which the mandrel will be drawn. After passing of the mandrel, draw a wire brush and swab through.
 6. A raceway, in the duct envelope, which does not require conductors, shall have a 1/8 inch polypropylene pull cord installed throughout the entire length of the raceway.
- B. Duct entrances shall be grouted smooth; duct for primary and secondary cables shall be terminated with flush end bells. Sections of pre-fabricated manholes and pullboxes shall be assembled with waterproof mastic and shall be set on a 6-inch bed of gravel as recommended by the manufacturer or as required by field conditions.
- C. Duct bank markers shall be installed every 200 feet along run of duct bank, at changes in horizontal direction of duct bank, and at ends of duct bank. Concrete markers, 6 by 6 inches square and one-foot long, shall be set 2 inches above finish grade. The letter "D" and arrow set in the concrete shall be facing in the direction of the duct alignment.
- D. Duct bank penetration through walls of manholes or pullboxes, and on building walls below grade shall be watertight.
- E. Trenches containing duct banks shall be filled with select backfill with no large rocks which could damage the duct.

3.3 RACEWAYS

- A. General: Raceways shall be installed as indicated, however, conduit routings shown are diagrammatic. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical and shall be accomplished with tools designed for the purpose intended. Bends in metallic conduit shall be accomplished by field bending or by the use of factory elbows. All installations shall be in accordance with the latest edition of the National Electrical Code.
- B. Raceways shall be installed in accordance with the following schedule:
1. Low Voltage Raceway (control and power):
 - a. Rigid Schedule 40 PVC shall be used for burial in earth.
 - b. Galvanized rigid steel (GRS) shall be used on exposed installations in general purpose areas.
 - c. Galvanized rigid steel or PVC shall be used for conduits embedded in concrete slab on grade and above grade.
 - d. Schedule 40 PVC or HDPE shall be used for fiber optic data hi-way system for buried in earth. See drawings.
 - e. Galvanized rigid steel shall be used in exposed installations in outdoor areas.
 2. Exposed Raceways
 - a. Conduits shall be rigidly supported with clamps, hangers, and Unistrut channels.
 - b. Intervals between supports shall be in accordance with the National Electrical Code.
 3. All underground elbows shall be GRS (PVC coated).
- C. Conduit Terminations
1. Empty conduit terminations not in manholes or pullboxes shall be plugged. Exposed raceway shall be installed perpendicular or parallel to buildings except where otherwise indicated. Conduit shall be terminated with flush couplings at exposed concrete surfaces. Conduit stubbed up for floor-standing equipment shall be placed in accordance with approved shop drawings. Metallic raceways installed below-grade or in outdoor locations and in concrete shall be made up with a conductive waterproof compound applied to threaded joints. Compound shall be Zinc Clads Primer Coatings No B69A45, HTL-4 by Crouse-Hinds, Kopr Shield by Thomas & Betts, or equal.
 2. Both rigid and flexible conduit shall be sealed against water at each entrance to enclosures. Unless indicated otherwise, rigid and flexible conduit shall enter panels through the top, shall continue down from the top to the bottom, and shall turn upward at the bottom.
- D. Conduit Installations
1. Conduit may be cast integral with horizontal and vertical concrete slabs, providing one-inch clearance is maintained between conduit surface and concrete surface. If said clearance cannot be maintained, the conduit shall be installed exposed below elevated slabs; provided, that in the case of slabs on grade, conduit shall be installed below the slab and shall be encased with a minimum cover of 3 inches of concrete. Maximum size of conduit that can be cast in slab above grade shall be 3 inches, in slab on grade shall be 1-1/2 inches.

2. Nonmetallic conduit may be cast integral with horizontal slabs with placement criteria stated above. Nonmetallic conduit may be run beneath structures or slabs on grade, without concrete encasement. In these instances, conduit shall be placed at least 12 inches below the bottom of the structure or slab. Nonmetallic conduit may be buried 24 inches minimum below grade, in open areas or where otherwise not protected by concrete slab or structures. Top of concrete cover shall be colored red. Nonmetallic conduit shall be permitted only as required by the Specifications and in concealed locations as described above.
3. Where a run of concealed PVC conduit becomes exposed, a transition to rigid steel conduit is required. Such transition shall be accomplished by means of a factory elbow or a minimum 3-foot length of rigid steel conduit, either terminating at the exposed concrete surface with a flush coupling. Piercing of concrete walls by nonmetallic runs shall be accomplished by means of a short steel nipple terminating with flush couplings.
4. Flexible liquid-tight conduit shall be used for the connection of equipment such as motors, transformers, instruments, valves, or pressure switches subject to vibration or movement during normal operation or servicing.
5. Equipment subject to vibration or movement which is normally provided with wiring leads, such as solenoid valves, shall be installed with a cast junction box for the make-up of connections. Flexible conduits shall be as manufactured by American Brass, Cablec, Electroflex, or equal.
6. Conduit penetrations on walls, concrete structures, pull boxes, and equipment cabinets shall be performed in accordance with the following:
 - a. Seal all raceways entering structures at the first box or outlet with conduit sealant to prevent the entrance into the structure of gases, liquids, or rodents.
 - b. Dry pack with nonshrink grout around raceways that penetrate concrete walls, floors, or ceilings aboveground, or use one of the methods indicated for underground penetrations.
 - c. Where an underground conduit enters a structure through a concrete roof or a membrane waterproofed wall or floor, provide an acceptable, malleable iron, watertight, entrance sealing device. When there is no raceway concrete encasement, provide such device having a gland type sealing assembly at each end with pressure bushings which may be tightened at any time. When there is raceway concrete encasement indicated, provide such a device with a gland type sealing assembly on the accessible side. Securely anchor all such devices into the masonry construction with one or more integral flanges. Secure membrane waterproofing to such devices in a permanently watertight manner.
 - d. Where an underground raceway without concrete encasement enters a structure through a nonwaterproofed wall or floor, install a sleeve made of Schedule 40 galvanized pipe. Fill the space between the conduit and sleeve with a suitable plastic expandable compound on each side of the wall or floor in such a manner as to prevent entrance of moisture. A watertight entrance sealing device may be used in lieu of the sleeve.
7. All underground GRS conduit shall be PVC coated.
8. Minimum size of buried conduit: 1".
9. Minimum size of exposed conduit: $\frac{3}{4}$ "

3.4 WIRES AND CABLES

- A. General: Conductors shall not be pulled into raceway until:
1. Raceway system has been inspected and accepted by the Engineer.
 2. Plastering and concrete have been completed in affected areas.
 3. Raceway system has been freed of moisture and debris.
- B. Wire and Cables
1. Conductors of No. 1 size and smaller shall be hand pulled. Larger conductors may be installed using power winches. Pulling tensions on the cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where needed, shall be UL approved.
 2. Wire in panels, cabinets, and gutters shall be neatly grouped using nylon tie straps and shall be fanned out to terminals.
- C. Splices and Terminations
1. The Contractor shall provide, install, and terminate the conductors required for power and controls to electrical equipment instrumentation terminal cabinets, control and instrumentation equipment except where indicated elsewhere. There shall be no splices in underground manhole or pullboxes of conductors smaller than #10 AWG.
 2. Two- and three-conductor shielded cables installed in conduit runs which exceed 2,000 feet may be spliced in pullboxes. These cable runs shall have only one splice per conductor.
 3. Control conductors shall be spliced or terminated only at the locations indicated and only on terminal strips or terminal lugs of vendor furnished equipment. For the purposes of the various Sections of Division 26 of the Specifications, "control conductors" are defined as conductors operating at 120 volts or less in circuits that indicate equipment status or that control the electric energy delivered to a power consuming device.
 4. All 120/208-volt and 480-volt branch circuit conductors may be spliced in suitable fittings at locations determined by the Contractor.
 5. Stranded conductors shall be terminated directly on equipment box lugs making sure that all conductor strands are confined within lug. Use forked-tongue lugs where equipment box lugs have not been provided.
 6. Splices in 600-volt wire which are not pre-insulated shall be insulated with three layers of tape each half lapped except that splices in below grade pull boxes or in any box subject to flooding shall be made watertight using in-line copper compression splices with heat shrink insulation.
 7. Splices to motor leads in motor terminal boxes shall be wrapped with mastic material to form a mold and then shall be taped with a minimum of 2 layers of varnished cambric tape overtaped with a minimum of 2 layers of high temperature tape. Provide 3M motor lead termination kits.
 8. Shielded power cable shall be terminated with pre-assembled stress cones in a manner approved by the cable manufacturer. Submit the proposed termination procedure as described for shop drawings.
 9. Control devices, such as solenoid operated valves that are normally supplied with conductor pigtails shall be terminated as described for control conductors.

- D. Cable Assembly and Testing: Cable assembly and testing shall comply with applicable requirements ICEA Publication No. S-68-516 and other relevant ICEA publications. The following tests shall be the minimum requirements:
1. Insulation resistance shall be obtained and shall not be less than the value recommended by ICEA.
 2. All cables rated at 600 volts shall be tested for insulation resistance between phases and from each Phase to a ground using a megohmmeter.
 3. All field testing mentioned above shall be done after cables are installed in the raceways.
 4. Cables failing in the said tests shall be replaced with a new cable or repaired. Such kind of repair methods shall be as recommended by the cable manufacturer and shall be performed by persons certified by the industry.
- E. Continuity Test: All control and instrumentation cables shall be tested for continuity, polarity, undesirable ground, and origination. Such tests shall be performed prior to placing all cables in service.

3.5 PULL AND JUNCTION BOXES

- A. Pull and junction boxes shall be sized in accordance with the requirements of the National Electrical Code or as shown on drawings.
- B. Outlet boxes shall be used as junction boxes wherever possible. Where separate pullboxes are required, they shall have screw covers.
- C. Pullboxes shall be installed when conduit run contains more than three 90-degree bends and runs exceed 200 feet or as shown on drawings.

3.6 CABINETS AND ENCLOSURES

- A. Cabinets shall be set plumb at an elevation that will cause the maximum circuit breaker height to be less than 5 ft 6 inches. Top edge of trim of adjacent panels shall be at the same height. Panels which are indicated as flush mounted shall be set so cabinet is flushed and serves as a "ground" for plaster application.
- B. All factory wire connections shall be made at shipping splits, and all field wiring and grounding connections shall be made after the assemblies are anchored.

3.7 CONCRETE HOUSEKEEPING

- A. Concrete housekeeping pads shall be provided for all floor standing electrical equipment. Housekeeping pads for all equipment, including future units, shall be 2 inches above surrounding finished floor or grade and 2 inches larger in both dimensions than the supported equipment, unless otherwise indicated.
- B. Concrete housekeeping curb shall be provided for all conduit stub-up in indoor and outdoor locations, not concealed by equipment enclosures. Such curb shall be 3 inches above finished floor or grade.

3.8 EQUIPMENT ANCHORING

- A. Freestanding or wall-hung equipment shall be anchored in place by methods that will meet seismic requirement in the area where project is located. Wall-mounted panels that weigh more than 500 pounds or which are within 18 inches of the floor shall be provided with fabricated steel support pedestal(s). Pedestals shall be of welded steel angle sections. If the supported equipment is a panel or cabinet and enclosed with removable side plates, it shall match supported equipment in physical appearance and dimensions. Transformers hung from 4-inch stud walls and weighing more than 300 pounds, shall have auxiliary floor supports.
- B. Leveling channels anchored to the concrete pad shall be provided for all switchgear and pad-mounted transformer installations. Area between the channels shall be grouted perfectly flat.
- C. Anchoring methods and leveling criteria specified in the printed recommendations of the equipment manufacturers are a part of the Work of this Contract. Such recommendations shall be submitted as required for shop drawings in Section 013320S – Submittal Procedures.

3.9 CABLE AND EQUIPMENT IDENTIFICATION

- A. General: The completed electrical installation shall be provided with adequate identification to facilitate proper control of circuits and equipment and to reduce maintenance effort.
- B. Cable: Assign each control and instrumentation wire and cable a unique identification number. Said numbers shall be assigned to all conductors having common terminals and shall be shown on all shop drawings. Identification numbers shall appear within 3 inches of conductor terminals. "Control" shall be defined as any conductor used for alarm, annunciator, or signal purposes:
 - 1. Multiconductor cable shall be assigned a number which shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath free-standing equipment. It is expected that the cable number shall form a part of the individual wire number. All individual control conductors and instrumentation cable shall be identified at pull points as described above. The instrumentation cable numbers shall incorporate the loop numbers indicated on the Drawings.
 - 2. All 120/208-volt system feeder cables and branch circuit conductors shall be color coded as follows: Phase 1-black, Phase 2-red, Phase 3-blue, and Neutral-white. The 480/277-volt system conductors shall be color coded as follows: Phase A-brown, Phase B-orange, Phase C-yellow, and Neutral-gray. Color-coding tape shall be used where colored insulation is not available. Branch circuit switch shall be yellow. Insulated ground wire shall be green, and neutral shall be gray. Color coding and phasing shall be consistent throughout the site, but bars at panelboards, switchboards, and motor control centers shall be connected Phase 1-2-3, top to bottom, or left to right, facing the front of the equipment.
 - 3. General purpose ac control cables shall be pink. General purpose dc control cables shall be blue.
 - 4. All spare cables shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.
 - 5. Terminal strips shall be identified by imprinted, varnished, marker strips attached under the terminal strip.

- C. Equipment: Equipment and devices shall be identified as follows:
1. Nameplates shall be provided for all panelboards, panels, starters, switches, and pushbutton stations. In addition to the name plates shown, control devices shall be equipped with standard collar-type legend plates.
 2. Control devices within enclosures shall be identified similar to the paragraph above.
 3. Three-phase receptacles shall be consistent with respect to phase connection of receptacle terminals. Errors in phasing shall be corrected at the bus, not at the receptacle.
 4. Toggle switches which control loads out of sight of switch, and all multiswitch locations of more than 2 switches, shall have suitable inscribed finish plates.
 5. Empty conduits shall be tagged at both ends to indicate the destination at the far end. Where it is not possible to tag the conduit, destination shall be identified by marking an adjacent surface.
 6. Provide typewritten circuit directories for panelboards; circuit directory shall accurately reflect the outlets connected to each circuit.
 7. Install identification tape directly above buried unprotected raceway; install tape 8 inches below grade and parallel with raceway to be protected. Identification tape is required for all buried raceway not under buildings or equipment pads except identification tape is not required for protection of street lighting raceway.

3.10 EXAMINATION

- A. Study all Drawings and Specifications and to report to the Engineer before bidding:
1. Any errors.
 2. Any omissions
 3. Any Electrical Code problems
 4. Any Local Building Code problems.
 5. Or any points of conflict with other trades.
- B. Review the existing site conditions and examine all shop drawings for the various items of equipment in order to determine exact routing and final terminations for all wiring and cables.
- C. The Contractor is responsible for the complete electrical and instrumentation Work:
1. Install extra conduits, cables, and interfaces as may be necessary to provide a complete and operating electrical, power, and Process Control and Instrumentation System.

3.11 GENERAL INSTALLATION

- A. Equipment locations shown on Electrical Drawings may change due to variations in equipment size or minor changes made by others during construction:
1. Verify all dimensions indicated on the Drawings:
 - a. Actual field conditions govern all final installed locations, distances, and levels.
 2. Review all information shown on the Contract Drawings, including architectural, structural, mechanical, instrumentation, and the accepted electrical and mechanical shop drawings, and coordinate Work as necessary to adjust to all conditions that arise due to such changes.

B. Cutting and patching:

1. Perform all cutting, patching, channeling, core drilling, and fitting required for the Electrical Work, except as otherwise directed:
 - a. Actual field conditions govern all final installed locations, distances, and levels.
 - 1) Before cutting, channeling, or core drilling any surface, ensure that no penetration of any other systems will be made.
 - a) Verify that area is clear and free of conduits, cables, piping, ductwork, post-tensioning cables etc.
 - b) Use tone-locate system or X-ray to ensure that area is clear of obstructions.
 - 2) Review the complete Drawing set to ensure that there are not conflicts or coordination problems before cutting, channeling, or core drilling any surface.
 2. Perform all patching to the same quality and appearance as the original Work. Employ the proper tradesmen to secure the desired results. Seal around all conduits, wires, and cables penetrating walls, ceilings, and floors in all locations with a fire stop material, typically:

a.	3M	CP25	Caulk
b.	3M	303	Putty
c.	T&B	S-100	Caulk
d.	T&B	FS-500	Putty
e.	T&B	FST-601	Putty
 3. Seal around conduit penetrations of below grade walls with a waterproof, non-shrink, nonmetallic grout. Use Fox Industries FX-225 or equal. Install in accordance with manufacturer's recommendations.

C. Earthwork and Concrete:

1. Install all trenching, shoring, concrete, backfilling, grading, and resurfacing associated with the electrical work.
2. Notify the Engineer before encasing or backfilling any electrical work and arrange for inspection.

D. Terminations:

1. Terminate all conductors required to interconnect power, controls, instruments, panels and other equipment otherwise specifically identified.

E. Miscellaneous Installation Requirements:

1. In case of interference between electrical equipment shown on the Drawings and the other equipment, notify the Engineer in writing of the proposed change:
 - a. Obtain Engineer's acceptance of the proposed changes before they are made.
2. Location of manholes and pullboxes shown on Drawings are approximate. Coordinate exact location of manholes and pullboxes with mechanical and civil Work.
3. Provide additional manholes or pullboxes to those shown where they are required to make a Workable installation.
4. Circuits of different service voltage:
 - a. Install in separate raceways, hand holes, pullboxes, and junction boxes.
 - b. In manholes, install all cables operating at less than 50 VDC PVC coated flexible metallic conduit.
 - c. The voltage and service levels are:

- 1) Medium voltage: 12:47 KV
- 2) Low voltage: 120V, 208V, 480V
- 3) Control: less than 50VDC

F. Labeling:

1. Provide all nameplates and labels as required on equipment.

G. Equipment Tie-Downs:

1. Anchor all instruments, control panels, and equipment by methods that comply with seismic and wind bracing requirements, which apply to the site.
2. All control panels, VCPs, LCPs, RTUs, PCMs, etc., must be permanently mounted and tied down to structures.

3.12 FIELD QUALITY CONTROL

A. Inspection:

1. Conduct inspection of electrical, instrumentation and control system installation.
2. Allow Owner, Engineer, or Owner's Representative access to site for inspection of materials, equipment, or installation at any time.
3. Provide any technical data or other assistance necessary to support inspection activities.
4. Electrical inspections include, but not limited to, the following:
 - a. Inspect equipment and materials for physical damage.
 - b. Inspect installation of compliance with plans and specifications
 - c. Inspect installation for obstructions and adequate clearances around equipment.
 - d. Inspect equipment installation for proper leveling, alignment, anchorage and assembly.
 - e. Inspect equipment nameplate data to verify compliance with design requirements.
 - f. Inspect raceway installation quality Workmanship and adequate support.
 - g. Inspect cable terminations.
 - h. Schedule Structural Engineer to inspect all mounting of electrical devices and all penetrations and connections to structures.
5. Inspection activities conducted during construction do not satisfy inspection requirements outlined in each section of the Division 26 specifications.

B. Testing:

1. When the electrical Work is substantially completed, notify the Engineer that the project is ready for Field Acceptance Testing.
2. Perform the acceptance test in conformance with each section of the Division 26 specifications.
3. Record results of the required tests along with the date of test:
 - a. Use conduit schedule identification numbers to indicate portion of circuit tested.

C. Workmanship:

1. Use only competent and skilled personnel experiences in their trade, Working under continuous competent supervision, to perform all Work, including installation, connection, calibration, testing, and adjustment.

- a. Perform all Work, including aesthetic as well as electrical and mechanical aspects, to standards consistent with the best practices of the trade.
2. All Work is subject to review by the Engineer or Owner at any time.
3. Provide all Work to the complete satisfaction of the Engineer or Owner.
4. Repair or replace any Work, which, in the sole opinion of the Engineer, does not conform to these Specifications, or trade practices.
5. Make all changes of any installed items to meet the intent of the Drawings and Specifications.
6. Install all materials and equipment in accordance with the Manufacturer's printed installation instructions.
 - a. Where Contractor asks to deviate from the Manufacturer's recommendations, such changes shall be reviewed by the Engineer and Manufacturer before installation.

3.13 CLEANING

- A. General Requirements:
 1. Maintain all surfaces to be painted in a clean and smooth condition.
 2. Remove all foreign material and restore all damaged finishes to the satisfaction of the Engineer and Owner.
 3. Remove all debris, rubbish, and scraps, etc. each night.
 4. Leave all areas swept clean each night.
 5. Wipe clean all exposed threads of conduit of the KOPR-SHIELD compound after installation.
- B. Vacuum clean all electrical enclosures of any debris before any wire or cable is installed.
- C. Clean and re-lamp all new and luminaries that were used in the area affected by the construction and return all used lamps to Owner.
- D. As specified in other Sections of the Specifications.
- E. Leave wiring in panels, manholes, boxes, and other locations neat, clean, and organized:
 1. Neatly coil and label spare wiring lengths.
 2. Shorten re-terminate, and re-label excessive spare wire and cable lengths, as determined by the Engineer.

END OF SECTION

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**SECTION 26 50 00
LIGHTING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. The general requirements for luminaries and light poles.

B. Related Sections

1. Contract Documents are a single integrated document, and as such all Divisions and Sections apply. It is the responsibility of the Contractor and its Sub-Contractors to review all sections to insure a complete and coordinated project.

1.2 DEFINITIONS

A. Definitions of terms and other electrical considerations as set forth in the:

1. National Electrical Code.
2. Institute of Electrical and Electronic Engineers.
3. National Fire Protection Association.
4. Illuminating Engineering Society.

1.3 SYSTEM DESCRIPTION

A. The Contractor shall furnish and install luminaries, and accessories for all lighting systems, complete and operable, all in accordance with the requirements of the Contract Documents.

B. Individual luminaire types etc. are identified in the plans and on the luminaire schedule.

1.4 SUBMITTALS

A. Furnish complete submittals in accordance with Section 26 05 00.

B. Product Data

1. Catalog literature for each luminaire specified cross referenced to the luminaire type found on the Luminaire Schedule in the plans.
 - a. Each such submittal shall clearly describe:
 - 1) Materials.
 - 2) Type of diffuser.
 - 3) Hardware.
 - 4) Gasketing.
 - 5) Reflector.
 - 6) Chassis.
 - 7) Finish.
 - 8) Ballast.
2. Complete literature for each luminaire substitutions.
 - a. Submittals for luminaries shall be sufficient for competent comparison of the proposed luminaire to the originally specified luminaire.

- 1) Photometric data shall include coefficients of utilization, average brightness, candle power distribution curves, and lumen output chart.
 - b. Substitutions for specified luminaires shall be based upon quality of construction, light distribution, appearance, and maintenance.
 3. Support method shall be submitted for interior fixtures weighing more than 50 pounds.
 4. Ballast catalog data indicating lamp wattage, input watts, sound rating, power factor, and type of ballast.
 - a. Data for outdoor ballast shall be include low temperature starting characteristics.
 5. Photocell data submittal shall indicate switching capacity, the means of adjusting the lighting pickup level, and enclosure.
 6. Pole-mounted luminaries, including complete data on the pole material, finish, handholes, anchoring, and fixture attachment.
 7. Pole height, dimensions, bolt hole circle layout, light supporting rating, and wind withstand rating based on effective area of luminaries, and hardware.
- C. Calculations
1. Provide mounting details for indoor lights with calculations showing that the installation meets the seismic requirements of the site.
 2. Calculations and design must be made by and stamped by a registered professional engineer registered in the state where the project is being constructed. In light of the fact that this design is being provided by a professional engineer the submittal will be reviewed for form and content but not reviewed for technical completeness, methods, or calculations.
- D. Record Drawings
1. The luminaire schedule in the plans must be updated to reflect the acceptable substitutions, after the substitution has been reviewed and accepted by the Engineer.

1.5 QUALITY ASSURANCE

- A. Without limiting the generality of other requirements of these specifications, all work hereunder shall conform to the applicable requirements of the referenced portions of the following documents, to the extent that the requirements therein are not in conflict with the provisions of this Section.
1. National Electric Code.
 2. Underwriters Laboratories.
 3. ANSI C82.1 Specifications for Fluorescent Lamp Ballasts.
 4. ANSI C84.4 Specifications for High-Intensity-Discharge Lamp Ballasts (Multiple Supply Type).
 5. Standards of the Certified Ballast Manufacturer's Association.
 6. Illuminating Engineering Society (IES).

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Luminaries shall be stored in their original cartons from the manufacturers until the time of installation.
- B. Luminaire poles shall be stored on blocks above grade until the time of installation.

1.7 PROJECT/SITE CONDITIONS

- A. Seismic and wind withstand ratings in accordance with Section 26 05 00.

1.8 SEQUENCING AND SCHEDULING

- A. Exterior lighting system operation shall be demonstrated during the hours of darkness.
- B. Lighting demonstration shall occur within 2 weeks prior to project acceptance.

1.9 WARRANTY

- A. The Contractor shall warrant all luminaries, ballasts, and lamps for a minimum period of one (1) year from Substantial Completion unless otherwise specified by the General Conditions.
 - 1. Furnish, and replace any defective equipment during that period at no charge to the Owner.
 - 2. Said warranty shall be independent of any manufacturer infant mortality or normal failure statistics.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Pre-approved manufacturers are indicated on the Luminaire Schedule, and in notes on the drawings.
 - 1. This selection of manufacturer's is not intended to be overly restrictive and the Contractor may make substitutions from the manufacturers listed in the Luminaire Schedule in order to offer a more advantageous luminaire package.
 - 2. The lighting design and luminaire selection has been based upon the photometrics of the identified luminaries. It is the Contractor's responsibility to insure and prove to the Engineer at time of submittal that any substitutions meet the quality and photometric requirements of the original design.
 - 3. The Engineer shall make final determination if proposed substitutes are acceptable.
 - a. The Contractor shall furnish the identified luminaries at no additional cost to the Owner for any luminaire substitutions that in the sole opinion of the Engineer, are not acceptable.

2.2 EQUIPMENT

- A. Luminaries – General
 - 1. All luminaries shall be pre-wired with leads of 18-AWG, minimum, for connection to building circuits.
 - 2. In general the luminaries furnished shall be as per the Luminaire Schedule. The specifications apply to those luminaries not described or as an addition or supplement to the luminaire schedule.
- B. Exterior Luminaries

1. Exterior luminaries in combination with their mounting pole and bracket shall be capable of withstanding winds of levels consistent with the levels identified in Section 26 05 00 without damage.
 2. Exterior luminaries shall have corrosion-resistant hardware and hinged doors or lens retainer.
 3. Luminaries specified to be furnished with integral photo-electrical control shall be of the luminaire manufacturer's standard design.
- C. Interior Luminaries
1. Interior luminaries without diffusers shall be furnished with end plates.
 2. Where diffusers are required, they shall be of high molecular strength acrylic.
 - a. Minimum thickness of the acrylic shall be 0.125 inches for all diffusers, except that those on 4-foot square fixtures shall be 0.187 inches thick.
- D. Photo-Electric Cells
1. Photoelectric cells for control of multiple fixtures shall be self-contained, weatherproof type and shall be provided with time-delay features.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Special Techniques
1. Luminaries shall be installed plumb and square with building and wall intersections.
 - a. Pendant-mounted luminaries which are mounted from sloping ceilings shall be suspended by ball hangers, unless otherwise indicated on the Drawings.
 - b. Luminaries installed in machinery rooms shall be located after machines have been installed.
 2. In all cases, luminaire locations shall be coordinated with work of other trades to prevent obstruction of light from the fixtures.
 3. Unless otherwise indicated, luminaries shall be centered on ceiling tiles.
 4. Luminaries weighing more than 25 pounds shall be supported independently of the outlet box.
 5. Recessed luminaries shall be installed light-tight to the ceiling and shall be provided with auxiliary safety supports attached directly to the building structure.
 - a. Said safety supports shall consist of #12 AWG soft drawn galvanized wire.
 6. Luminaries installed in suspended grid ceilings shall be supported independently of the grid.
 7. All luminaries installed in suspended grid ceilings shall be held in place with seismic restraint clips.
- B. Lighting Poles
1. Poles shall be set on anchor bolts and secured with double nuts on each bolt.
 2. After luminaire has been leveled and plumbed, the pole base shall be dry-packed.
 3. Poles that are specified as hinged shall have one pole lowering winch furnished for all of the poles.

3.2 ADJUSTING

- A. All outdoor luminaries shall be aimed after installation during dark evening hours as directed by the Engineer.

3.3 CLEANING

- A. Lenses, diffusers, and reflectors shall be cleaned just prior to the time specified for the system demonstrations.
- B. Luminaire trim, poles and support brackets, where finish has been damaged, shall be refinished.
- C. All luminaries used during construction for construction lighting shall be cleaned, the lamps shall be replaced, and the used lamps returned to the Owner.

3.4 DEMONSTRATION

- A. Exterior lighting system operation shall be observed to indicate that fixtures are properly focused, photo-cell operation is correct, and that switching functions as intended in accordance with the drawings.
- B. Similar requirements shall apply to interior lighting.
- C. Through demonstration, the Contractor shall also verify that panel schedules properly indicate the lighting outlets connected to each circuit.

3.5 SCHEDULES

- A. Refer to the Luminaire Schedules as found in the plans.

END OF SECTION

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**DIVISION 31
EARTHWORK**

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**SECTION 31 10 00
SITE PREPARATION**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SITE INSPECTION

- A. Prior to moving onto the Project site, the Contractor shall inspect the site conditions and review maps of the existing plant site and off-site pipeline routes and facilities delineating the Owner's property and right-of-way lines.
- B. Contractor shall submit photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site preparation.
- C. The Contractor shall identify and accurately locate utilities and other subsurface structural, electrical, and mechanical conditions. Existing conditions shall be incorporated into the record drawings for the project.

1.3 DEFINITIONS

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
 - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.
 - 1. Employ a qualified arborist, licensed in jurisdiction where project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
 - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.3 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.

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

3.4 SITE ACCESS

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

3.5 CLEARING, GRUBBING, AND STRIPPING

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

- E. Upon completion of Work within the construction areas stripped of topsoil, the stored topsoil shall be respread over the disturbed areas. Topsoil shall be spread in about a 6-inch layer. Respread topsoil shall match the existing terrain as much as possible. Interfaces between restored disturbed areas and undisturbed areas shall be chain dragged to eliminate obvious edges. All tracks and equipment marks shall be chain dragged or hand raked away. Replaced topsoil shall be thoroughly watered for dust control upon completion of the resspreading operations. Once topsoil replacement has been completed, no vehicles or other motorized equipment shall be allowed to travel on the finished surface.
- F. Unless otherwise indicated, native trees larger than three inches in diameter at the base shall not be removed without the Engineer's approval. The removal of any trees, shrubs, fences, or other improvements outside of rights-of-way, if not necessary for the Contractor's choice of means and methods, shall be arranged with the property owner and be removed and replaced at no increased cost to the Owner.
- G. Except in areas to be excavated, holes and other holes resulting from Work of this section shall be backfilled with suitable material in accordance with Section 31 23 00 – Earthwork.

3.6 SITE IMPROVEMENTS

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

3.7 DISPOSAL

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

END OF SECTION

**SECTION 31 23 00
EARTHWORK**

PART 1 - GENERAL

1.1 THE REQUIREMENT

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

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

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

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

1.3 CONTRACTOR SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

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

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

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

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

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

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

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

Pea Gravel or Squeegee is not acceptable as sand backfill.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

5. Proportion the CLSM to be a flowable, nonsegregating, self-consolidating low shrink slurry. The Contractor shall determine the materials and proportions used to meet the requirements of these Specifications.
6. Admixtures:
 - a. Air entraining admixture per ASTM C260
 - b. Water reducing admixture per ASTM C494

7. The unconfined compressive strength at 7 days shall be a minimum of 80 psi and a maximum of 200 psi. Contractor shall form a minimum of six test cylinders with proposed materials to confirm design strength and mix design. Four of the cylinders shall be broken at 7 days in conformance with applicable concrete cylinder specifications and results provided to Engineer. The remaining two cylinders shall be broken by Contractor at discretion of Engineer. Initial mix design and cylinder breaks shall be completed at least 28 days prior to use of the material on the jobsite. Final mix approval and use of the material shall not occur prior to confirmation of strength by the cylinder breaks.
8. The temperature of the CLSM discharged into the trench shall be below 90 degrees F but above 50 degrees F. Air temperature is to be 40 degrees F and rising. Do not place against frozen subgrade or other materials having temperature less than 32 degrees F. Protect flowable fill from temperatures below 40 degrees F for 72 hours.
9. Finish flowable fill smooth and to the grade indicated, finish free from fins, bulges, ridges, offsets and honeycombing. Wood float, steel trowel or similar is not required.
10. CLSM backfill under concrete structures shall be protected during curing as specified Section 03 30 00 - Cast-in-Place Concrete.
11. CLSM shall be tested in accordance with ASTM D 4832, ASTM D 5971, ASTM D 6023, and ASTM D6103

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

2.2 UNSUITABLE MATERIAL

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

2.3 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

- A. Use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder.
- B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, notify the Engineer immediately. In case of conflict between types of pipe embedment backfills, use the agency-specified backfill material if that material provides a greater degree of support to the pipe, as determined by the Engineer. In case of conflict between types of trench or final backfill types,

use the agency-specified backfill material if that material provides the greater in-place density after compaction.

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

2.4 PIPELINE MARKING TAPE

- A. Metallic Tape: Tape shall be minimum 5.5 mils thick aluminum foil imprinted on one side, encased in high visibility inert polyethylene jacket. Tape shall be a minimum of 6 inches wide. Imprinted lettering shall be 1 inch tall, permanent black, as indicated. Joining clips shall be manufacturer's standard tin or nickel coated. Tape shall be as manufactured by Reef Industries (Terra "D"), Allen (Detectatape), or equal.
- B. Plastic Tape: Tape shall be minimum 4-mil thick polyethylene which is impervious to alkalis acids, and chemicals and solvents which are likely in the soil. Tape shall be a minimum of 6 inches wide and lettering shall be 1-inch tall permanent black on a colored background. Tape shall be manufactured by Reef Industries (Terra Tape), Allen (Markline), or equal.
- C. Warning Tape: Warning tape manufactured for marking and identifying underground utilities continuously inscribed with a description of utility, colored as follows:
 - 1. Red; Electric.
 - 2. Yellow; Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water Systems.
 - 5. Green: Sewer Systems.

2.5 MATERIALS TESTING

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

PART 3 - EXECUTION

3.1 EXCAVATION – GENERAL

- A. General: Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including rock and all obstructions of any nature that would interfere with the proper execution and completion of the Work. The removal of said materials shall conform to the lines and grades indicated or ordered.

Unless otherwise indicated, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. Furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations. Excavations shall be sloped or otherwise supported in a safe manner in accordance with safety requirements of the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

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

3.2 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

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

- C. Notification of Engineer: Notify the Engineer at least 3 days in advance of completion of any structure excavation and allow the Engineer a review period of at least 1 day before the exposed foundation is compacted or is covered with backfill or with any construction materials.

3.3 PIPELINE AND UTILITY TRENCH EXCAVATION

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

3.4 OVEREXCAVATION NOT ORDERED OR INDICATED

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

3.5 EXCAVATION IN LAWN AREAS

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

3.6 EXCAVATION IN VICINITY OF TREES

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

3.7 BACKFILL – GENERAL

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

3.8 PLACING AND SPREADING OF BACKFILL MATERIALS

- A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that the depth of each uncompacted layer shall not exceed 8 inches of compacted thickness.
- B. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted the pipe zone backfill will provide uniform bearing and side support.
- C. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved.
- D. Where the backfill material moisture content is too high to permit the indicated degree of compaction the material shall be dried or mixed with drier material until the moisture content is satisfactory.

3.9 COMPACTION OF EARTH FILL, BACKFILL, AND EMBANKMENT MATERIALS

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

- G. **Compaction Requirements:** The following compaction test requirements shall be in accordance with ASTM D 1557, method C. Compaction shall be obtained with the moisture content within plus or minus 2 percent of the optimum moisture content. Where agency or utility company requirements govern, the highest compaction standards shall apply.

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

3.10 PLACEMENT OF CLSM

- A. Following placement and anchoring of the pipe, remove all loose soil from trench walls and floor. Remove any unstable soil at the top of the trench, which might fall into the trench during placement of the CLSM.
- B. Prior to placement of CLSM, the pipeline steel temperature shall be controlled as specified in Section 33 11 11 – Steel Pipe.
- C. Deliver the CLSM to the trench in ready mix trucks and utilize pump or chutes to place the CLSM in the trench. Direct CLSM to one side of the pipe, taking care not to displace the pipe at any time. Continue placing CLSM on one side of the pipe until CLSM has gone under the pipe and up the other side to a depth of 1.5 feet above the pipe bottom. Use at least two hand-held vibrators to continuously liquefy and move CLSM into all voids. Adjust water in mixture to maintain fluid consistency but maintain strength requirements. Continue placing CLSM on both sides of the pipe continuously using two vibrators for every 30 feet of pipe run.
- D. Maintain stability of pipe throughout CLSM placement. CLSM will likely require placement in lifts to prevent pipe flotation. No movement of the pipe caused by flotation will be allowed. If any movement occurs, the CLSM material shall be removed and the pipe placed back on line and grade. Any damage to the pipeline system caused by movement of the pipe shall be removed and/or repaired in full conformance with these Contract Documents at no additional cost to the Owner. Remove all sloughed material or other debris from top of previously placed CLSM.

3.11 PIPE AND UTILITY TRENCH BACKFILL

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

18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade.

- C. Marking Tape Installation:
 - 1. Continuously install metallic marking tape along the pipe at a depth of 3 feet below finish grade.
 - 2. Continuously install plastic marking tape along the pipe at the elevation indicated on the Drawings.
- D. Final Backfill: Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway subgrade.

3.12 FIELD TESTING

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

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**SECTION 31 32 19
GEOTEXTILES**

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

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

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

1.3 DEFINITIONS.

- A. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.
- B. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile provided.
- C. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile provided.

- D. Nondestructive Sample: Sample representative of finished geotextile, prepared for testing without destruction of geotextile.
- E. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.
- F. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D 4884.
- G. Woven geotextile: A geotextile fabric composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern.
- H. Nonwoven geotextile: A geotextile fabric composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern.

1.4 SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

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

protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

PART 2 - PRODUCTS

2.1 WOVEN GEOTEXTILE

- A. Woven geotextile shall be composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern. Products shall be calendared or finished so that yarns will retain their relative position with respect to each other.
- B. Polymeric yarn shall be long-chain synthetic polymers (polyester or polypropylene) with stabilizers or inhibitors added to make filaments resistant to deterioration due to heat and ultraviolet light exposure.
- C. Sheet Edges: Selvaged and finished to prevent outer material from separating from sheet.
- D. Unseamed Sheet Width: Minimum 12 feet.
- E. Nominal Weight per Square Yard: 6 ounces.
- F. Physical Properties: Conform to physical property requirements below:

Property	Requirement	Test Method
Apparent Opening Size (AOS)	No. 10 to No. 100 U.S. Standard Sieve Size	ASTM D4751
Water Permittivity	0.02 to 3.34 Sec. ⁻¹ , MinARV	ASTM D4491 (Falling Head)
Vertical Water Flow Rate	10 to 150 gpm/sq ft, MinARV	
Wide Width Strip Tensile Strength	60 to 1,500 MinARV	ASTM D4595
Wide Width Strip Elongation	14 to 60 percent, MaxARV	ASTM D4595
Trapezoidal Tear Strength	30 to 200 lb, MinARV	ASTM D4533
Puncture Strength	50 to 250 lb, MinARV	ASTM D4833
Abrasion Resistance	5 to 25 percent loss, 250 cycles, MaxARV	ASTM D4886
Ultraviolet Radiation Resistance	70 to 90 percent strength retention, MinARV after 500 hours	ASTM D4355

2.2 NONWOVEN GEOTEXTILE

- A. Nonwoven geotextile shall be composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern. Products shall be calendared or finished so that yarns will retain their relative position with respect to each other.

- B. Polymeric yarn shall be long-chain synthetic polymers (polyester, polypropylene, or polyethylene) with stabilizers or inhibitors added to make filaments resistant to deterioration due to heat and ultraviolet light exposure.
- C. Geotextile Edges: Selvaged or finished to prevent outer material from separating from sheet.
- D. Unseamed Sheet Width: Minimum 6 feet.
- E. Nominal Weight Per Square Yard: 8 ounces.
- F. Physical Properties: Conform to physical property requirements below:

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

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

2.3 SEWING THREAD

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

2.4 SECURING PINS

- A. Securing pins shall be steel rods or bars conforming to the following:
 1. 3/16-inch diameter.
 2. Pointed at one end; head on other end, sufficiently large to retain washer.
 3. Minimum Length: 12-inches.
- B. Steel Washers for Securing Pins:
 1. Outside Diameter: Not less than 1-1/2 inches.
 2. Inside Diameter: 1/4-inch.

3. Thickness: 1/8-inch.
- C. Steel Wire Staples:
1. U-shaped.
 2. 10-gauge.
 3. Minimum 6-inches long.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Laying Geotextile
1. Notify the Engineer whenever geotextiles are to be placed. Do not place geotextile prior to obtaining Engineer's approval of underlying materials.
 2. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.
- B. Orientation on Slopes
1. Orient geotextile with long dimension of each sheet parallel to direction of slope.
 2. Geotextile may be oriented with long dimension of sheet transverse to direction of slope only if sheet width, without unsewn seams, is sufficient to cover entire slope and anchor trench and extend at least 18-inches beyond toe of slope.
- C. Joints.
1. Unseamed Joints.
 - a. Overlap unseamed joints to the following dimensions unless otherwise indicated:
 - b. Foundation/Subgrade Stabilization: Minimum 18-inches.
 - c. Riprap: Minimum 18-inches.
 - d. Drain Trenches: Minimum 18-inches, except overlap shall equal trench width if trench width is less than 18-inches.
 - e. Other Applications: Minimum 12-inches.
 2. Sewn Seams.
 - a. Use sewn seams wherever stress transfer from one geotextile sheet to another is necessary. Sewn seams, as approved by Engineer, also may be used instead of overlap at joints for applications that do not require stress transfer.
 - b. Seam efficiency shall be minimum 70 percent.
 - c. Type: "J" type seams are preferred, but flat or butterfly seams are acceptable.
 - d. Stitch Count: Minimum 3 to maximum 7 stitches per inch.
 - e. Stitch Type: Double-thread chain stitch, Type 401, Federal Standard No. 751a.
 - f. Stitch Location: 2-inches from geotextile sheet edges, or more if necessary to develop required seam strength.
 - g. Sewing Machines: Capable of penetrating 4 layers of geotextile.
- D. Securing Geotextile.
1. Secure geotextile during installation as necessary with sand bags or other means approved by Engineer.
 2. Securing Pins
 - a. Insert securing pins with washers through geotextile, midway between edges of overlaps and 6-inches from free edges.

b. Spacing:

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

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

E. Placing Products over Geotextile.

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

F. Installing Geotextile in Trenches.

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

G. Riprap Applications.

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

H. Geotextile-Reinforced Earth Wall Applications.

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

I. Silt Fence Applications.

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

3.2 REPAIRING GEOTEXTILE

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

3.3 REPLACING CONTAMINATED GEOTEXTILE

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

3.4 FIELD QUALITY CONTROL

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

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DIVISION 32
EXTERIOR IMPROVEMENTS

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SECTION 32 80 00
LANDSCAPE IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY OF PROJECT

A. Work to be done on Project shall:

1. Include all labor, materials, equipment, tools and transportation.
2. Perform all operations, in connection with and reasonably incidental to; the complete installation of the irrigation system.
3. Follow direction is shown on the plan sheets, legend, notes, details, specifications (the Construction Documents, hereafter referred to as CD's).

B. Items of work specifically included are:

1. Procurement of all applicable licenses and permits.
2. Payment of any fees for connection to water source and power source.
3. Coordination of location of underground utilities, by contacting local services: 'Blue Stakes' or 'Call Before You Dig'.
4. Sleeving necessary for irrigation pipe and wire.
5. Provision for and connection of the electrical power supply to the irrigation control system.
6. One-year warranty of all irrigation components and all labor required to install.
7. 90-day maintenance period of irrigation system and components.

C. All disturbed areas shall receive irrigation unless specifically indicated on CD's.

D. Revise, repair, and/or restore existing irrigation system to continue operation of existing components and to accommodate new construction. All plant material on the Project shall be irrigated unless specifically indicated on CD's.

E. Contractor shall note that location or routing of irrigation components on CD's is approximate. Piping, sleeving and/or other components may be shown schematically on CD's for graphic clarity and to demonstrate component groupings and separations. All irrigation components shall be placed in landscaped areas, except for pipe and wire in sleeving under hardscaped areas.

1.2 DEFINITIONS

A. Construction Documents: All documents provided to Contractor for proper installation of irrigation system; including plan sheets, legend, notes, details, specifications and supplemental plan issues or addenda. Referred to in this section by the acronym CD's.

B. Contract: For the purposes of the irrigation section of the specification, (Section 32 80 00) this term refers to the Contract, Sub-Contract, or portion of the Contract dealing only with the irrigation system.

- C. Contractor: For the purposes of the irrigation section of the specification this term refers to the specific contractor or sub-contractor responsible for installation of the irrigation system for this project.
 - D. GPM: Acronym for Gallons per Minute.
 - E. Isolation Valve: A manual valve located on the main line that when shut off, will remove constant pressure to a specific section of the main line and corresponding downstream irrigation components.
 - F. Line Valve: A manual valve located on the main line that when shut off, restricts flow in the main line. More than one line valve must be shut off to isolate a section of main line and corresponding downstream irrigation components.
 - G. Lateral Line Piping: Circuit piping downstream of remote-control valve (RCV) providing water to sprinkler heads, bubblers, or drip components. Under pressure only when RCV activated and opened.
 - H. Line Voltage Wiring: Wiring used to convey power to electrically operated equipment on the Project, such as 120 VAC, 240 VAC, or 480 3PH VAC.
 - I. Low Voltage Wiring: Wiring used to convey power to irrigation system components, such as RCV's, master valve, flow meter, decoders, etc. An example would be: 14 AWG PE UL RCV control wire.
 - J. Main Line Piping: Piping downstream of Point of Connection (POC). Provides water to RCV's, Quick Couplers, and hose bibs. Normally under constant pressure.
 - K. OAR: Acronym for Owner's Approved Representative. This individual designated by Owner who is authorized to make decisions on behalf of the Owner. This individual is authorized by the Owner to direct actions of the Contractor. This individual shall have detailed involvement in the project and be on Project site at regular intervals.
 - L. POC: Acronym for Point of Connection. The physical location of the water source for this Project, and the actual components installed connecting to the water source. May require Contractor to provide additional saddles, valves, nipples, fittings, spools etc. to provide water to the Project.
 - M. RCV: Acronym for Remote Control Valve. An electrically operated 24 VAC valve.
 - N. Static Pressure: Pressure measured at the POC, with no flow taking place within the system.
 - O. Water Supply: Potable, and/or Non-Potable, and/or Effluent piping and components, furnished and installed by trades or contractors other than the irrigation contractor; to provide irrigation water to this Project upstream of (prior to) the POC.
- 1.3 ELIGIBILITY TO BID
- A. The minimum level of expectation for Experience and Qualifications required to be eligible to bid the irrigation system on this Project are listed below in this section.

1. See Sections referring to 'Experience, Qualifications and Certifications' for more information and details.
 2. Contractor shall follow these requirements at the bid date.
- B. Contractor shall be prepared to submit documentation supporting their Experience and Qualifications to the General Contractor and the OAR within 48 hours of bid date. Failure to provide supporting documents within 48 hours of bid may result in elimination of the Contractor's bid or his ability to work on this Project.
- C. Failure to meet the minimum requirements for Experience and Qualifications may result in elimination of the Contractor's bid or his ability to work on this Project.
- D. Requirements for documentation of Certifications are also listed below in the same Section. Contractor shall not be required to submit documentation of Certification at Bid date, but at date indicated.

1.4 PROJECT CONDITIONS

- A. Contractor shall accept Project site in 'as-is' condition.
- B. Contractor shall revise, restore, repair existing irrigation system to return to or continue operation of system outside project area of disturbance.
- C. Interruption of water service
1. Should irrigation installation require shut-down of existing Project irrigation system, Contractor shall be responsible to coordinate with and receive approval from OAR. Contractor shall be responsible to restore operation of existing irrigation systems within 48 hours.
 2. Contractor shall be responsible for continuous provision of irrigation water maintaining all existing or new plant material on Project in a healthy condition during full term of this project.
- D. Contractor shall maintain Project work area in a safe condition, and provide flagging, taping, barricades, trench covering, shoring and or fencing necessary to maintain safety.

1.5 PERFORMANCE REQUIREMENTS

- A. Minimum pressure and minimum flow required:
1. Irrigation CD's expect that the POC has available a minimum static pressure and a minimum flow capable to safely and efficiently operate irrigation system as designed. Minimum design requirements are listed in plan legend.
 2. Contractor shall perform static/working pressure and volume test within 48 hours of commencement of work and provide written results to OAR.
- B. Responsibility for coverage:
1. Irrigation system basic design intent is to provide 100% coverage of sprinklers (also known as double coverage or head-to-head coverage.)

2. Contractor shall have authority to make minor adjustments to actual placement of sprinkler heads or irrigation components vs. locations shown on plan, in order to best achieve full coverage indicated above, without significant overspray on hardscapes, buildings or other project features.
3. Contractor shall notify OAR in writing of potential discrepancies or weaknesses due to field conditions; in implementing irrigation CD's.

C. Layout of Components

1. During layout and staking, consult with OAR to verify proper placement of major irrigation components.
2. Contractor shall not proceed with implementation of CD's without OAR's approval.
3. Contractor shall have authority to make minor adjustments to pipe routing or equipment locations due to conflicts with site utilities or other obstructions.

1.6 SEQUENCING

- A. Contractor shall contact local utility locator service at least 48 hours prior to commencement of work on the Project.
- B. Contractor shall familiarize with himself with site utilities and hazards prior to commencement of work.
- C. Contractor shall coordinate this work with other work by other trades on Project as well as other landscape tasks on Project.
- D. Install sleeving prior to installation of concrete flat work, paving or other permanent site elements as needed.
- E. Irrigation system Point of Connection components, backflow prevention and pressure regulation devices shall be installed and operational prior to all downstream components.
- F. All main lines shall be thoroughly flushed of all debris prior to installation of Remote-Control Valves.
- G. All lateral lines shall be thoroughly flushed of all debris prior to installation of any sprinkler heads.

1.7 REFERENCE DOCUMENTS

- A. The following references apply to this project, the Contractor shall be responsible to be familiar with, refer to, and implement these references in completion of this project:
 1. ASTM – American Society for Testing and Materials.
 2. Irrigation Association: Turf and Landscape Irrigation Best Management Practices (BMPs).
 3. American Society of Irrigation Consultants (ASIC) 'ASIC Guideline 100-2002 (January 2, 2002) For Earth Grounding Electronic Equipment in Irrigation Systems.
 4. Utah Irrigation Professionals document: Minimum Standards for Landscape Design and Construction.

5. Any other existing local governing agency codes, ordinances and/or any standards, details and specifications for irrigation agency may have.
 6. Applicable industry codes, ordinances or standards such as (but not limited to) UBC or NEC.
- B. Generally, this specification section shall take precedence over all others. Any discrepancies discovered by Contractor shall be brought to OAR's attention within 8 hours via telephone and within 48 hours in writing. Contractor shall not proceed with work until OAR provided direction or approval.

1.8 RELATED SPECIFICATION SECTIONS

- A. 32 90 00 Landscaping

1.9 SUBMITTALS

- A. Contractor shall follow format and requirements as set forth in General Conditions section of this specification document for materials submittals.
- B. Contractor shall provide submittal for irrigation equipment and materials prior to ordering or taking delivery of any products.
- C. Equipment or materials purchased or installed prior to receiving written submittal approval is at risk of rejection by OAR. Contractor may be liable for removal or replacement of any or all non-approved products at his own expense.
- D. Contractor shall provide OAR with 2 copies of Operations and Maintenance manual, containing:
1. Copy of approved submittal products
 2. Instruction for Spring Start-up and Winterization.
 3. Site map showing Controller zones, each zone distinguished by a different color.
 4. Table showing typical Controller program schedule for worst case day.
 5. Copy of control system certification if required for this Project.

1.10 EXPERIENCE

- A. Contractor shall provide an Experience resume or document; in pdf format, indicating:
1. That Contractor is licensed to perform landscape and irrigation construction in the State where Project resides.
 2. That Contractor is bondable and insured for the work to be performed.
 3. That Contractor has been installing sprinkler systems on commercial projects for the last five previous years.
 4. References of five projects of similar scope and size completed within the last five years. Three of the projects listed shall be local.

1.11 QUALIFICATIONS

- A. Contractor shall provide a Qualifications resume or document; in pdf format indicating:
1. That Contractor currently employs both skilled and unskilled workers in enough quantities to complete project within time limits indicated by Contract.
 2. A list of employees to be assigned to this project and their irrigation experience.
 3. Contractor shall include a listing of the supplier(s) where irrigation related material will be purchased for this Project.
 4. That Contractor possesses proper power equipment of appropriate size and quantity to complete project within time limits indicated by Contract.
 5. Person on project site, in charge of irrigation daily field operations: (Project Foreman, Superintendent, Supervisor etc.)
 - a. Has at least five consecutive years of commercial irrigation experience.
 - b. This person can communicate with OAR. Is fluent in reading, writing and speaking English.
 - c. Is a Certified Irrigation Contractor (CIC) in good standing as set forth by the Irrigation Association. This person shall be on the project site at least 75% of each working day.
 - i. Contractor's CIC shall be a regular full-time employee of the Contractor firm, or a sub-contractor to Contractor, where sub-contractor's firm provides all irrigation installation for the Project and meets all listed requirements for Experience, Qualifications and Certifications.
 - ii. NOTE: Contractor shall not engage a CIC as a consultant or representative to oversee Contractor's staff install the Project irrigation system, i.e. the Contractor shall not 'rent' a CIC or CIC's license.

1.12 CERTIFICATIONS

- A. Contractor shall provide copies of appropriate Certification documents for all applicable staff. In order to provide a minimum level of workmanship, all installation personnel expected to perform any tasks involving PVC pipe, electrical components, and or drip components; shall have Certificates for each task they perform as designated below:
1. All installation personnel who will work on PVC pipe and PVC fittings in the irrigation system shall be certified by IPS Corporation. The certification shall cover PVC pipe and fitting assembly using solvent weld joining techniques. It is the responsibility of the Contractor to obtain such certification and to provide a copy of the "Certificate of Completion" for each person handling PVC products on the project to the OAR prior to commencement of work. It is the Contractors responsibility to contact IPS Corporation and then the local IPS authorized representative well in advance of commencement of work to schedule his/her attending of a scheduled seminar or to make an appointment to schedule a new seminar. Contact IPS Corporation, Weld-On Customer Service at 800 421-2677, to obtain a referral for the local IPS factory authorized representative contact information.
 2. All installation personnel who will work on the electrical circuits of the irrigation system shall be certified by Paige Electric Co., LP. The certification shall cover irrigation wires, cables, proper installation and splicing methods, and protecting electronic equipment from lightning and power surges. It is the responsibility of the Contractor to obtain such certification and to provide a copy of the "Certificate of

Completion" for each person installing electrical products on the project to the OAR prior to commencement of work. It is the Contractors responsibility to contact Paige Electric well in advance of commencement of work to schedule his/her attending of a scheduled seminar or to make an appointment for a new one. Contact Vince Nolletti, Vice President Irrigation Operations, Paige Electric Co, LP, 559 431-2346.

3. If Drip irrigation products are to be used on this Project, all installation personnel who will work on drip components of the irrigation system shall be certified by the manufacturer of the corresponding drip products specified to be used on the Project. The certification shall cover proper application and installation of point source and inline drip irrigation products, and adaptation of drip product to Project soil types and infiltration rates. It is the responsibility of the Contractor to obtain such certification and to provide a copy of the "Certificate of Completion" for each person installing drip products on the project to the OAR prior to commencement of work. It is the Contractors responsibility to contact the drip product manufacturer and the local manufacturer's authorized representative well in advance of commencement of work to schedule his/her attending of a scheduled seminar or to make an appointment for a new one. Courtesy contact information for the following manufacturers is shown below)
-Rain Bird Corporation—Dave Chandler (801) 664-6798
4. Documents verifying certifications for the following shall be provided to OAR through the General Contractor at least 7 days prior to commencement of any irrigation work on the Project:
 - a. PVC Solvent Weld certification
 - b. Electrical certification
 - c. Drip certification

1.13 QUALITY ASSURANCE

A. Inspection Scheduling

1. Contractor shall expect a minimum of five irrigation inspections:
 - a. Main Line pipe and wire
 - b. Main Line pressure test
 - c. Progress inspection
 - d. Final inspection
 - e. Completed Punch list inspection

B. Main Line Piping

1. Main line pipe shall not be buried until approved by OAR. Pipe buried prior to approval shall be excavated and exposed for OAR's review.
2. Upon completion of main line pipe or sections thereof, Contractor shall isolate and pressurize to 150 PSI for two hours. OAR shall determine acceptable amount of loss. Contractor shall expect to provide a test with losses not to exceed between 0.5% and 5%
3. Contractor shall provide OAR with 48 hours request prior to testing date and time.

C. Grounding Resistance Testing

1. Pedestal Controllers shall be tested by Licensed Electrical Contractor and show resistance of 10 Ohms or less.
2. Grounding not in compliance shall be corrected by Contractor at his expense.
3. Specific grounding requirements for Central Control systems shall be met by Contractor or corrected at his expense.

D. Project Record Copy

1. Maintain on Project site, one copy of all CD's clearly marked 'Project Record Copy'. Mark any deviation in material installation on CD's. Maintain and update sheets at least weekly.
2. Project Record Copy shall be available to OAR on demand.

E. Regulatory Requirements

1. Contractor shall comply with all plumbing requirements which direct work to be done by a licensed plumber.
2. Contractor shall comply with all electrical requirements which direct work to be done by a licensed electrician.
3. All work and materials shall be according to any and all rules, regulations or codes, whether they are local, state or national requirements.
4. CD's may not be construed or interpreted to permit work or materials not conforming to the above codes.

F. Adequate Water Supply

1. Water supply to this Project is or shall be installed by trades other than the Irrigation Contractor. Connection to this supply at the POC shall be by this Contractor. Contractor shall be responsible to verify that proper connection exists and is of adequate size and pressure.
2. Notify OAR verbally immediately and in writing within 48 hours of problems encountered with water supply.

G. Workmanship and Materials

1. It is the intent of the Irrigation CD's that all material required shall be of the highest quality available and meeting the requirements specified.
2. All work shall be performed in accordance with the best standards of practice relating to this trade.

1.14 PROJECT MATERIALS

- A. Owner shall retain option to purchase materials to be used on Project and provide them to Contractor. Owner shall not provide materials for Project.
- B. Contractor shall not remove materials purchased for this Project from this site.
- C. Contractor shall not store or co-mingle materials for this Project with materials for other Projects on this site.
- D. Delivery, Storage and Handling

1. All materials shall be protected from contamination, damage, vandalism and prolonged exposure to sunlight.
 2. All material stored on project site shall be neatly organized in a compact arrangement, and this storage shall not disrupt project owner or other trades on Project site.
 3. Project materials shall be handled by Contractor with care necessary to prevent damage or breaking.
 4. Damaged or blemished materials attributed to Contractor shall be replaced with new, at Contractors expense.
- E. If this Project qualifies for manufacturer rebate, credit or incentive programs; Contractor shall provide OAR with documents in pdf format from distributor and/or manufacturer indicating required information of product purchased and/or dollar value which qualify for corresponding program. Documents shall be delivered within 14 days of purchase of products.

1.15 EXTRA MATERIALS

A. Furnish the following items to OAR:

1. One (1) 30" gas cock key (also referred to as sprinkler or meter key) for manual drains.
2. One (1) 5-6' key for 2" square operating nut valve.
3. One (1) 5-6' key for stop & waste valve.
4. Two (2) keys for each automatic controller.
5. Two (2) quick coupler keys with hose swivels attached.
6. One (1) quick coupler valve.
7. One (1) of each size or type of remote-control valve used on Project.
8. Five (5) of each sprinkler head and each nozzle used on Project.
9. Two (2) of each type of specialty screwdriver/key/wrench/tool (used to adjust arc, radius, change nozzle etc.) for each type of sprinkler.

1.16 WARRANTY

- A. Contractor shall provide one-year Warranty for Project. Warranty shall cover all material, workmanship and labor.
- B. Warranty period begins upon date of acceptance by OAR that Project is substantially complete.
- C. Warranty shall include filling and/or repairing depressions, replacing turf or other plantings due to settlement of irrigation trenches or irrigation system components, and adjustment of valve boxes, sprinkler heads and all other irrigation components which have settled from proper finish grade.

1.17 ADDITIONAL SERVICES

- A. Winterization:

1. Contractor shall winterize entire irrigation system installed under this Contract prior to the first winter following installation; prior to hard frost--but no later than November 15th, unless directed otherwise by OAR in writing.
 2. Winterize entire system via 'blow-out' method, using compressed air.
 - a. Compressor shall be industrial type, capable of evacuating water from all main line and lateral line pipe, with a minimum capacity of 185 CFM.
 - b. Compressor shall be mechanically regulated to not more than 60 PSI.
- B. Spring Start-up:
1. Contractor shall start up entire irrigation system the Spring following installation; prior to plant need--but following danger of damaging frost, yet no later than April 15th.
 2. Contractor shall energize entire main line pipe, all RCV's, and check for correct program installation and operation of Controller, each RCV and each quick coupler valve.
- C. As-built documents: Prior to final inspection, prepare and submit to OAR As-built drawings.
1. Show field dimensioned locations of sleeving, POC, mainline piping, wiring runs not in main line pipe trench, and valves/valve boxes.
 2. Dimensions are to be taken from permanent site features or finished hardscapes.

1.18 OWNER'S INSTRUCTION

- A. After system is installed, inspected, and approved; Contractor shall instruct OAR or other OAR designated individuals in complete operation and maintenance procedures of irrigation system. Coordinate instruction with references to previously submitted Operation and Maintenance manual.

PART 2 - PRODUCTS

2.1 GENERAL NOTES

- A. Contractor shall use products as specified by CD's.

2.2 POWER SOURCE

- A. Power source for irrigation equipment shall not be included in the irrigation Contractor's portion of this Contract.

2.3 CENTRAL CONTROL SYSTEM

- A. A Central Control System is not included in this Project. Central Control equipment is not included in this project.

2.4 CONTROLLER

- A. Manufacturer and model shall be as listed on plan legend.

- B. Contractor shall connect control wires and power wires to controller.
- C. Controller shall be wall mounted interior.
- D. Exterior wall mount controllers shall use rigid galvanized steel electrical conduit for all wiring.
- E. PVC pipe, conduit sweeps, and fittings shall not be used for any controller wiring.

2.5 POWER WIRE

- A. DIRECT BURY WIRE FOR FIELD LOCATED WALL OR PEDESTAL MOUNTED CONTROLLERS:
 - 1. All power cables shall be Paige Wire, type Tray Cable.
 - 2. Wire shall be Paige Wire specification number P7266D for 10 AWG and smaller.
 - 3. Wire shall be Paige Wire specification number P7267D for 8 AWG and larger.
 - 4. 120 VAC wires shall be 3 conductors (hot, neutral and ground)
 - 5. 240 VAC cables where service is provided to controller only, shall be 3 conductors (2 hot and 1 ground)
 - 6. 240 VAC cables where service is provided to controller and other 120 VAC equipment (such as a convenience outlet) shall be 4 conductors (2 hot, 1 neutral and 1 ground)
- B. CONVENTIONAL WIRING FOR WALL MOUNTED CONTROLLERS:
 - 1. Power wire or cable for conventionally wired wall mount or conduit-fed pedestal mount shall be according to local and NEC codes.

2.6 CONTROL WIRE

- A. Remote Control Valve wire shall be Paige Electric specification number P7079D.
- B. Common wire shall be white in color, 12 AWG, Paige part number 150170.
- C. Control or 'hot' wire for projects with a single controller shall be red in color, 14 AWG, Paige part number 150040.
- D. Spare wire shall be orange in color, 14 AWG, Paige wire.
- E. Trace wire shall be Yellow in color, 14 AWG, Paige wire.
- F. Master Valve wire shall be blue in color, 14 AWG, Paige wire.
- G. NO SUBSTITUTIONS ALLOWED.

2.7 COMMUNICATION WIRE

- A. Communication wire/Sensor wire shall be Paige brand, model 7171D or P7315D (PE 39).

2.8 WIRE CONNECTORS

A. RCV wire splicing connectors and Decoder wire splicing connectors shall be Paige P7364D, Paige part number 270670 or 270671 (3M model 'DBY/R'). No substitutions allowed.

B. Communication wire splicing or connection shall be Paige brand, model 273211 (3M model SliC) and Paige brand, model 270228R (3M model 316IR). No substitutions allowed.

2.9 POINT OF CONNECTION

A. Precise or specific products required of Contractor for installation of the POC are unknown. Contractor shall be prepared for a variety of POC conditions including:

1. Tapping, Saddling, Pac-Joint connection, extension, flared end connectors.

B. Stop & Waste Valve

1. POC's with connection sizes 1" through 2"

2. Mueller Oriseal H-10288 1" - 2"

3. Cambridge Brass 263NL-FXFX 1" - 2"

2.10 MASTER VALVE

A. Manufacturer and model shall be as listed on plan legend.

2.11 FLOW METER

A. Manufacturer and model shall be as listed on plan legend.

2.12 SLEEVING PIPE

A. Minimum sleeve size shall be 2" pipe.

B. Sleeving 2" through 4" shall be S/40 PVC pipe. Sleeving 6" and larger shall be CL/200 PVC pipe.

- C. Sleeves shall typically be two nominal sizes larger than the pipe to be placed within them. Sleeve material and sizes shall be according to the following SLEEVING TABLE:

INTERIOR PIPE	SLEEVE PIPE	INTERIOR PIPE	SLEEVE PIPE
¾" S/40	2" S/40	4" CL/200	8" CL/200
1" S/40	2" S/40	6" CL/200	10" CL/200
1-1/4" S/40	2-1/2" S/40	8" CL/200	12" CL/200
1-1/2" S/40	3" S/40	10" CL/200	14" C905
2" S/40	4" S/40		
3" S/40	6" CL/200		

2.13 MAIN LINE PIPE

- A. Pipe 1" through 3" shall be S/40, solvent weld-bell end.
- B. Pipe 4" through 12" shall be CL/200 gasketed-bell end.
- C. Yelomine pipe with grooved ends and couplers shall be used for above grade applications such as bridge crossings.

2.14 MAIN LINE FITTINGS

- A. All main line fittings 3" and smaller shall be S/80.
- B. All main line fittings 4" and larger shall be mechanical joint, or 'MJ'.
- C. All MJ fittings shall include megalug restraints.

2.15 MANUAL CONTROL VALVES

- A. Line or isolation valves 2-1/2" and larger shall be:
1. Matco Norca model 200 RTD ductile iron resilient wedge push on w 2" square operating nut.
 2. Matco Norca model 200 WD ductile iron resilient wedge flanged with 2" square operating nut.
 3. Matco Norca model 200 MD ductile iron resilient wedge Mechanical Joint (MJ) with 2" square operating nut.
- B. Line or isolation valves 2" and smaller shall be:
1. Matco Norca model 503 bronze gate valve OR
 2. Milwaukee model 105 bronze gate valve OR
 3. Hammond model IB645 bronze gate valve
- C. Isolation valves for RCV Manifolds (1" through 2-1/2") shall be:

1. Matco Norca model 503 bronze gate valve OR
2. Milwaukee model 105 bronze gate valve OR
3. Hammond model IB645 bronze gate valve

D. Drain Valves shall be:

1. $\frac{3}{4}$ " Mueller Oriseal model H-10288.
2. $\frac{3}{4}$ " Cambridge Brass model 263NL-F3F3.

2.16 QUICK COUPLER VALVE

- A. Manufacturer and model shall be as listed on plan legend.
- B. Swing joint for 1" quick coupler valves shall be Lasco model 13S-212 factory assembled swing joint.
- C. Swing joint for $\frac{3}{4}$ " quick coupler valves shall be Lasco model 13T-212 factory assembled swing joint.
- D. No substitutions for quick coupler swing joint shall be accepted.

2.17 VACUUM/AIR RELIEF VALVE

- A. Manufacturer and model shall be as listed in plan legend.
- B. Additional product necessary for installation and operation of vacuum/air relief valve shall be indicated on plan detail sheet.
- C. Contractor shall submit for approval, vacuum/air relief valve and assembly components.

2.18 REMOTE CONTROL VALVE

- A. Manufacturer and model shall be as listed on plan legend.
- B. Union assembly products shall be as listed on plan detail sheet.
- C. Contractor shall submit for approval; remote control valve and all components necessary to complete installation of valve.

2.19 VALVE BOXES

- A. Carson Industries Specification Grade valve boxes shall be used on this project unless otherwise indicated.

2.20 LATERAL LINE PIPE

- A. All lateral piping shall be new, S/40 PVC, solvent weld bell end. Sized as indicated on plans.

2.21 LATERAL LINE FITTINGS

- A. All lateral line fittings shall be new S/40 PVC.

2.22 MEDIUM ROTOR HEAD SPRINKLERS

- A. Manufacturer and model shall be as listed on plan legend.
- B. Nozzles for medium rotor heads shall be as listed on plan legend.
- C. All rotor heads shall be on a swing joint assembly composed of one 12" S/80 nipple (extruded, cut and threaded—not molded), and three marlex street elbows. Swing joint fittings shall be same size as inlet on head.
- D. Contractor shall submit for approval rotor heads and swing joint components.

2.23 ROTARY NOZZLE SPRAY HEAD SPRINKLER

- A. Manufacturer and model shall be as listed on plan legend.
- B. Rotating type nozzles for spray heads shall be as listed on plan legend.
- C. All small rotor sprinklers shall be on a swing joint assembly composed of 12-24" of swing pipe, two ½" spiral barb elbows, 12-24" swing pipe, one M412-005 ½" marlex street elbow.
- D. Contractor shall submit for approval spray heads, rotary nozzles, swing pipe, spiral barb elbow, and marlex street elbows.

2.24 SPRAY HEAD SPRINKLER

- A. Manufacturer and model shall be as listed on plan legend.
- B. Nozzles for spray heads shall be as listed on plan legend.
 - 1. Nozzles shall be fixed spray type whenever possible, adjustable arc nozzles shall be used only when a fixed spray model is not available.
- C. All spray heads shall be on a swing joint assembly composed of 12-24" of swing pipe, two ½" spiral barb elbows, 12-24" swing pipe, one M412-005 ½" marlex street elbow.
- D. Contractor shall submit for approval: spray heads, spray head nozzles, and swing joint assembly components.

2.25 DRIP COMPONENTS

- A. Drip components shall be manufacturer and model as listed on plan legend or details.

2.26 GLUE AND PRIMER

- A. Sprinkler pipe glue shall be IPS Weld-On model 711.
- B. Sprinkler pipe primer shall be IPS Weld-On model P-70.
- C. No substitutions allowed.

PART 3 - EXECUTION

3.1 GENERAL NOTES

- A. Contractor shall repair or replace work damaged by irrigation system installation.
- B. If damaged work is new, Contractor shall engage original installer of that work to perform repairs.
- C. The existing landscape of this Project shall remain in place. Contractor shall protect existing plant material and work around existing plant material as necessary.
- D. Plant material deemed damaged by OAR shall be replaced at Contractor's expense.
- E. Contractor shall route pipe, wire and other irrigation elements around outside of tree canopy drip line to minimize damage to tree roots.
- F. Contractor shall not cut existing tree roots larger than 2" to install this Project.
- G. Coordination of trench and valve locations shall be laid out with OAR prior to any excavation occurring.
- H. Contractor shall have no part of existing irrigation system used by other parts of Project landscape without water for more than 48 hours.

3.2 POWER SOURCE

- A. Power supply to irrigation controller (Strong Box installation and Meter base with load center) shall not be included in the irrigation portion of this Project. Power supply shall be a part of other Contracts associated with this Project. See Electrical Construction Documents and Specifications for information and/or detail. Controller power wire from load center(s) to Controller shall be a part of this Contract.
- B. Pedestal mount controllers shall have Paige Wire grounding grid installed per Section 1.05 C. of this document.
- C. Locate Controllers in general location shown on Construction drawings. Coordinate power supply and breaker allocation with electrical contractor. Contractor shall be responsible for all power connections to Controllers, whether they are wall mount or pedestal mount. Contractor shall coordinate with electrical or other Project trades as needed to facilitate installation of power to controllers.

3.3 CONTROLLER

- A. All grounding shall be as directed by controller manufacturer and ASIC guidelines, not to exceed a resistance reading of 10 OHMs.
- B. Locate controllers in protected, inconspicuous place when possible.
- C. Coordinate location of pedestal controllers with OAR to minimize visibility.

- D. Coordinate location of wall mount controllers with building or electrical Contractor to facilitate electrical service and future maintenance needs. Wall mount shall be securely fastened to surface. If exterior mounted, wall mount controllers shall have electrical service wire and field control wire in separate, appropriately sized weatherproof electrical conduit, PVC pipe shall not be used.
- E. Wire under hardscape surfaces shall be placed continuously in conduit.
- F. Pedestal controllers shall be placed upon VIT-Strong Box Quick Pad as per manufacturer's recommendations.
- G. Controllers shall be oriented such that Owner's Representative maintenance personnel may access easily and perform field system tests efficiently.
- H. Place Standard valve box at base of controller or nearby to allow for three to five feet of slack field control wire to be placed at each controller.
- I. This Contractor shall provide conduit access if needed for Electrical contractor. Electrical supply and installation, as well as hook-up to controller shall be by this Contractor.

3.4 CONTROL WIRE

- A. One spare wire from every valve grouping containing three or more valves shall be 'home run' to the controller.
- B. Install at least one spare wire for every five valves.
- C. Total number of spare wires shall not be less than 1/5th of the total control valves installed.
- D. Spare wire shall be looped within each valve box of the grouping it is to service.
- E. A minimum of 24" of additional wire shall be left at each valve, each splice box and at each controller.

3.5 WIRE CONNECTORS

- A. Wire splicing between controller and valves shall be avoided if possible.
- B. Any wire splices shall be contained within a valve box.
- C. Splices within a valve box that contains no control valves shall be stamped 'WIRE SPLICE' or 'WS' on box lid.

3.6 SLEEVING PIPE

- A. Sleeves shall be extended 6" minimum beyond walk or edge of pavement.
- B. Wire or cable shall not be installed in the same sleeve as piping, but shall be installed in separate sleeves.

- C. Sleeve ends on sleeve sizes 4" and larger shall be capped with corresponding sized PVC slip cap, pressure fit, until used, to prevent contamination.
- D. Sleeve ends on sleeve sizes 3" and smaller may be thoroughly taped to prevent contamination.
- E. Sleeves shall be installed at appropriate depths for main line pipe or lateral pipe
- F. Contractor shall be responsible to protect existing underground utilities and components.
- G. Sleeve all piping and wiring that pass under paving or hardscape features.
- H. Sleeves shall be positioned relative to structures or obstructions to allow for pipe or wire within them to be removed if necessary.

3.7 MAIN LINE / LATERAL LINE PIPE

- A. All fittings 3" and larger having change of direction shall have proper concrete thrust block installed.
- B. Pulling of pipe shall not be permitted on this project.
- C. Over excavate trenches both in width and depth. Ensure base of trench is rock or debris free to protect pipe and wire. Grade trench base to ensure flat, even support of piping. Backfill with clean soil or import material.
- D. Contractor shall backfill no less than 2" around entire pipe with clean, rock free fill.
- E. Main line piping and fittings shall not be backfilled until Designer or Owner's Representative has inspected and pipe has passed pressure testing. Perform balance of backfill operation to eliminate any settling.
- F. Place irrigation pipe and other elements at uniform grades. Automatic drains shall not be installed on this Project. Manual drains shall only be installed at POC where designated on Construction Drawings.
- G. Install pipe to allow for expansion and contraction as recommended by pipe manufacturer.
- H. Install main line pipes with 18" of cover, lateral line pipes with 12" of cover.
- I. Drawings show diagrammatic or conceptual location of piping—Contractor shall install piping to minimize change of direction, avoid placement under large trees or large shrubs, avoid placement under hardscape features.
- J. Plastic pipe shall be cut squarely. Burrs shall be removed; spigot ends of pipes 3" and larger shall be beveled.
- K. Pipe shall not be glued unless ambient temperature is at least 50 degrees F. Pipe shall not be glued in rainy conditions unless properly tented.

- L. All solvent weld joints shall be assembled using IPS 711 glue and P70 primer according to manufacturer's specification, no exceptions.
- M. Glued main line pipe shall cure a minimum of 24 hours prior to being energized. Lateral lines shall cure a minimum of 2 hours prior to being energized and shall not remain under constant pressure unless cured for 24 hours.
- N. All threaded joints shall be wrapped with Teflon tape or paste unless directed by product manufacturer or sealing by o-ring.
- O. All main line pipe, lateral line pipe and other irrigation elements shall be bedded and backfilled with clean soil, free of rocks 1" and larger.
- P. Contractor shall furnish and install additional backfill material as necessary due to rocky conditions.
- Q. Trenches and other elements shall be compacted and/or water settled to eliminate settling.
- R. Debris from trenching operations un-usable for fill shall be removed from project and disposed of properly by Contractor.
- S. Maximum acceptable flow through piping shall be 5.0 FPS maximum flow through piping shall be:
 - 1. 1"—13 GPM
 - 2. 1-1/4"—22 GPM
 - 3. 1-1/2"—30 GPM
 - 4. 2"—50 GPM
 - 5. 2-1/2" 75 GPM

3.8 MANUAL CONTROL VALVE

- A. For 3" and larger valves, place sleeve of 6" or larger pipe over top of valve vertically and then extend to grade. Place 10" round valve box over sleeve at grade. See detail for additional information.
- B. Isolation valves 2-1/2" and smaller shall be contained in a Carson Standard size valve box. Valves shall be installed with S/80 PVC TOE Nipples one both sides of valve.

3.9 QUICK COUPLER VALVE

- A. Quick coupler valves shall be placed with manifold groups and protected by manifold isolation valves.
- B. Top of quick coupler valve cover shall allow for complete installation of valve box lid, but also allow for insertion and operation of key.
- C. Base of quick coupler valve and top of quick coupler swing joint shall be encased in 3/4"-gravel.

D. Contractor shall not place quick coupler valves further than 200 feet apart, to allow for spot watering or supplemental irrigation of new plant material.

E. Quick coupler valve at POC shall not be eliminated or relocated.

3.10 REMOTE CONTROL VALVE

A. Contractor shall place remote control valves in groups as practical to economize on quantity of manifold isolation valves.

B. Remote control valves shall be located separately and individually in separate control boxes.

1. Flows through 1" valves shall be 1-25 GPM.
2. Flows through 1-1/2" valves shall be 26-50 GPM.
3. Flows through 2" valves shall be 51 through 75 GPM
4. Flows through 3" valves shall be 76 GPM through 200 GPM.

C. Valves shall be in boxes with ample space surrounding them to allow access for maintenance and repair.

D. Where practical, group remote control valves in proximity, and protect each valve with a manifold isolation valve as shown in details. Valve boxes shall be set over valves so that all parts of the valve can be reached for service. Valve box and lid shall be set to be flush with finished grade.

E. Only one remote control valve may be installed in a Carson 1419124 box.

F. Place a minimum of 4" of 3/4" washed gravel beneath valve box for drainage.

G. Bottom of remote-control valve shall be a minimum of 2" above gravel.

H. See remote control valve manifold detail for more information.

3.11 DRIP COMPONENTS

A. Planting beds shall be graded to continuous uniform finish grade prior to tubing installation. Surface installed drip tubing shall be installed after plant material, but prior to bark mulch being installed. Tubing shall be installed with equal spacing between lateral runs of tubing. Tubing shall be adequately staked or stapled to the soil surface to prevent tubing from penetrating bark surface. Any tubing visible at bark surface shall be re-installed and re-stapled at Contractor expense.

B. Sub-surface drip tubing shall be installed at uniform depth and uniform lateral spacing using small powered pipe puller or other similar method. Care shall be taken to prevent contamination with soil in tubing.

C. Contractor shall place filters, regulators, air/vac vents and flush valves as necessary to meet manufacturer's minimum recommendations.

- D. Field conditions, specifically soil type conditions shall dictate any alteration in emitter size, emitter spacing and row spacing. Contractor shall notify OAR to request confirmation of soil type prior to ordering drip tubing products to ensure proper product and proper spacing are used.

3.12 SYSTEM ADJUSTMENT

- A. Sprinkler heads shall be adjusted to proper height when installed.
- B. Changes in grade or adjustment of head height after installation shall be considered a part of the original contract and at Contractor's expense.
- C. Adjust all sprinkler heads for arc, radius, proper trim and distribution to cover all landscaped areas that are to be irrigated. Adjust sprinklers so they do not water buildings, structures, or other hardscape features.
- D. Adjust run times of stations to meet needs of plant material the station services.
- E. No sprinkler shall be located closer than 6" to walls, fences, or buildings.
- F. Heads adjacent to walks, curbs, or paths shall be located at grade and 2" away from hardscape.
- G. Control valves shall be opened and fully flush lateral line pipe and swing joints prior to installation of sprinklers.
- H. Spray heads shall be installed and flushed again prior to installation of nozzles.
- I. Contractor shall be responsible for adjustment if necessary due to grade changes during landscape construction.

3.13 CLEANUP

- A. Contractor shall clean all work areas daily, leaving areas accessible to the public in a 'broom clean' condition.
- B. Open trenches and or hazards shall be protected by chain link fence, snow fencing, or caution tape as directed by the OAR.
- C. Contractor shall coordinate with OAR for periodic as well as final cleanliness inspection.
- D. Upon project completion, Contractor shall remove all excess material, construction debris, packing, etc. attributable to his work.

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**SECTION 32 90 01
SITE RESTORATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide site restoration, landscaping and appurtenant work, complete and in place, in accordance with the Contract Documents.
- B. Landscaping as referred to herein shall include supplying and placing topsoil, soil preparation, installation of headers, weed control, finish grading, furnishing and installing plant materials, seeding, erosion control, cleanup, and maintenance guarantee.

1.2 DEFINITIONS

- A. The terms "plant material" or "plants" refer to all vegetation, including but not limited to sod, seed, and seeded areas, etc.
- B. "Quality" refers to general development without consideration of size or condition. "Standard quality" indicates the least acceptable quality. "Standard quality" seeded and germinated plants shall be typical of the species and variety of good average uniform growth, shall be well formed.
- C. "Condition" is the factor controlled by vitality and ability to survive and thrive and be comparable with normal plants of the same species and variety in the vicinity at the same season of the year. Plants shall be free from physical damage or adverse conditions that would prevent thriving. "Condition" also sometimes refers to state of growth, i.e., whether "dormant condition" or "growing condition" and this state shall be comparable to plants of similar species in the vicinity for leaves, formation of buds, and the like.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards:

ASTM D 422 Method for Particle-Size Analysis of Soils

ANSI Z60.1 Nursery Stock

American Association of Rules and Grading Provisions Nurserymen, Inc.

1.4 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be furnished in accordance with Division 1 - Contractor Submittals.
- B. Product Information
 - 1. Manufacturer's product information on slow release fertilizer, fertilizer tablets, seed, sod, and erosion control materials.
 - 2. **Topsoil Analysis Report:** A report certified by an analytical laboratory which shows results of analyzing representative samples of topsoil proposed for use. Approval of

the report does not constitute final acceptance of the topsoil. Topsoil report will only be required if imported topsoil is used for the site.

3. Supplier's information and testing information on compost for soil amendment.

C. Certificate

1. Certificates shall accompany each product delivery stating source, quantity, and type of material. All certificates shall be submitted to the Landscape Architect at the time of delivery.
2. Certificates of inspection of plant material, as may be required by Federal, State, or other authorities having jurisdiction, which accompany the shipment, shall be submitted to the Landscape Architect at the time of delivery.
3. Landscaping Subcontractor guarantee to perform seed maintenance and weeding services during the one-year correction of defects period.

1.5 QUALITY ASSURANCE

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

1.6 CLEANUP

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

C. During the entire Contract period, plant containers that have been cut or removed from plant materials shall be removed from the site daily.

D. All fertilizer packaging shall be cleared from the site at the end of every day.

1.7 MAINTENANCE OF LANDSCAPING PLANTING PRIOR TO ACCEPTANCE OF PROJECT

A. General: The Contractor shall be responsible for protecting and maintaining all seeded areas until final acceptance of all Work under the Contract.

B. Protection: The Contractor shall provide adequate protection to all newly seeded areas including the installation of approved temporary fences to prevent trespassing and damage, as well as erosion control, until the end of the correction of defects period.

C. The Contractor shall replace any materials or equipment that its employees or Subcontractors have damaged.

D. Partial utilization of the project shall not relieve the Contractor of any of the requirements contained in the Contract Documents.

E. Seeded/sod areas shall be maintained by weeding, fertilizing, spraying, and other operations necessary.

F. Maintenance shall include, in addition to the foregoing, cleaning, the repair of erosion, reseed bare areas, and all other necessary maintenance work. Sidewalks, retaining walls and paved areas shall be kept clean while seeding and maintenance are in progress.

1.8 FINAL INSPECTION AND GUARANTEE

A. Inspection of all seeded areas will be part of final inspection under the Contract.

B. Written notice requesting inspection shall be submitted to the Landscape Architect at least 10 days prior to the anticipated inspection date.

C. Final acceptance prior to start of the guarantee period of the Contract will be on written approval by the Engineer or Landscape Architect, on the satisfactory completion of all Work, including maintenance, but exclusive of the replacement of plant material or reseed areas that have less than 60% coverage.

D. Any delay in the completion of any item of work in the planting operation which extends the seeding/sod installation into more than one season shall extend the correction period in accordance with the date of completion given above.

E. The Contractor shall reseed or replace sod, as soon as weather conditions permit, all bare areas or areas that show less than 60% seed germination/plant growth which are noted at the end of the one-year correction period.

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

1.9 MAINTENANCE AND GUARANTEE FOLLOWING ACCEPTANCE OF PROJECT

- A. General: The Contractor shall be responsible for a period of one year after date of acceptance of the Work of this Section, for maintaining all seeded areas, including fertilizing, controlling insects and diseases and weeding. The Contractor shall obtain a written guarantee from the landscaping Subcontractor embodying the provisions of this paragraph.
- B. The Work covered by the maintenance and guarantee portions of this paragraph includes providing all reseeded of seeding areas and the re-installation of sod for the one-year maintenance period or for two full growing seasons if the maintenance periods starts in the fall or winter, labor, materials, chemicals, equipment, and supplies and in performing all operations in connection with maintenance and guarantees.
- C. The Contractor shall clean-up and remove unused or waste materials from the Site and leave the area in a neat condition satisfactory to the Owner whenever it performs work during the maintenance period.
- D. Final Inspection: The Owner and Contractor shall make a final inspection at the end of the one-year maintenance and correction period. Any bare seed or sod areas or less than 60% coverage at time of final inspection shall be reseeded within a time agreed upon by both parties. If it is outside of the seeding window for seeding/sod installation, work shall take place within the next seeding/sod installation window even though reseeded may run beyond the maintenance and correction period.

PART 2 - PRODUCTS

2.1 GENERAL

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

2.2 TOPSOIL

- A. Imported topsoil shall be obtained from naturally drained areas and shall be fertile, friable loam suitable for plant growth. Topsoil shall be subject to inspection and approval by the Landscape Architect at the source of supply and upon delivery to the site. All laboratory soil testing shall be ordered and paid by the Contractor.
- B. Onsite or imported topsoil shall be of uniform quality, free from toxic substances, subsoil, stiff or lumpy clay, hard clods, hardpan, rocks, disintegrated debris, plants, roots, seeds, and any other materials that would be toxic or harmful to plant growth. **Topsoil shall contain no noxious weeds or noxious weed seeds.**
- C. Imported topsoil used for this Work shall meet the following requirements.

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

2.3 FERTILIZER AND AMENDMENTS

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

2.4 NATIVE SEED AND SOD

- A. Seed shall conform with applicable City, County, State, Federal regulations and meet Utah Seed Law. Seed shall be mixed by dealer. The Contractor shall furnish dealer's guaranteed germination figure for each variety. Grass seed shall not be delivered until samples have been approved in writing by the Engineer, Landscape Architect or its authorized landscape representative. Approval of samples, however, shall not affect the right of the Engineer, Landscape Architect or the authorized landscape representative to reject seed upon or after delivery. Seed that has become wet, moldy, or otherwise damaged prior to use will not be accepted.

- B. All seed shall be fresh, clean, new-crop seed, composed of the following varieties mixed in the proportions by weight. Purity and germination percentage shall be the results of testing.
- C. Weather Conditions: Fertilizing, seeding, sod installation, or mulching operations will not be permitted when wind velocities exceed 5 miles per hour or when the ground is frozen, unduly wet, or otherwise not in a tillable conditions. Seeding shall not be conducted when temperatures exceed 75°F.
- D. Topsoil: Four inches of approved, onsite or imported, amended topsoil shall be placed in all areas to be seeded or installed with sod. Imported, amended topsoil shall be placed and raked smooth prior to seeding or sodding.
- E. Soil Preparation: The ground to be seeded/sod placement shall be graded in conformance with the Drawings and shall be loose and reasonably free of large rocks, roots, and other material which will interfere with the work. The site shall be rough and scraped with the teeth of a track hoe bucket or similar.
- F. Supply seed on a pure live seed (PLS) basis.
- G. Obtain seed from lots that have been tested by a state certified seed testing laboratory. (Association of Seed Analyst (AOSA) or Society of Commercial Seed Technologists (SCST)). Seed germination tests older than 18 months for grass seed, and 9 months for shrub or tree seed are not acceptable.
- H. Do not use wet, moldy or otherwise damaged seed.
- I. All areas will be restored per existing conditions before disturbances occur. Areas with existing sod/turf grass/Kentucky bluegrass will be restored with Kentucky bluegrass sod. Areas with native vegetation and grasses will be restored with the native seed mix provided in this specification. Based on existing conditions, all park strips and park properties will be restored with Kentucky bluegrass sod and the current vacant lot will be restored with the native seed mix
- J. See pages 7 this specification for restoration seed mix to be used in the vacant lot.
- K. Sod shall be installed in all disturbed park strips and parks to match existing conditions.
- L. In disturbed areas, complete all weed removal, final grading, trench settling, surface preparation and irrigation work (if applicable) before seeding begins.
- M. Roughen soil receiving seed/sod.
- N. Do not install seed or sod when soil is saturated or frozen.
- O. MAINTENANCE
 - 1. During the maintenance period the contractor shall be responsible for removing weeds and maintaining the site to provide as good of conditions as possible for seed to grow.

2. Contractor shall plan on one re-seeding and one period of sod replacement if the vegetative coverage has not established to a minimum of 60% coverage at the end of the warranty period.

2.5 SEED MIXES

A. Upland Seeding:

1. The site specific upland seed mix below shall be applied at a seeding rate of 22 pounds of pure live seed (PLS) per acre. Application shall be drill seeding or hydroseeding.

Southwest Aqueduct Reach Vacant Lot Seed Mix - BC&A 9/27/2024						
SEED NO.	SPECIES NAME		Number of Seeds per Pound (LBS)	SEED		
	BOTANICAL NAME	COMMON NAME		Pounds (LBS) of Pure Live Seed (PLS)/Acre	Percentage of Seed mixture	Number of Seeds (PLS/Sq. Foot)
GRASSES						
1	<i>Achnatherum hymenoides</i>	Indian ricegrass	141,000	4.00	18.07%	13
2	<i>Elytrigia repens x Pseudoroegneria spicata</i> 'Newhy'	Newhy Hybrid wheatgrass	122,000	3.50	13.68%	10
3	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	Thickspike wheatgrass	154,000	3.00	14.80%	11
4	<i>Elymus trachycaulus</i> ssp. <i>Trachycaulus</i> 'Pryor'	Pryor Slender wheatgrass	159,000	3.50	17.83%	13
5	<i>Festuca ovina</i> 'Covar'	Covar Sheep fescue	680,000	0.50	10.89%	8
6	<i>Poa secunda</i> ssp. <i>Sandbergii</i>	Sandberg bluegrass	1,047,000	0.50	16.77%	12
9	<i>Linum lewisii</i>	Lewis flax	170,000	1.00	5.45%	4
11	<i>Triticum aestivum x Secale cereale</i>	Triticale	13,000	6.00	2.50%	2
TOTALS =				22.00	100.00%	72

2.6 BROADCAST SEEDING

- A. Broadcast seed is not allowed. Only drill or hydroseeding is allowed.

2.7 SOD INSTALLATION

- A. Sod shall be Kentucky bluegrass sod to match existing turf grass conditions.
- B. Sod installation will not occur when the ground is frozen, unduly wet, or otherwise not in a tillable condition.
- C. All areas with existing sod will be restored with sod to match existing conditions. This includes parkstrips and parks within the area of disturbance unless otherwise approved in writing by the Engineer or Landscape Architect.

2.8 DRILL SEEDING

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

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

2.9 HYDROSEEDING

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

2.10 EROSION CONTROL BLANKET

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

PART 3 - EXECUTION

3.1 GENERAL

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

governing authorities and the State's OSHA safety requirements from dusk to dawn each day and when needed for safety.

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

3.2 SOIL PREPARATION

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

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

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

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

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

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

G. Finish grading shall consist of:

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

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

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DIVISION 33
UTILITIES

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**SECTION 33 05 07
STEEL PIPE CASING**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for the installation of steel pipe casing.
- B. Materials and procedures for the Installation of carrier pipe within pipe casing.
- C. Fill of annular space.

1.2 REFERENCES

AASHTO Standard Specifications for Roads and Bridges

ASTM A36: Standard Specification for Structural Steel

ASTM A53: Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A139: Standard Specification for Electric-Fusion (Arc) – Welded Steel Pipe

ASTM A283: Standards Specification for Low and Intermediate Tensile Strength Carbon Steel
Plates

American Public Works Association (APWA)

AWWA C200: Steel Water Pipe 6 Inches and Larger

AWWA C206: Field Welding of Steel Water Pipe

AWS D1.1 Structural Welding Code

1.3 DEFINITIONS

- A. Carrier Pipe: Pipe installed within the casing pipe.
- B. Annular Space: Void between pipe casing and carrier pipe.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 Submittal Procedures
- B. Provide Mill Certificates of casing material steel.
- C. Provide Manufacturer's certificates of compliance and shop drawings showing that furnished casings meet or exceed the requirements in this section, Article 2.1.

- D. Provide Manufacturer's certificates of compliance and shop drawings showing that furnished spacers and end seals meet or exceed the requirements in this section, Article 2.2 and 2.3.

1.5 QUALITY ASSURANCE

- A. Notify Engineer a minimum of three (3) days in advance of starting excavation and installation operations. Perform Work in the presence of the Engineer unless Engineer grants approval otherwise.
- B. Perform welding by skilled welders, welding operators and tackers with demonstrated adequate experience in type of material used.
- C. Qualify welders in accordance with ANSI/AWS D1.1 by an independent local, approved testing agency not more than 12 months prior to commencing work on casing piping.
 - 1. Quality welders pursuant to the provisions of AWWA C206.
- D. Perform welding procedures used to fabricate steel casings in accordance with ANSI/AWS D1.1.
- E. Welding procedures are required for, but not limited to, longitudinal and girth special welds for pipe cylinders, casing joint welds and reinforcing plates.
- F. Comply with the requirements of the affected public agencies and owners of public utilities or other facilities to safeguard traffic and improvements which might be endangered by excavation, jacking and installation operations.

1.6 SAFETY

- A. Perform work in accordance with AWWA C200, except as modified below.
- B. Ascertain the absence of potential hazards such as explosive or flammable gases and report to Engineer.

PART 2 - PRODUCTS

2.1 STEEL CASING

- A. Fabricate in accordance with AWWA C200, except as modified below.
- B. Provide casing material in conformance to ASTM A283, Grade B, C or D; ASTM A139 Grade B; ASTM A36; or ASTM A53; or as noted in the Drawings.
- C. Provide casing material with a minimum diameter and thickness as shown on plans.
- D. Weld joints continuous around casing and reinforce joints to withstand installation operations.
- E. Weld joints in accordance with AWWA C206 and provide grounded smooth finish on interior of casing.

2.2 SPACERS

- A. Provide bolt-on style spacers, Insulator Style, with the following attributes:
 - 1. Bands/Shells: Stainless Steel Type 304, minimum 14-gauge thickness, and 12-inch Wide.
 - 2. Risers: 304 Stainless Steel, 10 gauge minimum, where required.
 - 3. Fasteners: Stainless Steel Type 316.
 - 4. Runners: Glass reinforced polyester or ultra-high molecular weight polymer.
 - 5. Provide with Heavy Duty Vinyl or PVC liner, insulator style.
- B. Provide spacers from the following manufacturers:
 - 1. Calpico, Model M-12-SS.
 - 2. PowerSeal Pipe Product, Model 4810.
 - 3. Advanced Products and Systems, LLC Model SI-12.
 - 4. CCI Pipeline Systems, Model CSS12.
 - 5. Or Engineer approved equal.

2.3 END SEALS

- A. Provide 1/8" thick pull-on type, synthetic rubber end seals secured with 316 SST bands from the following manufacturers:
 - 1. Calpico Model C – Seamless Slip-on End Seals.
 - 2. Garlock, Model S – Standard Pull-On Casing End Seals.
 - 3. Pipeline Seal and Insulator – Model C Pull-On End Seals.
 - 4. Or Engineer approved equivalent for installation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate with Owner and Engineer before beginning excavation.
- B. Obtain all permits prior to beginning installation.
- C. Confirm all utility locations prior to installing pipe casing.
- D. Pothole existing utilities within and adjacent to proposed location of casing.
- E. Notify Engineer of conflicts with existing utilities.
- F. Investigate soils and subsurface conditions to provide appropriate equipment to remediate conditions which can cause delay, such as groundwater, running sand, boulders and so forth.
- G. Lubricate casing and runners with food grade soap, do not use petroleum products such as oil and grease lubricants.

3.2 INSTALLATION OF PIPE CASING

- A. Provide casing installation methods at the following locations:
 - 1. 12600 South Casing (Sta 371+50) - Trenchless Crossing

2. SWA-02 casing at Jordan Aqueduct (Sta 406+50)- Trenchless Crossing
 3. JBID Sewer Casing extension (Sta 402+20) – Install casing by open cut methods.
 4. F
-
- B. Steel Pipe Casing: install pipe in accordance with minimum design specifications. For trenchless crossing installation locations, the details of Jacking and/or Boring equipment and methods to be determined by the Contractor. Contractor to submit calculations of jacking forces, equipment details and trenchless installation method requirements to Engineer to demonstrate suitability of contractor's chosen equipment and methods for the intended casing application, casing materials and existing geotechnical data.
 - C. Welded Joints: Electrically weld joints continuous around and along casing in accordance with AWWA C206.
 - D. Install pipe casing true to line and grade.
 - E. Join casing section by full penetration butt-welding in the field, unless otherwise approved by Engineer. Provide a ¼ inch by 45 degree chamfer on the outside edges of casing to prepare ends of casing for welding.
- 3.3 PROTECTION OF CARRIER PIPE
- A. Protect carrier pipe and coatings during installation inside casing pipe. Clean inside of Casing pipe prior to installing carrier pipe.
 - B. Protect plastic carrier pipes from heat during welding of casing with sacrificial heat shielding where required.
 - C. Maintain line and grade through casing per design drawings.
 - D. Provide casing spacers at minimum of every 5 feet unless manufacturer requires additional supports to support the carrier pipe inside the casing, place a spacer within 1 foot of each end of casing.
 - E. Remove loose and disturbed materials below pipe grade and recompact.

END OF SECTION

SECTION 33 05 31
POLYVINYL CHLORIDE (PVC) PIPE (AWWA C900 AND C905, MODIFIED)

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide polyvinyl chloride (PVC) pressure pipe, complete in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

ANSI/AWWA C104/A21.5	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
ANSI/AWWA C105/A21.5	Polyethylene Encasement for Ductile Iron Pipe
ANSI/AWWA C110/A21.10	Ductile-Iron and Gray-Iron Fittings 3-in Through 48-in for Water and Other Liquids
ANSI/AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
ANSI/AWWA C600	Installation of Ductile-Iron Water Mains and Appurtenances
ANSI/AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe 4-in Through 12-in for Water Distribution
ANSI/AWWA C905	Polyvinyl Chloride (PVC) Pressure Pipe 14-in Through 48-in for Water Distribution
ASTM D 2584	Test Method for Ignition Loss of Cured Reinforced Resins
PPI Technical Report TR 3/4	Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
AWWA Manual M23	PVC Pipe - Design and Installation

1.3 CONTRACTOR SUBMITTALS

- A. Shop Drawings: The Contractor shall submit shop drawings of pipe, fittings, and appurtenances in accordance with the requirements in Section 01 33 20 –Submittal Procedures. Manufacturer’s literature for metallic locating tape.
1. Showing dimensions and details of pipe joint fittings, fitting specials, valves and appurtenances.

2. Detailed layout, spool or fabrication drawings showing pipe spools, spacers, adapters, connectors, fittings and pipe supports not indicated in the Contract Documents.
 3. Manufacturer's product data and samples of all materials proposed for use on the work.
- B. Certifications: A certified affidavit of compliance for pipe and other products or materials under this Section.
- C. Test Reports:
1. Hydrostatic proof test reports.
 2. Sustained pressure test reports.
 3. Burst strength test reports.
- D. The Contractor shall be responsible for performing and paying for sampling and testing as necessary for the certifications.
- E. Owner's Manual
1. Manufacturer's technical data and installation instructions.
 2. Manufacturer's certificates of compliance indicating that all materials provided under this Section meet the requirements of the Contract Documents.

1.4 QUALITY ASSURANCE

- A. Inspection: Pipe shall be subject to inspection at the place of manufacture.
- B. During manufacture of the pipe, the Engineer shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.
- C. Tests: Materials used in manufacture of the pipe shall be tested in accordance with the requirements of this Section and the referenced standards, as applicable.
- D. The Contractor shall perform said material tests. The Engineer shall have the right to witness testing; provided that the Contractor's schedule is not delayed for the convenience of the Engineer.
- E. In addition to those tests specifically required, the Engineer may request additional samples of any material for testing by the Owner. The additional samples shall be furnished as a part of the Work.

1.5 INSPECTION

- A. All pipe may be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein. The Contractor shall notify the District in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.
- B. During the manufacture of the pipe, the Owner shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

1.6 SOURCE QUALITY CONTROL

- A. Except as modified herein, pipe shall be tested in accordance with the requirements of this Section and AWWA C900 or C905, as applicable.
 - 1. The Contractor shall perform said material tests in accordance with the requirements of the Contract Documents. The Owner shall have the right to witness all testing conducted by the Contractor; provided, that the Contractor's schedule will not be delayed for the convenience of the Owner.
 - 2. All expenses incurred in obtaining samples for testing shall be borne by the Contractor at no increased cost to the Owner.
 - 3. In addition to those tests specifically required, the Owner may request additional samples of any material for testing by the Owner. The additional samples shall be furnished at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. PVC pressure pipe (4-inch through 12-inch) shall conform to the applicable requirements of ANSI/AWWA C900 subject to additional requirements herein.
- B. PVC pressure pipe (14-inch through 48-inch) shall conform to the applicable requirements of ANSI/AWWA C905 subject to additional requirements herein.
- C. Each piece of pipe and fitting shall be clearly labeled to identify its size, pressure class and manufacture date.

2.2 PIPE DESIGN CRITERIA

- A. General: PVC pressure pipe shall be designed in accordance with the requirements of ANSI/AWWA C900 and ANSI/AWWA C905.
- B. Polyvinyl Chloride (PVC) pipe shall have outside diameter dimensions conforming to cast iron pipe and shall be the diameter and class indicated on the plans. The pipe shall meet the pressure class requirements indicated on the drawings, and shall meet the requirements of Table 2 of AWWA C900 or C905 as applicable.
- C. PVC pipe shall be provided in standard 20 foot lengths, unless otherwise specified, detailed or required on the approved plans. Shorter lengths, up to 10 feet, will be permitted when authorized by the Engineer. Field cut lengths of pipe used as closures may not be shorter than 2 feet in length, and must be approved by the Engineer.

2.3 PIPE

- A. The pipe shall be of the diameter and pressure class specified or shown, shall be furnished complete with rubber gaskets, and all specials and fittings shall be provided as required in the Contract Documents. Unless otherwise noted, diameters shown in the Contract Documents shall refer to Cast-Iron Pipe Equivalent Outside Diameters (CIOD), conforming to the requirements of AWWA C900 or C905 as appropriate.

- B. Additives and Fillers: Unless otherwise allowed in alternate qualification procedures of PPI-TR3, compounds which have a Hydrostatic Design Basis (HDB) of 4000 psi at 73.4 degrees F and for water shall not contain additives and fillers that exceed the recommended values in Table 1, Part Y of PPI-TR3 (e.g., allowable content range for calcium carbonate is 0.0-5.0 parts per hundred of resin). If requested by the Engineer, the additive and filler content shall be determined using the pyrolysis method as specified in ASTM D 2584.
- C. Color: Pipe for use in potable or culinary water systems, or directly attached to potable or culinary water systems shall be white or blue. Pipe used in irrigation, reuse, utility water or any other non-potable use shall be purple.
- D. Joints: Except where specifically noted or where designated as "fusible PVC," joints for buried PVC pipe shall be either an integral bell manufactured on the pipe or a separate coupling both employing a rubber ring joint. The bell and coupling shall be the same thickness as of the pipe barrel, or greater thickness. The sealing ring groove in the coupling shall be of the same design as the groove in cast iron fittings and valves available from local water works supply distributors. No restrained joint PVC pipe will be allowed. When the spigot end of pipe is to be inserted into a mechanical joint fitting, the beveled end of the pipe shall be removed prior to insertion. Solvent weld joints are not permitted.
- E. Joint shall be sealed with an elastomeric gasket meeting the requirements of ASTM F 477 and ASTM D3139. Gaskets and lubricants shall be made from materials that are compatible with the plastic material and with each other when used together. They shall not support the growth of bacteria and shall not adversely affect the potable qualities of the water that is to be transported. One elastomeric gasket shall be furnished with each length of bell-end pipe.
- F. Joint Deflection: Deflection at the joint shall not exceed 1.5 degrees or the maximum deflection recommended by the manufacturer. No deflection of the joint shall be allowed for joints which are over-belled or not belled to the stop mark.

2.4 FITTINGS

- A. Fittings shall be ductile iron conforming to the requirements of ANSI/AWWA C153/A21.53 or ANSI/AWWA C110/A21.10 for diameters 3-inch through 48-inch and shall have a minimum pressure rating of 250 psi. Fittings shall be wrapped in polyethylene encasement per AWWA C-105 and all hardware shall be coated with a wax tape coating system in accordance with Section 09 90 10 – Pipeline Coatings and Linings.
- B. Where fabricated PVC fittings are specifically required:
 1. Fittings (4-inch through 12-inch) shall conform to the applicable requirements of ANSI/AWWA C900 subject to additional requirements herein.
 2. Fittings (14-inch through 48-inch) shall conform to the applicable requirements of ANSI/AWWA C905 subject to additional requirements herein. All fabricated PVC fittings 14-inch and larger shall include fiberglass reinforcement permanently bonded to the outside surfaces of the fitting.
- C. All ductile iron fittings shall be cement-mortar lined ductile, coated with a bituminous material.. The cement lining shall conform to the requirements of AWWA Standard C104.

- D. Each fitting shall be of the diameter and pressure class indicated and clearly labeled to identify its size and pressure class.
- E. All fittings and valves shall be restrained against thrust forces by concrete thrust blocks furnished and installed as indicated in the Drawings.
- F. Fittings shall be furnished with mechanical joints, push-on joints, flanged joints, and restrained joints as required.
 - 1. Mechanical and push-on joints shall conform to ANSI/AWWA C111/A21.11.
 - 2. Restrained Joints:
 - a. Manufactured proprietary joint that mechanically restrains pipe to adjoining pipe without setscrews or devices with shoes or wedges activated by setscrews.
 - b. The use of devices utilizing setscrews shall not be allowed. Primary permanent restraint for all buried pipe fittings shall be accomplished using concrete thrust blocks. Temporary fitting restraint for testing of pipelines can be accomplished using mechanical thrust restraint utilizing multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21/53. Temporary (or secondary) fitting restraint shall be in addition to primary permanent restraint. Permanent restraint for straight-run pipe joints can be accomplished using manufacturer's proprietary joint (e.g. Tyton Lock with Sure Stop gasket, or equal) or with mechanical joint restraints (e.g. EBAA Iron Megalug, or equal) utilizing multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21/53.
 - c. Rated at minimum working pressure equal to or greater than that of the pipe class.
 - d. The use of field-lock, gripper ring type restraining devices shall be limited to only locations where unforeseen field conditions or closure places require the pipe to be field fit, cut, and joined, and as approved by the Engineer. Where field locking, gripper ring type restraining devices are used, the gripper ring shall be installed a minimum of one full pipe length away from the fitting or closure. The installation of gripper ring type restraining devices where used shall be in strict accordance with the manufacturer's installation instructions.
 - e. Field welding of ductile iron pipe and fitting shall not be allowed.
 - 3. Flanged joints shall conform to ANSI/AWWA C115/A21.15.
- G. Joint Clearances: For bell-and-spigot ends with rubber gaskets, the clearance between the bells and spigots shall be such that when combined with the gasket groove configuration and the gasket itself, will provide watertight joints under all operating conditions when properly installed. The Contractor shall require the pipe manufacturer to submit details complete with significant dimensions and tolerances and also to submit performance data indicating that the proposed joint has performed satisfactorily under similar conditions. In the absence of a history of field performance, the results of a test program shall be submitted.

2.5 TRACER WIRE

- A. Tracer wire shall be stranded No. 12 AWG copper wire, THWN-2 jacketed for underground services.

2.6 SERVICE SADDLES

- A. Bronze bodied saddles with double bronze straps or full circle body clamp double bolted to each side of the saddle shall be used on pipe sizes 4 inch through 12 inch. The saddle body shall be manufactured from cast bronze in accordance with ASTM B62 or B584 and AWWA C800. The single strap shall have double bolts on each end of the strap to connect it to the bronze saddle. The ears of the strap shall turn inward and rest against the inside of the strap. The gasket shall be Buna N. The saddle shall be threaded with 1 inch or 2 inch iron pipe threads.

PART 3 - EXECUTION

3.1 GENERAL

- A. Laying, jointing, testing for defects and for leakage shall be performed in the presence of the Engineer, and shall be subject to approval before acceptance. Material found to have defects will be rejected and the Contractor shall promptly remove such defective materials from the Site.
- B. Installation shall conform to the requirements of AWWA M23, instructions furnished by the pipe manufacturer, and to the supplementary requirements herein. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.
- C. The Contractor shall install all the pipe closure sections, fittings, valves and appurtenances shown on the approved plans, including bolts, nuts, gaskets and joining materials.
- D. The Contractor shall excavate sufficiently in advance of pipe laying operations to enable the alignment and profile to be revised to clear existing utilities and to align with existing connection points.
- E. PVC pipe which has been gouged shall not be used. PVC pipe which has received minor scratches during handling may be used solely at the discretion of the Engineer.
- F. The Contractor shall maintain the interior of the pipe clean, sanitary and free from foreign materials. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trenches shall be kept tightly closed to prevent the entrance of animals and foreign materials. To prevent unwanted water intrusion, open ends of pipe shall be closed temporarily with a watertight bulkhead.
- G. Do not install any pipe contaminated with a petroleum product (inside or outside).
- H. Do not install any pipe that shows evidence of exposure to sunlight, age, surface deterioration, or other physical damage. The decision of the Engineer shall be final as to the acceptability of the pipe to be installed.

3.2 HANDLING AND STORAGE

- A. Handling: Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from

flanges and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches. The pipe shall be hoisted with mechanical equipment using a cloth belt sling or a continuous fiber rope which avoids scratching the pipe. A chain is not permitted. Pipes up to 6 inches in diameter can be lifted by hand.

- B. Storage: Pipe should be stored, if possible, at the Site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression damage or deformation to bell ends of the pipe. Pipe shall be supported uniformly while being stored in such a way as to prevent sagging or bending and be protected from exposure to direct sunlight by covering with an opaque material while permitting adequate air circulation above and around the pipe. Gaskets should be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

3.3 TRENCHING AND BACKFILL

- A. Trench excavation and backfill shall conform to the requirements of Section 31 23 00 – Earthwork. Care shall be taken to ensure that pipe zone material is compacted and in full contact with the haunches of the pipe and that the pipe is fully supported.

3.4 INSTALLATION

- A. Bell-and-spigot pipe shall be laid with the bell end pointing in the direction of laying. Pipe shall be graded in straight lines, taking care to avoid the formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable. At the end of each day's work, open ends of pipe shall be closed temporarily with wood blocks or bulkheads.
- B. Pipe shall be supported at its proper elevation and grade, care being taken to secure firm and uniform support. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the pipe bed, with recessed excavation to accommodate bells, joints, and couplings. Anchors and supports shall be provided where indicated and where necessary for fastening work into place. Fittings shall be independently supported.
- C. Short lengths of pipe shall be used in and out of each rigid joint or rigid structure. Piping that does not allow sufficient space for proper installation of jointing material shall be replaced by one of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- D. Joints shall be installed according to manufacturer's recommendations. Trenches shall be kept free of water until joints have been properly made. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's recommendations.
- E. Pipe shall be cut by means of saws, power driven abrasive wheels, or pipe cutters, which will produce a square cut. No wedge-type roller cutters will be permitted. After cutting, the end of the pipe shall be beveled using a beveling tool, portable type sander, or abrasive disc.

- F. Pipe end shall be secure at all times and care shall be taken to prevent any foreign object, dirt, rocks, debris, rubbish, tools, etc. from entering the pipe. Pipe end shall be capped at the end of each days laying operations. Provided required minimum separation from adjacent utilities are satisfied.
- G. Install PVC pipe such that the indelible identification strip markings on each pipe section are continuously aligned for the total length of the pipeline being installed. Orient the strip marking upward to the 12 o'clock position (top) of the trench opening.
- H. Assemble the pipe joint using the lubricant supplied by the manufacturer. Ensure lubricant is NSF 61 certified for use in potable water systems. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint.
- I. Tapping saddles shall be installed a minimum of 5 feet from the edge of the saddle to any pipe joint or other saddle. Multiple taps of 6 inches or larger shall not be made in the same length of pipe without the approval of the Engineer.

3.5 INSTALLATION OF METALLIC LOCATING TAPE

- A. Polyvinyl chloride pipelines shall be provided with a metallic locating tape laid along the centerline of the pipe trench at a depth of 18 inches below finished grade **OR** above top of pipe. The Contractor shall furnish manufacturer's literature, completely describing the tape proposed to be furnished. No tape shall be used prior to receipt of written approval of the Engineer.

3.6 INSTALLATION OF LOCATOR WIRE

- A. Polyvinyl chloride pipelines shall be provided with locator wire secured to the pipe with surface connections provided at all valve boxes and hydrants and as required to maintain a maximum distance between connections of no greater than 500 feet. Tracer wire shall be laid along the top of the pipe and held in place with ties or hitches. The ties or hitches shall be spaced not more than 10 feet apart. The copper wire is to be used in the future as a means of locating the pipe with an electronic-type pipe locator.

3.7 FIELD TESTING AND DISINFECTION

- A. Field testing shall conform to the requirements of Section 33 13 00 – Water Pipeline Testing and Disinfection as applicable.

END OF SECTION

**SECTION 33 11 11
STEEL PIPE (AWWA C200, MODIFIED)**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide mortar-lined steel pipe coated as specified herein, complete, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards: The following standards are listed for convenience only. All specified standards, whether listed or not, shall apply to the Work.

ANSI/ASTM A 20	General Requirements for Steel Plates for Pressure Vessels
ASTM E 165	Practice for Liquid Penetrant Examination
ASTM A 370	Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A 516	Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ANSI/AWWA C200	Steel Water Pipe 6 In and Larger
ANSI/AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In and Larger - Shop Applied
ANSI/AWWA C206	Field Welding of Steel Water Pipe
ANSI/AWWA C207	Steel Pipe Flanges for Waterworks Service 4 in to 144 in
ANSI/AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
ANSI/AWWA C209	Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
ANSI/AWWA C214	Tape Coating Systems for the Exterior of the Steel Water Pipelines
ANSI/AWWA C215	Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines
ANSI/AWWA C216	Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines

ANSI/AWWA C218	Coating the Exterior of Above Ground Steel Water Pipelines and Fittings
ANSI/AWWA C222	Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings
ANSI/AWWA C602	Cement-Mortar Lining of Water Pipelines 4-In (100 mm) and Larger - In Place
ANSI/ASTM A 36	Carbon Structural Steel
ANSI/ASTM A 283	Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 570	Steel Sheet and Strip, Carbon, Hot-Rolled Structural Quality
ASTM A 572	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM C 150	Portland Cement
ANSI/AWS D1.1	Structural Welding Code – Steel
API Standard 1104	Welding Pipelines and Related Structures
AWWA M-11	Steel Water Pipe - A Guide for Design and Installation
ASME	Boiler and Pressure Vessel Code

1.3 CONTRACTOR SUBMITTALS

- A. Shop Drawings: Submit shop drawings of pipe and fittings in accordance with the requirements in Section 01 33 20 – Submittal Procedures, and the following supplemental requirements as applicable. Fittings and specials shall conform to Section 33 11 12 - Steel Pipe Fabricated Specials. Contractor's submittals for steel pipe and specials shall be coordinated between the sections.
- B. Fabrication Information
- a. Pipe/fitting wall construction details which indicate the type and thickness of cylinder; the position, type, size, and area of reinforcement; manufacturing tolerances; maximum angular joint deflection limitations; and all other pertinent information required for the manufacture and installation of the product.
 - b. Welded joint details shall be submitted for all joint types, including beveled ends for alignment conformance and deep bell or butt strap joints required for control of temperature stresses.
 - c. Rubber gasket joint design and details complete with dimensions, tolerances, and performance or test data.
 - d. Pipe Fabricator's Credentials: Submit the credentials of the pipe manufacturer/fabricator. Credentials shall include reference names, telephone numbers, and descriptions of projects for pipe conforming to AWWA C200 that is of similar diameter, length, and wall thickness to the pipe

- in this project. Project description shall include length, diameter, wall thickness, steel metallurgy, location of facility where pipe was manufactured/fabricated, and names of key plant personnel responsible for the manufacturing process. Submit names and qualifications of current plant personnel to be responsible for manufacture of the pipe in this project
- e. Manufacturer's Written Quality Assurance/Control Program.
 - f. ISO 9001:2000 Certification or Steel Pipe Fabricators Association (SPFA) certification.
2. Materials: Material lists and steel reinforcement schedules which include and describe all materials to be utilized. Metallurgical test reports for steel proposed for use on the project. Submit chemical and physical test reports from each heat of steel that indicate the steel conforms to the Project Specifications.
 3. Line Layout Information
 - a. Line layout and marking diagrams compatible with the requirements of AWWA Manual 11 (M-11) and which indicate the specific mark number of each pipe and fitting and the location of each pipe and the direction of each fitting in the completed line. In addition, the line layouts shall include: the pipe station and centerline elevation at all changes in grade or horizontal alignment; the station and centerline elevation to which the bell end of each pipe will be laid; all elements of curves and bends, both in horizontal and vertical alignment. The location of all mitered pipe sections, beveled ends for alignment conformance, and deep bell or butt strap joints for temperature stress control shall be clearly indicated on the diagrams.
 - b. Dimensional drawings of all valves, fittings, and appurtenances as specified in Section 40 05 00 – Piping, General.
 - c. Drawings showing the location and details of bulkheads for hydrostatic testing of the pipeline, and details for removal of test bulkheads and repair of the lining.
 - d. Details and locations of closures for length adjustment, temporary access manways, vents, and weld lead pass holes as indicated and as required for construction convenience.
 4. Welding Information
 - a. Information regarding location, type, size, and extent of all welds with reference called out for Welding Procedure Specifications (WPS) numbers shall be shown on the shop drawings. The shop drawings shall distinguish between shop and field welds. Shop drawings shall indicate by welding symbols or sketches the details of the welded joints, and the preparation of parent metal required to make them.
 - b. Written welding procedures for shop and field welds, including Welding Procedure Specifications (WPS's) and Procedure Qualification Records (PQR's).
 - c. Written nondestructive testing procedure specifications, and nondestructive testing personnel qualifications for shop and field welds.
 - d. Current welder performance qualifications (WPQ's) shall be submitted for each welder used prior to its performing any Work either in the shop or field. Qualification testing shall be as specified in Article 1.4 - Quality Assurance, Paragraph F, in this Section.
 - e. Submit the credentials of the Contractor's certified welding inspectors (CWI's) and quality control specialist for review prior to starting any welding

- in the shop or field. The credentials shall include, but not be limited to, American Welding Society QC-1 Certification.
- f. Submit all nondestructive testing (NDT) data for each shop-welded and field-welded joint. This data shall include all testing on each weld joint, including re-examination of repaired welds, using radiographic, magnetic particle, dye penetrant examination, ultrasonic, or air test examination methods specified. Test data shall be reviewed and signed by the welding inspector(s).
 - g. Submit a welder log for field and shop welding. Log shall list all welders to be used for the Work and the types of welds each welder is qualified to perform.
 - h. Submit a welding map showing the sequence of welds for all field welds.
 - i. Submit a written weld repair procedure for each type of shop and field weld proposed for use on the Project.
 - j. Submit a written rod control procedure for shop and field operations demonstrating how the Contractor intends to maintain rods in good condition throughout the Work. The rod control procedure shall also demonstrate how the Contractor intends to ensure that the proper rods are used for each weld.
5. Handling and Support Information: Detail drawings indicating the type, number and other pertinent details of the slings, strutting and other methods proposed for pipe support and handling during manufacturing, transport, and installation. Calculations supporting the handling and support system design shall be submitted. Drawings and calculations shall be sealed by a registered professional engineer.
 6. Control of Temperature Stresses
 - a. Submit proposed sequencing of events to control temperature stresses in the pipe wall during installation prior to starting of any field welding.
 - b. Submit the proposed sequencing of events or special techniques to minimize distortion of the steel as may result from shop welding procedures.
 - c. Submit plan for monitoring pipeline temperatures.
 7. Field Lining
 - a. Submit field lining contractor's credentials.
 - b. Submit a description of lining equipment and personnel to be used.
 - c. Submit written procedures for pipe surface preparation, lining application, and curing.
 - d. Submit cement mortar mix design.
- C. Certifications: Furnish a certified affidavit of compliance for all pipe and other products, materials, or related work provided under this Section, as specified in ANSI/AWWA C200, C205, C602, and C206, respectively, and the following supplemental requirements:
1. Compliance with the additional requirements included in these Contract Documents.
 2. Physical and chemical properties of all steel.
 3. Hydrostatic test reports.
 4. Results of production weld tests.
 5. Sand, cement, and mortar tests.
 6. Rubber gasket tests.
 7. All materials are NSF approved for use with potable water where applicable.
 8. Pipe temperature complies with Specifications prior to pouring pipe zone material, during and between periods of CLSM placement, and prior to and during welding temperature control joints (including supporting data).
 9. All welds were performed in conformance with these documents.

- D. All expenses incurred in making samples or collecting data for certification of tests shall be borne by the Contractor at no increased cost to the Owner.

1.4 QUALITY ASSURANCE

- A. Inspection: All pipe, linings, welds, coatings, and related work shall be subject to inspection at the place of manufacture and/or the place the Work is performed in accordance with the provisions of ANSI/AWWA C200, C205, C206, C602, C209, C214, C215, and C222 as applicable, as supplemented by the requirements herein. Notify the Engineer in writing not less than 14 calendar days prior to the start of any phase of the pipe manufacture, welding, lining, coating, testing, or field operations.
- B. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of ANSI/AWWA C200, C205, C206, and C602, as applicable.
 - 1. After the joint configuration is completed and prior to lining with cement-mortar, if applicable, each length of pipe of each diameter and pressure class shall be shop-tested and certified to a pressure of at least 75 percent of the minimum yield strength of the pipe steel. Test pressure shall be maintained for a sufficient time to observe the weld seams. There shall be no leaks. Any leaks shall be repaired and the pipe retested.
 - 2. Production weld tests as required in ANSI/AWWA C200, except weld tests shall be conducted on each 5,000 feet of production welds at a minimum, and at least one set of tests per operator per work shift shall be performed.
- C. Perform said material tests at no additional cost to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor; provided, that the Contractor's schedule is not delayed for the convenience of the Engineer.
- D. In addition to those tests specifically required, the Engineer may request additional samples of any material including mixed concrete and lining and coating samples for testing by the Owner. The additional samples shall be furnished at no additional cost to the Owner.
- E. Welding Procedure Specifications: All welding procedures used to fabricate and install pipe shall be in accordance with the ASME Boiler and Pressure Vessel Code (BPVC) for shop welds and ANSI/AWS D1.1 for field welds. Written welding procedures shall be required for all welds, both shop and field. Welds qualified per the ASME BPVC shall include Supplementary Essential Variables for notch-tough welding. All provisions of ANSI/AWS D1.1 pertaining to notch-tough welding shall apply.
- F. Welder Performance Qualifications: All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified by the Contractor under the provisions of ASME BPVC for shop welds and ANSI/AWS D1.1 for field welds. Furnish all material and bear the expense of qualifying welders.
- G. Shop Nondestructive Testing: Nondestructive testing shall be performed for various weld categories as specified below. Testing shall include submitting written documentation of procedures per Section V, and acceptance criteria shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code.

1. Butt Joint Welds: Spot radiographically examine pipe in accordance with Paragraph UW-52 of the ASME Boiler and Pressure Vessel Code Section VIII, Division 1. If, in the opinion of the Engineer, the butt joint welds cannot readily be radiographed, they shall be 100 percent ultrasonically examined.
 2. Fillet Welds: 100 percent examine all fillet welds using the magnetic particle inspection method.
 3. Groove Welds: 100 percent ultrasonically examine all groove welds that cannot be readily radiographically spot examined.
 4. All Welds: Certified welding inspector shall 100 percent visually examine all welds as a minimum.
 5. In addition to weld tests hereinbefore specified, doubler pads shall be air tested as stated in AWWA C206.
 6. Refer to Section 33 13 00 - Water Pipeline Testing and Disinfection for field nondestructive testing.
- H. Onsite Observation: The pipe fabricator shall provide an experienced staff member to train the contractor's installation crews regarding pipe handling, jointing, and backfilling. Training shall be provided for a minimum of two weeks at the beginning of the project, and as needed during construction. The staff member's duties shall include, but not be limited to, the following:
1. Observe the installation and welding of the pipe and fittings.
 2. Report any concerns to the Engineer's onsite observer.
 3. Answer questions and provide assistance to the Engineer and the Contractor.
- I. Certified Welding Inspector (CWI): Furnish the services of a certified welding inspector(s) for all shop and field welding as specified in AWWA C200 and C206. The certified welding inspector(s) shall 100 percent visually inspect all welds, verify proper procedures are being followed using qualified welders, supervise Contractor's non-destructive testing, and witness Engineer's non-destructive testing. The welding inspector(s) shall submit written certification that all welds were performed in conformance with these documents. All shop weld tests shall be reviewed and signed by the inspector(s).
- J. Pipe Manufacturer/Fabricator: The manufacturer or fabricator of the pipe shall be experienced in fabricating pipe of similar diameters and wall thicknesses required for this Work and shall have the manufacturing capability to meet the schedule requirements of this project. Experience shall include successful fabrication to AWWA C200 standards of at least 30,000 linear feet of 66-inch and larger pipe with wall thicknesses 0.3125- inch or larger within the 4-year period preceding the bid date. This experience requirement shall apply to the fabrication plant facility and responsible personnel, not to the firm which owns the facility or employs the personnel.
- K. Single Manufacturer: A single manufacturer shall be made responsible for coordination of design, fabrication, testing, and furnishing of mainline pipe and fabricated specials. Separate suppliers for mainline pipe and specials will not be allowed.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise indicated, steel pipe, linings and coatings shall conform to ANSI/AWWA C200, C205, C602, C209, C214, C215, C216, and C222, as applicable, subject to the following supplemental requirements. The pipe shall be of the diameter and wall thickness shown, shall be furnished complete with welded or gasket joints, as indicated in the Contract Documents, and all specials shall be provided as required in Section 33 11 12 - Steel Pipe Fabricated Specials. For pipe larger than 24 inches in diameter, the inside diameter after lining shall not be less than the nominal diameter indicated unless otherwise shown. Pipe 24 inches in diameter and smaller may be provided in standard outside diameters.
- B. Markings: Legibly mark all pipes and specials in accordance with the laying schedule and marking diagram. Each pipe shall be numbered in sequence and said number shall appear on the laying schedule and marking diagram in its proper location for installation. All special pipe sections and fittings shall be marked at each end with top field centerline. The word "top" shall be painted or marked on the outside top spigot of each pipe section.
- C. Handling and Storage: The pipe shall be handled by use of wide slings, padded cradles, or other devices, designed and constructed to prevent damage to the pipe coating/exterior. The use of chains, hooks, or other equipment which might injure the pipe coating/exterior will not be permitted. Stockpiled pipe shall be suitably supported and shall be secured to prevent accidental rolling and to avoid contact with mud, water, or other deleterious materials. Stockpiled pipe shall be supported on sand or earth berms free of rock exceeding 1 inch in diameter. The ends of all pipe shall be securely bulkheaded or otherwise sealed during transport to the jobsite. All pipe handling equipment and methods shall be acceptable to the Engineer.
- D. Pay the cost of replacement or repair of pipe which is damaged at no increased cost to the Owner.
- E. Strutting: Adequate strutting (stulling) shall be provided on all specials, fittings, and straight pipe so as to avoid damage or distortion to the pipe and fittings during handling, storage, hauling, and installation. The following requirements shall apply:
1. The strutting shall be placed as soon as practicable after the pipe is fabricated or the mortar lining has been applied and shall remain in place while the pipe is loaded, transported, unloaded, installed and backfilled at the jobsite.
 2. The strutting materials, size and spacing shall be the responsibility of the Contractor and shall be adequate to prevent deflection and support the earth backfill plus any greater loads which may be imposed by the backfilling and compaction equipment. One strut shall be placed vertical oriented with the top of pipe. One set of struts shall be set 2 feet from each end of each pipe section and at a maximum interval of 15 feet in-between
 3. Any pipe damaged during handling, hauling, storage, or installation due to improper strutting shall be repaired or replaced.
- F. Laying Lengths: Maximum pipe laying lengths shall not be limited unless specifically required by the Drawings. Contractor shall select lengths to accommodate the Contractor's operation.

- G. Lining: The pipe lining shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing and roughness.
- H. Cathodic Protection System: Cathodic protection systems shall be applied to pipelines as shown on the Drawings. Refer to Division 13 – Special Construction.
- I. Closures and Correction Pieces: Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing indicated. The locations of correction pieces and closure assemblies shall be shown on the pipe layout diagrams and shall be subject to the Engineer's review. Any change in location or number of said items shall be approved by the Engineer.
- J. Shop-Welded Surfaces: All weld seams on pipe surfaces that will have a flexible tape or polyolefin coating in accordance with Section 09 90 10 – Pipeline Coatings and Linings shall be ground such that the maximum weld bead height will not exceed 1/32 inch. All ground weld seams shall be smooth and free of all burrs. Do not grind into, or gouge, the adjacent pipe wall material.

2.2 MATERIALS

- A. Cement: Cement for mortar shall conform to the requirements of ANSI/AWWA C205; provided, that cement for mortar coating shall be Type V, and mortar lining shall be Type II or I V, per ASTM C 150. Fly ash or pozzolan shall not be used as a cement replacement.
- B. Steel: Provide steel coils for spiral welded steel pipe or steel plate for straight seam welded steel pipe per AWWA C200 and as follows:
 - 1. Yield Strength: 42,000 psi minimum. Measured yield strength shall not exceed 85% of measured tensile strength.
 - 2. Minimum Tensile Strength: 60,000 psi
 - 3. Coils: Steel coils shall be made from the continuous cast process or continuous cast slabs, fully killed, fine-grain practice conforming to the physical and chemical characteristics of ASTM A1018/A1018M, SS Grade 45. For sheet steel, the maximum allowable thickness variation shall be 0.010 inch under or over the nominal thickness.
 - 4. Plate: Steel plate shall be fully killed, conform to ASTM A20, and be manufactured to fine-grain practice conforming to the physical and chemical characteristics of ASTM A572/A572M, Grade 50. For plate steel, the maximum allowable thickness variation shall be 0.010 inch under or over the nominal thickness.
- C. Pipe shall be manufactured as fabricated pipe per AWWA C200 as modified herein. ASTM pipe manufacturing standards referenced in AWWA C200 shall not be used. Pipe sections shall be fabricated by either of the following methods:
 - 1. Pipe sections may be spirally welded or fabricated from short cylindrical courses joined circumferentially by complete penetration butt joint welds with not more than two longitudinal seams per course. Longitudinal seams shall be staggered on both sides of the pipe.
 - 2. Pipe sections may be rolled or pressed from no more than three sheets the full length of the pipe and welded with no more than three longitudinal seams. Patching inserts, overlays, or pounding out of dents will not be permitted. Repair of notches or laminations on second ends will not be permitted. Damaged ends shall be removed

as a cylinder and the section end properly prepared. Distorted or flattened lengths shall be rejected. A buckled section shall be replaced as a cylinder.

D. Charpy Tests

1. General. Steel used in production manufacturing of pipe and specials shall be tested for notch toughness using Charpy V-Notch tests per ASTM A 370. The test acceptance shall be 25 foot-pounds at a test temperature of 30 degrees F.
2. Charpy V-Notch tests shall be conducted on all steel used in fabricating pipe and reinforcement materials 0.5-inch or greater in thickness. Test outside diameter wrap of two coils minimum per heat lot.
3. The Owner may elect to increase the Charpy testing to include more steel than indicated above at a negotiated price.

2.3 SPECIALS AND FITTINGS

- A. Unless otherwise required, all specials and fittings shall be in accordance with Section 33 11 12 – Steel Pipe Fabricated Specials and shall conform to the dimensions of ANSI/AWWA C208.

2.4 DESIGN OF PIPE

- A. General: The pipe shall be steel pipe, mortar-lined and flexible or mortar-coated as shown on the Drawings, with field welded joints or gasket as indicated. The pipe shall consist of a steel cylinder, lined with portland cement-mortar as indicated, with an exterior coating as indicated in Section 09 90 10 – Pipeline Coatings and Linings. Field lining will only be allowed where specifically indicated on the Drawings.
- B. The pipe shall be manufactured, tested, inspected, and marked according to applicable requirements previously stated and except as hereinafter modified, shall conform to ANSI/AWWA C200.
- C. Pipe Dimensions: The pipe shall be of the diameter and wall thickness shown on the Drawings. The minimum steel cylinder thickness for each pipe size shall be as indicated.
- D. Specials Dimensions: The specials shall be of the diameter and wall thickness indicated on the Drawings, or as specified in Section 33 11 12 - Steel Pipe Fabricated Specials.
- E. Joint Design: Unless otherwise shown on the Drawings, the standard field joint for steel pipe shall be a double-welded (fully circumferential)lap joint. Mechanically coupled, or flanged joints shall be required where indicated on the Drawings. Butt-strap joints shall be used only where required for closures or where indicated. The joints furnished shall have the same or higher pressure rating as the abutting pipe. Provide air test tapped holes for each double welded lap joint as defined in Section 33 13 00 - Water Pipeline Testing and Disinfection.
- F. Lap joints prepared for field welding shall be in accordance with ANSI/AWWA C200. The method used to form, shape and size bell ends shall be such that the physical properties of the steel are not substantially altered. Unless otherwise approved by the Engineer, bell ends shall be formed by an expanding press or by the pipe being moved axially over a die in such a manner as to stretch the steel plate beyond its elastic limit to form a truly round bell of suitable diameter and shape. The ends shall not be rolled. Faying surfaces of the bell and

spigot shall be essentially parallel, but in no case shall the bell slope vary more than 2 degrees from the longitudinal axis of the pipe.

- G. Moderate deflections and long radius curves may be made by means of beveled joint rings, by pulling standard joints, by using short lengths of pipe, or a combination of these methods; provided that pulled joints shall not be used in combination with bevels and maximum joint deflections are not exceeded. The maximum total allowable angle for beveled joints shall be 5 degrees per pipe joint. Bevels shall be provided on the bell ends. Mitering of the spigot ends will not be permitted. The maximum allowable angle for pulled joints shall be 75 percent of the manufacturer's recommendations or the angle which results from a ¾-inch pull out from normal joint closure, whichever is less. In no case shall pulled joints result in a gap between the bell and spigot at the weld location that exceeds 1/8 inch. All horizontal deflections or fabricated angles shall fall on the alignment, as shown.
- H. All vertical deflections shall fall on the alignment within laying tolerance as described in Section 3.1.
- I. Shop-applied interior linings and exterior coatings shall be held back from the ends of the pipe as indicated or as otherwise acceptable to the Engineer. Holdback areas shall be coated as hereinafter specified.
- J. Temperature Control Lap Joint: A special longer bell end (temperature control lap joint) shall be provided at a maximum spacing of 400 feet to account for movement of the installed pipe due to temperature changes. The pipe manufacturer shall determine the length required for the longer bell as defined by the Contractor's pipe laying procedures and the location of the special bell. Minimum temperature control lap joint length shall be as shown on the Drawings.
- K. Joint Shop Coating: All holdback areas for welded joints, all butt straps, and all bell and spigot joint rings for rubber-gasketed joints shall be thoroughly cleaned and given a shop coat of rust-inhibitive primer. The surface preparation and primer shall be compatible with the intended finish coating as specified in Section 09 90 0 - Protective Coatings and Linings, Section 09 90 10 - Pipeline Coatings and Linings, as applicable.
- L. Shop Fit Test
 1. To ensure that joints may be fully assembled and that excessive annular space between spigots and bells does not exist, and that the pipe meets the requirements of AWWA C200, the pipe fabricator shall perform a shop fit test on a minimum of five joints. The joints to be tested shall be selected by the Engineer based on pipe measurements.
 2. The shop fit test shall join the pipe ends in the shop with the proposed adjacent pipe end.
 3. Record the actual annular space, with the data to include as a minimum:
 4. Maximum space at any point.
 5. Minimum space at any point.
 6. Space at 90-degree intervals--top, bottom, and spring line on both sides.
- M. The pipe ends shall be match marked after shop assembly.

2.5 CEMENT-MORTAR LINING

- A. Cement-Mortar Lining for Shop Application: Where indicated on the Drawings, interior surfaces of all steel pipe, fittings, and specials shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with ANSI/AWWA C205. During the lining operation and thereafter, the pipe shall be maintained in a round condition by suitable bracing or strutting. The lining machines shall be of a type that has been used successfully for similar work and shall be approved by the Engineer. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at the delivery site, or after installation, the damaged or unsatisfactory portions shall be replaced with lining conforming to these Specifications at no additional cost to the Owner.
- B. The minimum lining thickness shall be in accordance with Section 09 90 10 - Pipeline Coatings and Linings.
- C. The pipe shall be left bare where field joints occur as indicated. Ends of the linings shall be left square and uniform. Feathered or uneven edges will not be permitted.
- D. Defective linings, as determined by the Engineer, shall be removed from the pipe wall and shall be replaced to the full thickness required. Defective linings shall be cut back to a square shoulder in order to avoid feather edged joints. Temperature and shrinkage cracks in the mortar less than 1/16 inch wide need not be repaired. Pipe, specials, or fittings with cracks wider than 1/16 inch shall be rejected or repaired per AWWA C205 at the discretion of the Engineer.
- E. The progress of the application of mortar lining shall be regulated in order that all hand work, including the repair of defective areas is cured in accordance with the provisions of ANSI/AWWA C205. Cement-mortar for patching shall be the same materials as the mortar for shop or machine lining, except that a finer grading of sand and mortar richer in cement shall be used when field inspection indicates that such mix will improve the finished lining of the pipe.
- F. Cement-Mortar Lining: Unless otherwise indicated, all steel pipe shall be mortar-lined. The materials and design of in-place cement-mortar lining shall be in accordance with ANSI/AWWA C602 and the following supplementary requirements:
1. Pozzolanic material shall not be used in the mortar mix.
 2. Admixtures shall contain no calcium chloride.
 3. The minimum lining thickness shall be as indicated for shop-applied cement-mortar lining and finished inside diameter after lining shall be as indicated.
 4. Temperature and shrinkage cracks in the mortar less than 1/16 inch wide need not be repaired. Pipe, specials, or fittings with mortar cracks wider than 1/16 inch shall be rejected or repaired at the discretion of the Engineer.
 5. Field applied mortar lining shall meet the requirements of this Subparagraph F.
 6. Grout mixture for field applied joint lining shall include two parts sand to one part Portland Cement by volume and potable water. NSF approved acrylic latex admixture (Flex-Con, or equal) shall be added to mortar as needed to make dough like consistency for hand packing into joint area.
- G. Protection of Pipe Lining/Interior: For all pipe and fittings with plant-applied cement-mortar linings, provide a polyethylene or other suitable bulkhead on the ends of the pipe and on all

special openings to prevent drying out of the lining. All bulkheads shall be substantial enough to remain intact during shipping and storage until the pipe is installed.

2.6 EXTERIOR COATING OF PIPE

- A. Exterior Coating of Steel Pipe: The exterior coating of all steel pipe shall be in accordance with Section 09 90 10 – Pipeline Coatings and Linings.

2.7 PIPE APPURTENANCES

- A. Pipe appurtenances shall be in accordance with the requirements of Section 40 05 00 – Piping, General.

2.8 PIPELINE MARKING TAPE

- A. Metallic tape: HyTech Detectable Tape manufactured by [NorthTown](#) Pipe Protection Products; or approved equal, having the following essential characteristics:
 - a. Aluminum foil encased in high visibility inert polyethylene jacket.
 - b. Total thickness: 5.0 mils, minimum.
 - c. Width: 6 inches, minimum.
 - d. Imprinted on one side, 1-inch-tall, permanent black lettering.
 - e. Color: as listed below.
 - f. Joining clips shall be manufacturer's standard
 - g. Tape shall read for example "JWCD-Buried Pipeline Below".
- B. Plastic tape: Terra Tape manufactured by Reef Industries, Inc., 9209 Alameda Genoa Road, Houston, TX 77075, www.reefindustries.com; or equal, having the following essential characteristics:
 - a. Polyolefin or similar chemically inert material unsusceptible to alkalies, acids, and chemicals and solvents likely in the soil.
 - b. Thickness: 4.0 mil, minimum.
 - c. Width: 12 inches minimum.
 - d. Color: as listed in below.
 - e. Imprinted on one side, 1-inch-tall, permanent black lettering on a colored background.
 - f. Tape shall read for example "JWCD-Buried Pipeline Below".

2.9 MARKERS

- A. Provide pipeline markers at the locations indicated. Markers in open areas shall be High Visibility Tri-View Utility Marking Posts as manufactured by Rhino Marking and Protection Systems (www.rhinomarkers.com). Coordinate color and lettering with Owner prior to installation. Markers shall be provided at the following locations:
 - 1. Both sides of street and canal crossings.
 - 2. At locations of cathodic protection test stations (see test station table).
 - 3. At the beginning and end of open areas and at a maximum interval of 500-ft.
- B. Brass Caps: Caps shall be 2-1/2-inch diameter brass caps with posts set by epoxy into holes drilled into the curb adjacent to the pipeline. Brass caps and monuments shall be provided

in locations as described in the plans. Caps shall be stamped as shown on the details and shall be provided at the following locations:

1. Fittings, bends, deflections or elbows.
2. Both sides of street and canal crossings.
3. Within deck of concrete structures (manholes, vaults, etc.)
4. Minimum distance of 1,000LF along pipeline

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE

- A. Handling and Storage: All pipe, fittings, and specials shall be carefully handled and protected against damage to lining and coating/interior and exterior surfaces, impact shocks, and free fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe shall not be placed directly on rough ground but shall be supported in a manner which will protect the pipe against injury whenever stored at the trench site or elsewhere. Pipe shall be handled and stored at the trench site in accordance with the requirements stated below. No pipe shall be installed when the lining or coating/interior or exterior surfaces show cracks or other damage that may be harmful as determined by the Engineer. Such damaged lining and coating/interior and exterior surfaces, shall be repaired to the satisfaction of the Engineer, or a new undamaged pipe shall be furnished.
- B. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor at no additional cost to the Owner.
- C. Inspect each pipe and fitting to insure that there are no damaged portions of the pipe. Remove or smooth out any burrs, gouges, weld splatter or other small defects prior to laying the pipe.
- D. Before placement of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance, which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work.
- E. Lifting points shall be no closer than the 1/3 and 2/3 points along the length of the Section. Contractor shall be responsible for selecting lifting points that when used, do not result in damage to the pipe.
- F. Excavations shall be made as needed to facilitate removal of handling devices after the pipe is laid. Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations and for application of coating on field joints.
- G. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints, short lengths of pipe, by the use of beveled joint rings, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed 75 percent of the maximum deflection recommended by the pipe manufacturer or the amount that results in more than a 1/8-inch gap at the weld location, whichever is less. No joint shall be misfit

any amount which will be detrimental to the strength and water tightness of the finished joint.

- H. Except for short runs which may be permitted by the Engineer, pipes shall be laid uphill on grades exceeding 10 percent. Pipe which is laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement. All bends shall be properly installed as shown.
- I. Pipe struts shall be left in place until backfilling operations have been completed for pipe 42 inches in diameter and larger. Struts in pipe smaller than 42 inches may be removed immediately after laying, provided, that the deflection of the pipe during and after backfilling does not exceed that specified. After the backfill has been placed to a minimum of 3-feet, the struts shall be removed by the Contractor and shall remain the property of the Contractor. Struts shall not be removed with a torch or any other method that may damage the pipe lining or coating. The parent pipe material shall not be nicked, gouged, or damaged during strut removal. All repairs of gouges or nicks in the parent material shall be made using 3/32-inch maximum diameter E-6010 welding electrodes with a maximum heat input of 5.6 kj per inch. Tack welds, stull metal, weld splatter, slag, and burrs that remain attached to the parent metal surface after cutting shall be ground to within 1/32 inch of the parent metal. Grinding shall not penetrate the parent metal. The Contractor shall notify the Engineer prior to grinding. Following grinding, all pipe surfaces at the tack weld shall be visually inspected for defects. All defects deeper than 1/16 inch shall be repaired by welding in accordance with ANSI/AWSD.1.1 and AWWA/ANSI C206. All inspection work shall be performed by a certified welding inspector.
- J. For pipe backfilled with CLSM, the pipe shall be laid directly on moist sandbags or other suitable supports approved by the Engineer in preparation for CLSM pipe zone material. Sandbags shall be placed to provide at least 6 inches of CLSM below the bottom of the pipe. Sandbags shall be spaced at a maximum interval of 8 feet and one set shall be placed within 3 feet on both sides of each joint. The Contractor shall provide additional sandbags as needed to support the pipe on line and grade. For pipe bedded in granular material, no blocking will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Excavations shall be made as needed to facilitate removal of handling devices after the pipe is laid. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings. Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations and for application of coating on field joints.
- K. At all times, means shall be provided to prevent the pipe from floating. Take all necessary precautions to prevent the pipe from floating due to water entering the trench or from backfilling with CLSM. The Contractor shall assume full responsibility for any damage due to this cause and shall at its own expense restore and replace the pipe to its specified condition and grade if it is displaced due to floating. Maintain the inside of the pipe free from foreign materials and in a clean and sanitary condition until its acceptance by the Owner.
- L. Bulkheads
 - 1. Prior to shipment of pipe with cement mortar lining the lining shall be wetted then a suitable bulkhead shall be attached to each end of the pipe section. This bulkhead shall remain in place and in good condition through transit to the Project.

2. During construction the openings of all pipe and specials where the pipe and specials have been cement-mortar lined in the shop shall be protected with suitable bulkheads to maintain a moist atmosphere and to prevent unauthorized access by persons, animals, water or any undesirable substance. The bulkheads shall be so designed to prevent drying out of the interior of the pipe. Introduce water into the pipe as needed to keep the mortar moist where moisture has been lost due to damaged bulkheads.
- M. Pipe Cleanup: As pipe laying progresses, keep the pipe interior free of all debris. Completely clean the interior of the pipe of all sand, dirt, mortar splatter and any other debris following completion of pipe laying and any necessary interior repairs prior to testing and disinfecting the completed pipeline.
- N. Installation Tolerances: Each section of pipe shall be laid in the order and position shown on the laying diagram and the following requirements:
1. Each section of pipe having a nominal diameter less than 48 inches shall be laid to line and grade, within plus or minus 2 inches horizontal deviation and plus or minus 1 inch vertical deviation.
 2. Each section of pipe having nominal diameter 48 inches and larger shall be laid to line and grade, within plus or minus 5 percent of diameter horizontal deviation and plus or minus 2.5 percent of diameter vertical deviation.
 3. In addition to the horizontal and vertical tolerances above, lay the pipe so that no high or low points other than those on the laying diagram are introduced.
 4. Pipe deflection, after backfill but prior to installation of field-applied cement mortar lining, if applied, shall not exceed 2.25 percent for flexible coated pipe and 1.5 percent for cement mortar coated pipe. Deflection shall be measured by the difference in vertical inside diameter in the installed pipe and the manufactured pipe.
 5. Pipe not conforming to these criteria or which otherwise impact the ability to complete the Work shall be removed and reinstalled in full conformance with the Contract Documents at no additional cost to the Owner.
 6. For each section of pipe, record the invert elevation at the lower end and incorporate the data on the Record Drawings.
- O. Protection of Pipe: At locations where the Contractor proposes to cross the installed pipeline with heavy equipment, precautions as approved by the Engineer shall be taken to protect the pipe from damage. Acceptable precautions include: backfilling the pipe trench as necessary to protect the pipe, concrete encasing the pipe, and placing steel plating over the pipe. Any damage to the pipe caused by the Contractor's operation or his equipment shall be repaired at no additional cost to the Owner.

3.2 WELDED JOINTS

- A. Welding Procedures, Welding Qualifications, and Testing:
1. Field welding procedures, welders, welding operators, and tackers shall be qualified in accordance with AWS D1.1 and as defined in Section 3 of ANSI/AWWA C206 or ANSI/AWWA C200, as applicable. All qualifications shall be in accordance with all-position pipe tests as defined in Section 5 of AWS D1.1.
 2. For field welding, the welder qualification testing shall be performed at the site. Previous qualifications will not be accepted. The Contractor shall obtain the services of an independent testing laboratory to perform the welder qualification onsite.

Copies of all test data and certifications shall be provided to the Engineer. All costs for welder qualification testing shall be at no increased cost to the Owner.

3. Upon completion of each field-welded joint, the welding operator shall mark his regularly assigned identification number and the last two numbers of the year in which the Work was completed, or the Contractor may have a records system that traces a welder's work completion to a specific joint. Steel stamping directly on piping will not be permitted unless "low stress" die stamps, such as interrupted dot or round nose types, are used.
 4. All single welded lap joints will be inspected by the CONTRACTOR in the presence of the Engineer using magnetic particle or dye penetration methods. Field butt welds will be inspected by the CONTRACTOR in accordance with the requirements of API 1104 by the radiographic method and the acceptance criteria of API 1104. Magnetic particle testing is not required for seal welds.
 5. All double welded lap joints and butt strap joints shall be air tested by the CONTRACTOR in the presence of the Engineer in accordance with Section 33 13 00 - Water Pipeline Testing and Disinfection. Repairs and retesting shall be required if any loss of pressure occurs. All double welded lap joints will also be inspected by the CONTRACTOR in the presence of the Engineer using magnetic particle or dye penetration methods.
 6. The Contractor shall inform the Engineer before completed weld joints are to be backfilled so that the joint may be inspected. The Contractor shall assume all costs of exposing backfilled joints for inspection when backfilling preceded the inspection.
 7. Personnel performing visual inspection of welds shall be qualified and currently certified as Certified Welding Inspectors (CWI) in accordance with AWS QC1, Standard for Qualification and Certification of Welding Inspectors. Personnel performing nondestructive tests shall be qualified and certified to the requirements of SNT-TC-1A.
 - a. The Engineer may also order nondestructive testing by an independent testing laboratory in addition to any testing specified herein. Except as otherwise specified herein, all costs for the independent testing laboratory to inspect and test field welds will be paid for by the Owner. If the weld is defective, the inspection costs shall be paid for by the Contractor. Defective welds shall be repaired and retested at the Contractor's expense.
 - b. Test reports of all laboratory tests shall be submitted as provided in the quality control section.
- B. Where exterior welds are performed, adequate space shall be provided for welding and inspection of the joints.
- C. Lap Welded Joints: During installation of welded steel pipe in either straight alignment or on curves, the pipe shall be laid so that at any point around the circumference of the joint there is a minimum lap as shown on the Drawings.
- D. Butt Straps: Where used or required, shall be as shown on the Drawings.
- E. After the pipe and pipe joint are properly positioned in the trench, weld and provide external joint protection for all joints except the special temperature control lap joint hereinafter specified. The length of pipe between special temperature control joints shall be backfilled to at least one foot above the top of the pipe as hereinafter specified. The special temperature control joints shall be welded after the pipe is backfilled to at least one foot above the top of

the pipe for the full distance between the temperature control joints upstream and downstream. Joint protection shall be provided for special temperature control joints after completion of the joint welds and tests as specified. Care shall be exercised during the initial backfilling to prevent movement of the pipe and to prevent any backfill material from being deposited on the special temperature control joint.

F. Control of Temperature Stresses

1. Control temperature stresses in accordance with AWWA C206, the approved temperature stress control submittal, and these Specifications. Provide special temperature control lap joints at intervals of 400 feet or less, unless otherwise approved by the Engineer.
2. To control temperature stresses, the unbackfilled special temperature control joint areas of all pipe shall be shaded from the direct rays of the sun by the use of properly supported awnings, umbrellas, tarpaulins, or other suitable materials until the pipe is backfilled at least 1 foot over the top of the pipe. The "temperature control joint area" is defined as the entire length of pipe left exposed near a control joint after placing the pipe backfill between it and the other control joints in each direction. The term "special temperature control joint area" is defined as the entire length of pipe left exposed near a control joint after placing the backfill between it and the other control joints in each direction. Shading materials at the joint area shall not rest directly on the pipe but shall be supported to allow air circulation around the pipe. Shading of the pipe joints need not be performed when the ambient air temperature is below 45 degrees F.
3. At intervals not exceeding 400 feet along welded reaches of the pipeline, at the first regular lap-welded field joints outside concrete encasements and structures, and where shown, the pipe shall be supplied with a special temperature control lap joint and laid with an initial lap of not less than 3 inches greater than the typical lap joint. Where temperature control lap joints occur in a traveled roadway or other inconvenient location, the location of the joint may be adjusted, as acceptable to the Engineer.
4. Provide and install thermocouple temperature gauges to monitor the temperature of the steel pipe wall on the inside top of the pipe as it lays in the trench. All pipe temperature requirements specified herein shall be measured at the top inside of the steel cylinder. Specific temperature requirements for the pipeline steel cylinder shall be met prior to installation of the controlled low strength material (CLSM), during and after placement of CLSM, and during welding of the special temperature control joints. If atmospheric conditions do not allow the conditions to be met, supplemental cooling shall be required by the Contractor. The following outlines the specific temperature control requirements.
 - a. Prior to and during placement of the CLSM, the pipeline steel temperature shall be at or below 90 degrees F. The specified temperature shall be maintained for at least three hours after the placement of CLSM. The specified temperature shall be maintained until the line is fully backfilled. Provide supplemental cooling as required.
 - b. Placement of CLSM shall proceed in the direction of pipe laying from one special temperature control joint to the next. During placement of CLSM, the lead end of the pipe section (toward the next special temperature control joint) shall be left unbackfilled or otherwise unrestrained such that the end of the pipe is free to move in response to expansion or contraction due to temperature changes. CLSM shall not be placed in a direction which would

result in CLSM placement proceeding in a direction toward previously or simultaneously placed CLSM without the written permission of the Engineer. The direction of CLSM placement will not be limited for placement at the short unbackfilled section immediately adjacent to the special temperature control joints.

- c. During periods between CLSM placement operations, any section of pipeline that is backfilled with CLSM shall be shaded from the direct rays of the sun by the use of properly supported awnings, umbrellas, tarpaulins, or other suitable materials until the pipe is backfilled at least 1 foot over the top of the pipe. The temperature of the partially backfilled pipe shall not be allowed to exceed 110 degrees Fahrenheit at any time. Provide supplemental cooling as required. Shading materials shall not rest directly on the pipe but shall be supported to allow air circulation around the pipe. Shading of the partially backfilled pipe need not be performed when the Contractor can demonstrate to the satisfaction of the Engineer, using thermocouple data, that shading is not necessary to the Contractor to meet the specified temperature requirement.
 - d. Prior to welding the special temperature control joints, the pipeline extending 400 feet each direction from the joint shall be maintained at or below 85 degrees F. Additionally, the pipeline extending 400 feet each direction from the joint shall be backfilled with CLSM to at least one foot over the top of the pipe. At the specified temperature, the special temperature control joints can be welded. Begin and complete the weld during the coolest interval of suitable length within a 24-hour day. Use the thermocouple temperature data to demonstrate to the Engineer the coolest interval of the day.
 - e. After welding any temperature control joint, the pipe temperature for 150 feet in each direction from the control joint shall be maintained below 110 degrees F for a minimum of 24 hours after the temperature control joint area has been backfilled to at least 1 foot over the top of the pipe. This requirement is in addition to the shading and CLSM placement temperature requirements indicated herein.
- G. Prior to the beginning of pouring CLSM or beginning the welding procedure, any tack welds or joint stops used to position the pipe during laying shall be removed. Any annular space between the faying surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. The weld shall then be made in accordance with ANSI/AWWA C206. Where more than one pass is required, all dirt, slag, and flux shall be removed before the succeeding bead is applied.
- H. Testing of Joints: The pipeline joints shall be tested as specified herein and in Section 33 13 00 - Water Pipeline Testing and Disinfection.
- I. Following tests of the joint, the exterior joint spaces shall be coated in accordance with these Specifications after which backfilling may be completed.
- J. Joints: The pipe ends shall be cut straight on joints where butt straps are used for realignment, adjustment, or deflection, and fillet welds shall be made as indicated.
- K. Repair of Welds: All welds that are defective shall be repaired by the Contractor to meet the requirements of this Section at no additional cost to the Owner. Defects in welds or defective

welds shall be removed, and that section of the joint shall then be rewelded. Only sufficient removal of defective material that is necessary to correct the defect is required. After the repair is made, the joint shall be checked by repeating the original test procedure. Welds deficient in size shall be repaired by adding weld metal.

3.3 JOINT COATING AND LINING

- A. General: The interior and exterior joint recesses shall be thoroughly wiped clean and all water, loose scale, dirt and other foreign material shall be removed from the inside surface of the pipe. The grout for joint coating and lining shall be cement grout in accordance with Section 03 60 00 - Grouting, except that composition shall be one part cement to two parts sand and sufficient water for dry-pack consistency
- B. Joint Coating: In accordance with the requirements of Section 09 90 10 – Pipeline Coatings and Linings.
- C. Joint Lining:
 - 1. Clean joint to remove dirt, debris, and other contaminants.
 - 2. Apply a single application of NSF approved acrylic latex bonding admixture (Flex-Con, or equal) to wet out joint for the promotion of adhesion.
 - 3. The grout for joint lining shall be cement grout in accordance with Section 03 60 00 – Grouting, except that composition shall be one part cement to two parts sand and sufficient water for dry-pack consistency. NSF approved acrylic latex admixture shall be added to develop a dough like consistency.
 - 4. Mortar mixture is hand packed into the joint area.
 - 5. Joint is troweled smooth to create a uniform transition between existing mortar lined pipe.
 - 6. Joint area is swept clean of debris.
 - 7. After the backfill has been completed to final grade, the interior joint recess of shop-lined pipe shall be filled with grout, tightly packed into the joint recess and troweled flush with the interior surface. All excess shall be removed. At no point shall there be an indentation or projection of the grout exceeding 1/16 inch. With pipe smaller than 24 inches in diameter, before the spigot is inserted into the bell, the bell shall be daubed with grout containing one part cement to two parts sand. The spigot end then shall be forced to the bottom of the bell and excess mortar on the inside of the joint shall be swabbed out.

3.4 CEMENT-MORTAR LINING, FIELD-APPLIED

- A. Unless otherwise indicated, the Contractor shall construct the cement-mortar lining in-place after the pipeline is backfilled to approximate finished grade. The application of in-place cement-mortar lining shall be in accordance with ANSI/AWWA C602.
 - 1. The lining machine shall be of a type that has been used successfully for a similar size of pipe. Perform all Work in a thorough and workmanlike manner by trained personnel, under the supervision of experienced personnel skilled in machine application of cement-mortar lining to pipelines of size comparable to this Work.
 - 2. Curing of the in-place cement-mortar lining shall be in accordance with ANSI/AWWA C602, except the Contractor shall be responsible for curing and maintaining the lining until final acceptance by the Owner. Provide a system to maintain a suitably moist environment within the pipe to properly cure and maintain

the lining. Provide additional protective devices as required to ensure that the airtight covers, which maintain a moist condition in the pipeline, are not damaged.

3. Defective areas encompassing the full diameter of the pipe shall be replaced by machine wherever the length measured along the pipe centerline is greater than 5 feet; otherwise defective areas may be replaced by hand.

3.5 INSTALLATION OF PIPE APPURTENANCES

- A. Protection of Appurtenances: Where the joining pipe is concrete or coated with cement mortar, buried appurtenances shall be coated with a minimum thickness of one inch of cement mortar having one part cement to not more than two parts plaster sand. Following coating with cement mortar, the appurtenances shall be coated with a protective overcoat in accordance with the paragraph entitled "Protective Coating."
- B. Installation of Valves: All valves shall be handled in a manner to prevent any injury or damage to any part of the valve. All joints shall be thoroughly cleaned and prepared prior to installation. Adjust all stem packing and operate each valve prior to installation to insure proper operation. Valves (body and seat) shall not be subjected to test pressures greater than manufacturer's recommendation. In some cases this may require an increase in the valve pressure class.
- C. All buried valves shall be coated and protected in accordance with Section 09 90 10 - Pipeline Coatings and Linings.
- D. All valves shall be installed so that the valve stems are plumb and in the location indicated.
- E. Installation of Flanged Joints: Before the joint is assembled, the flange faces shall be thoroughly cleaned of all foreign material with a power wire brush. The gasket shall be centered and the connecting flanges drawn up watertight without unnecessarily stressing the flanges. All bolts shall be tightened in a progressive diametrically opposite sequence and torqued with a suitable, approved and calibrated torque wrench. All clamping torque shall be applied to the nuts only.
- F. All buried flanges shall be coated and protected in accordance with Section 09 90 10 - Pipeline Coatings and Linings.
- G. Flexible Coupled Joints: When installing flexible couplings, care shall be taken that the connecting pipe ends, couplings and gaskets are clean and free of all dirt and foreign matter with special attention being given to the contact surfaces of the pipe, gaskets and couplings. The couplings shall be assembled and installed in conformity with the recommendation and instruction of the coupling manufacturer.
- H. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened so as to secure a uniform annular space between the follower rings and the body of the pipe with all bolts tightened approximately the same amount. Diametrically opposite bolts shall be tightened progressively and evenly. Final tightening shall be done with a suitable, approved and calibrated torque wrench set for the torque recommended by the coupling manufacturer. All clamping torque shall be applied to the nut only.

I. Upon completion of the coupled joint, the coupling and bare metal of the pipe shall be cleaned, primed and protected in accordance with the requirements of Section 09 90 10 - Pipeline Coatings and Linings.

3.6 CORROSION CONTROL

A. Cathodic Protection: Corrosion mitigation and testing materials shall be provided where indicated and in accordance with Division 13.

3.7 MARKING TAPE INSTALLATION

A. As shown on the Drawings.

B. Per specification 31 23 00 – Earthwork.

3.8 PIPELINE TESTING

A. The steel pipe shall be hydrostatically tested as specified in Section 33 13 00 – Water Pipeline Testing and Disinfection.

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SECTION 33 11 12
STEEL PIPE FABRICATED SPECIALS (AWWA C200, MODIFIED)

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide all bends, reducers, wyes, tees, crosses, outlets, manifolds and other steel plate specials, complete in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ASME B 16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASTM E 165	Practice for Liquid Penetrant Examination
ANSI/AWWA C200	Steel Water Pipe 6 In and Larger
ANSI/AWWA C205	Cement Mortar Lining and Coating – Shop Applied
ANSI/AWWA C206	Field Welding of Steel Water Pipe
ANSI/AWWA C207	Steel Pipe Flanges for Waterworks
ANSI/AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
ANSI/AWWA C602	Cement-Mortar Lining of Water Pipelines - 4 In (100 mm) and Larger - In Place
ASTM A234	Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ANSI/AWS D.1.1	Structural Welding Code - Steel
API Standard 1104	Welding Pipelines and Related Structures
AWWA M-11	Steel Water Pipe - A Guide for Design and Installation
ASME	Boiler and Pressure Vessel Code

1.3 CONTRACTOR SUBMITTALS

- A. Shop Drawings: Submit shop drawings including line and layout diagrams of all steel pipe fabricated specials in accordance with the requirements in Section 01 33 20 – Submittal Procedures. All submittals required for steel pipe and related work as listed in Section 33 11 11 – Steel Pipe, shall also be required for specials. Shop drawings shall indicate the type, size, and location of all reinforcement pieces.

- B. Design calculations shall be submitted to the Engineer for review prior to manufacture of steel pipe fabricated specials.
- C. Certifications: A certified affidavit of compliance with referenced Specifications and these Contract Documents shall be furnished for all steel pipe fabricated specials and other products or materials provided under this Section.

1.4 QUALITY ASSURANCE

- A. Inspection: All specials shall be subject to inspection at the place of manufacturer/ fabrication as outlined in Section 33 11 11 – Steel Pipe.

- B. Shop Testing of Steel Pipe Fabricated Specials:

1. If steel pipe fabricated specials have been fabricated from untested straight pipe, they shall be hydrostatically tested with a pressure equal to 1-1/2 times the design working pressure shown on the Drawings. If steel pipe fabricated specials have been fabricated from successfully tested straight pipe, no hydrostatic test shall be required unless otherwise indicated. In no case shall shop test pressure be less than 150 psi. All tees with crotch plates shall be hydrostatically tested as indicated regardless of whether or not the straight pipe sections used were previously tested.
2. All welds shall be non-destructive tested at the specials fabricator's facility as specified below for various weld categories. Testing shall include submitting written documentation of procedures per Section V, and acceptance criteria shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code.
 - a. Butt Joint Welds: Spot radiographically examine pipe in accordance with paragraph UW-52 of the ASME Boiler and Pressure Vessel Code Section VIII, Division 1. If, in the opinion of the Engineer, the welds cannot readily be radiographed, they shall be 100 percent ultrasonically examined.
 - b. Fillet Welds: 100 percent examine all fillet welds using the magnetic particle inspection method.
 - c. Groove Welds: 100 percent ultrasonically examine all groove welds that cannot be readily radiographically spot examined.
 - d. Welds on pipe seams for previously successfully tested straight pipe do not need to be retested.
 - e. All Welds: Contractor's certified welding inspector shall 100 percent visually examine all welds as a minimum.
 - f. In addition to weld tests herein before specified, doubler pads shall be air tested as stated in AWWA C206.
 - g. Refer to Section 33 13 00 – Water Pipeline Testing and Disinfection for field non-destructive testing.
3. Where welded test heads or bulkheads are used, extra length shall be provided to each opening of the special. After removal of each test head, the special shall be trimmed back to the design points with all finished plate edges ground smooth, straight, recoated and prepared for the field joint.
4. Testing shall be performed before pipe and joints have been coated or lined.
5. Perform tests at no additional cost to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor, provided that the Contractor's schedule is not delayed for the convenience of the Engineer.
6. In addition to those tests specifically required, the Engineer may request additional samples of any material including mixed concrete and lining and coating samples for

testing by the Owner. The additional samples shall be furnished at no additional cost to the Owner.

- C. Field Testing: Field testing shall conform to the requirements of Section 33 13 00 – Water Pipeline Testing and Disinfection.
- D. Welding Procedure Specifications: All welding procedures used to fabricate pipe shall be in accordance with Section 33 11 11 – Steel Pipe.
- E. Welder Performance Qualifications: All welder performance qualifications shall be in accordance with Section 33 11 11 – Steel Pipe.
- F. Certified Welding Inspector: A certified welding inspector shall be provided for shop fabricated work and shall have the responsibilities outlined in Section 33 11 11 – Steel Pipe.
- G. Fittings and Specials Fabricator:
 - 1. Experienced in fabrication of fittings and specials of similar diameters and wall thickness required for the Work.
 - 2. Demonstrate current production capability for volume of Work required for the Project.
 - 3. Experience shall be for project requiring fabrication to AWWA C200/208 standards of at least 25 fittings 66-inch or larger pipe, with wall thickness 0.375-inch or larger within the 5-year period preceding the bid date.
 - 4. Experience requirement shall apply to the fabrication plant facility and responsible personnel, not the firm which owns the facility or employs the personnel.
 - 5. See Section 33 11 11 – Steel Pipe for qualifications for steel pipe fabricators..
- H. Fabrication: All specials shall be fabricated in the shop. No field fabrication of specials will be allowed.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Steel pipe fabricated specials (specials) are defined as fittings, closure pieces, bends, elbows, reducers, wyes, tees, crosses, outlets, manifolds, steel pipe wall sleeves, and other steel plate specials wherever located, and all piping above ground or in structures.

2.2 DESIGN

- A. Design: Except as otherwise provided herein, specials shall be fabricated from materials or straight pipe in full conformance with the requirements of Section 33 11 11 - Steel Pipe, ANSI/AWWA C200, and the dimensions of ANSI/AWWA C208. All fittings and specials shall be properly reinforced to withstand the internal pressure, with circumferential and longitudinal, or external loading conditions, whichever is greater. The minimum thickness of plate for pipe from which specials are to be fabricated shall be no less than the thickness of the adjacent mainline pipe, the thickness shown, or the following, whichever is thicker:

Nominal Pipe Diameter (in)	Pipe Manifolds, Piping Above Ground, and Piping in Structures	Elbows, Bends, and Reducers
30 and under	Standard Weight	Standard Weight
Over 30	3/8-inch	Same as Adjacent Pipe

- B. Pipe installed on saddle supports shall be designed to limit the longitudinal bending stress to a maximum of 10,000 psi. Design shall be in accordance with the provisions of Chapter 7 of AWWA M-11, and other applicable industry standards.
- C. Joints: All joints and related work for field assembly of the pipe and specials shall conform to Section 33 11 11 – Steel Pipe. All shop joints shall be complete penetration butt-welds unless otherwise shown.

2.3 FABRICATION AND MATERIALS

- A. General: Reinforcement for wyes, tees, outlets, and nozzles shall be as shown. Shop welding shall conform to the applicable provisions of the ASME Boiler and Pressure Vessel Code. Field welding shall conform to ANSI/AWS D1.1 and ANSI/AWWA C206. Specials and fittings shall be equal in pressure design strength and shall have the same lining and coating as the adjoining pipe. Unless otherwise indicated, the minimum radius of elbows shall be 2.5 times the pipe diameter and the maximum miter angle on each section of the elbow shall not exceed 11-1/4 degrees resulting in a maximum deflection angle of 22.5 degrees per miter weld as recommended in AWWA C208.
- B. Specials and fittings that cannot be mechanically lined and coated shall be lined and coated by hand-application, using the same materials as are used for the pipe and in accordance with the applicable AWWA or ASTM Standards, and as modified in Section 09 90 10 - Pipeline Coatings and Linings, or by other applicable sections in these Specifications. Coating and lining applied in this manner shall provide thickness and protection equal to that specified for the pipe. Fittings may be fabricated from pipe that has been mechanically lined and/or coated. Areas of lining and coating that have been damaged by such fabrication shall be removed and reapplied by hand-applications.
- C. Access manholes with covers shall be as indicated. All threaded outlets shall be forged steel suitable for 3,000-psi service, and shall be as manufactured by Vogt or equal.
- D. Moderate deflections and long radius curves may be made by means of beveled joint rings, by pulling standard joints, by using short lengths or pipe, or a combination of these methods; provided that pulled joints shall not be used in combination with bevels and maximum joint deflections are not exceeded. The maximum total allowable angle for beveled joints shall be 5 degrees per pipe joint. Bevels shall be provided on the bell ends. Mitering of the spigot ends will not be permitted. The maximum allowable angle for pulled joints shall be 75 percent of the manufacturer's recommendations or the angle which results from a 3/4-inch pull out from normal joint closure, whichever is less. In no case shall pulled joints result in a gap between the bell and spigot at the weld location that exceeds 1/8 inch. All horizontal deflections or fabricated angles shall fall on the alignment, as shown.

- E. All vertical deflections shall fall on the alignment and at locations adjacent to underground obstructions, points of minimum earth cover, and pipeline outlets and structures, the pipe angle points shall match the angle points indicated.
- F. Outlets, Tees, Wyes, and Crosses
1. Outlets 14-inch and smaller shall be fabricated from ASTM A 53, Type E or S, Grade B, standard weight steel pipe in the standard outside diameters, i.e., 14, 12-3/4-inch, 10-3/4-inch, 8-5/8-inch, 6-5/8-inch, and 4-1/2-inch. Wall thickness and collar reinforcing shall be as shown.
 2. In lieu of collar reinforcement as shown, pipe or specials with outlets may be fabricated in their entirety of steel plate having a thickness equal to the sum of the pipe wall plus the required reinforcement.
 3. Where required by Manual M-11 or other industry standard, the design procedure for crotch plate reinforcement, such reinforcement shall be required.
- G. Steel Welding Fittings: Steel welding fittings for pipe spools and fittings smaller than 24 inches in diameter shall be in accordance with ANSI B16.9 conforming to ASTM A 234. Use standard weight. Taper pipe wall at welds at 4:1 for connection to pipe of different wall thicknesses. The Contractor shall be fully responsible for coordinating the difference in diameter convention between these specials and AWWA C200/C208 pipe and fittings to provide complete piping systems as shown.
- H. Ends for Mechanical-Type Couplings: Except as otherwise indicated, where mechanical-type couplings are indicated, the ends of pipe shall be banded with Type C collared ends using double fillet welds. Where pipe 12-inch and smaller is furnished in standard schedule thicknesses, and where the wall thickness equals or exceeds the coupling manufacturer's minimum wall thickness, the pipe ends may be grooved.
- I. Lining: All requirements pertaining to thickness, application and curing of cement mortar lining indicated for straight pipe shall apply to specials, with the following provision. If the special cannot be lined centrifugally or with field lining equipment, it shall be lined by hand. In such case, the lining shall be reinforced with welded wire fabric positioned approximately in the center of the lining and in accordance with AWWA C205 for lining of specials.
- J. Coating: All requirements pertaining to thickness, application and curing of coating indicated for straight pipe shall apply to specials. Unless otherwise indicated the coating on the buried portion of a pipe section passing through a structure wall shall extend 4" into the vault. Pipe above ground or in structures shall be shop primed and field-painted in accordance with Section 09 90 00 – Protective Coatings and Linings.
- K. Marking: A mark indicating the true vertical axis of the special shall be placed on the top and bottom of the special.
- L. Shop Welded Surfaces: All weld seams on pipe surfaces that will have a flexible tape or polyolefin coating in accordance with AWWA C209, C214, C215, or C216 shall be ground such that the maximum weld bead height will not exceed 1/32 inch. All ground weld seams shall be smooth and free of all burrs.

- M. Portions of wall sleeves that penetrate into hydraulic structures and will be embedded into concrete shall be shop lined and coated in accordance with requirements for submerged conditions as outlined in Section 09 90 00 – Protective Coatings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide all fittings, closure pieces, elbows, bends, reducers, wyes, tees, crosses, outlets, manifolds, and other steel plate specials, bolts, nuts, gaskets, jointing materials, and all other appurtenances as indicated to provide a complete and workable installation. Where pipe support details are indicated, the supports shall conform thereto and shall be placed as indicated; provided, that the support for all exposed piping shall be complete and adequate regardless of whether or not supporting devices are specifically indicated. Where indicated, concrete thrusts blocks and welded joints shall be provided. At all times when the Work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in trenches or structures shall be kept tightly closed to prevent entrance of animals and foreign materials.
- B. Take all necessary precautions to prevent the pipe from floating due to water entering the trench or from backfilling with CLSM. The Contractor shall assume full responsibility for any damage due to this cause and shall at its own expense restore and replace the pipe to its specified condition and grade if it is displaced due to floating. Maintain the inside of the pipe free from foreign materials and in a clean and sanitary condition until its acceptance by the Owner.
- C. Unless otherwise indicated, all specials shall be installed in full conformance with Section 33 11 11 – Steel Pipe, and other applicable sections of these Contract Documents.

END OF SECTION

**SECTION 33 13 00
WATER PIPELINE TESTING AND DISINFECTION**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall perform flushing and testing of all pressure pipelines and appurtenant piping and disinfection of all pipelines and appurtenant piping for potable and fire water, complete.
- B. This specification applies to all pipelines requiring hydrostatic tests (water medium) regardless of the pipeline service medium.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ANSI/AWWA B300	Hypochlorites
ANSI/AWWA B301	Liquid Chlorine
ANSI/AWWA C206	Field Welding of Steel Water Pipe
ANSI/AWWA C651	Disinfecting Water Mains

1.3 CONTRACTOR SUBMITTALS

- A. A testing schedule, including proposed plans for water conveyance, control, disposal, and disinfection shall be submitted in writing for approval a minimum of 14 days before testing is to start.
- B. A copy of the Utah Pollutant Discharge Elimination System (UPDES) permit application shall be submitted a minimum of 30 days prior to the proposed date to start testing. A copy of the approved UPDES permit shall be submitted prior to the start of testing.
- C. Chlorine residual test data and bacteriological test data shall be submitted to document the results of the pipeline disinfection. Tests shall be conducted 24 hours after the start of disinfection.

PART 2 - PRODUCTS

2.1 MATERIALS REQUIREMENTS

- A. All test equipment, chemicals for chlorination, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor subject to the Engineer's review. No materials shall be used which would be injurious to the construction or its future function.

- B. Used pressure gauges shall be recertified prior to testing.
- C. Chlorine for disinfection shall be in the form of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.
- D. Liquid chlorine shall be in accordance with the requirements of ANSI/AWWA B301. Liquid chlorine shall be used only:
 - 1. In combination with appropriate gas flow chlorinators and ejectors;
 - 2. Under the direct supervision of an experienced technician;
 - 3. When appropriate safety practices are observed.
- E. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300 - Hypochlorite.

PART 3 - EXECUTION

3.1 GENERAL

- A. Water for testing and disinfecting water pipelines shall be furnished by the Contractor. The Contractor shall make all necessary provisions for conveying the water from the source to the points of use, and disposal of the water (and dechlorinating - where applicable).
- B. All pipelines shall be tested. Disinfection shall be accomplished by chlorination for all pipelines providing potable water or connected to a potable water system. All chlorinating and testing operations shall be performed in the presence of the Engineer.
- C. Disinfection operations shall be scheduled as late as possible during the contract time period so as to assure the maximum degree of sterility of the facilities at the time the Work is accepted by the Owner. Samples for bacteriological testing shall be collected by the Contractor, and testing shall be performed by the Owner laboratory and at the expense of the Contractor. Results of the bacteriological testing shall be satisfactory with the State Department of Health or other appropriate regulatory agency.
- D. Pipeline pressure tests will include the following tests:
 - 1. Air test of double welded lap joints.
 - 2. Hydrostatic pressure test of the complete pipeline, in segments as required to match pipe pressure class.
 - 3. Contractor shall conduct the discharge in accordance with the Utah Pollutant Discharge Elimination System (UPDES) permit from the Utah Division of Environmental Quality (UDEQ). The Contractor shall apply a reducing agent to the discharged water to neutralize the chlorine residual and meet the chlorine residual limit required under the permit. The Owner shall conduct the water quality sampling of the discharge as required by the permit. The Contractor shall notify local agencies, secure appropriate other permits and approvals, and provide erosion control measures for any releases as appropriate. Release of water after pipeline testing and disinfection have been completed shall be only if acceptable to the Engineer.
- E. Notification: Notify the Engineer at each of the following stages:
 - 1. Three working days prior to the start of filling the pipeline with water.

2. Three working days prior to the start of chlorination.
3. Twenty-four hours before withdrawing samples for bacteriological testing.
4. Three working days prior to the start of flushing.

3.2 VISUAL INSPECTION

- A. All welds shall be 100% visually inspected in accordance with ANSI/AWS D1.1, Table 6.1; Visual Inspection Acceptance Criteria for Statically Loaded Non-Tubular Connections.

3.3 AIR TEST

- A. All double welded lap joint or double gasket Carnegie joint shall be pressure tested to a minimum of 40-psi air pressure for a period of 10 minutes per AWWA C206. No air leakage will be allowed.
- B. If the test pressure drops below 40 psi, paint the welds with a soap solution. Mark any leaks indicated by the escaping gas bubbles.
- C. Any joints which leak shall be repaired and retested.

3.4 HYDROSTATIC TESTING OF PIPELINES

- A. Prior to hydrostatic testing, all pipelines shall be flushed or blown out as appropriate. Test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 7 days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. The Contractor shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. Provide sufficient temporary air tapping in the pipelines to allow for evacuation of all entrapped air in each pipe segment to be tested. In section tested where no air valves exist, provide temporary air valves for the automatic venting of air and vacuum protection. After completion of the tests, such temporary air valves are to be removed and taps shall be permanently plugged. Care shall be taken to see that all air vents are open prior to and during filling.
- B. The pipeline shall be filled at a rate not to exceed 2-feet per second as calculated by using the cross-sectional area based on the inside diameter of the pipe and which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pocket. No personnel shall be within or enter any vault or confined space subject to flooding during the initial filling and for a 24 hour period. After the 24 hour period bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the Engineer shall be taken.
- C. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 4 hours. The test pressure for distribution and transmission pipelines shall be 150 percent of

the working pressure in the pipeline, or as indicated on the drawings, measured at the lowest point of the pipeline section being tested. All drain lines off the SWA-2 shall be tested to match the adjacent pipeline. Test pressures for gravity flow pipelines and irrigation lines, shall be tested to 50 psi unless noted otherwise. All visible leaks shall be repaired in a manner acceptable to the Engineer.

- D. The maximum allowable leakage for distribution and transmission pipelines shall be;
 - 1. 10 U.S. gallons per inch of diameter per mile of pipe per 24 hours for pipe with 40-foot or greater lengths between joints and with rubber-gasketed joints and
 - 2. 20 U.S. gallons per inch of diameter per mile of pipe per 24 hours for pipe with 20-foot or less lengths between joints and with rubber-gasketed joints.
 - 3. The maximum leakage for yard piping shall be as shown on the Piping Schedule.
 - 4. Pipe with welded joints shall have no leakage.
- E. In the case of pipelines that fail to pass the prescribed leakage test, determine the cause of the leakage, take corrective measures necessary to repair the leaks, and again test the pipelines at no additional cost to the Owner.
- F. The pipeline shall be drained after successful completion of the hydrostatic test.
- G. Complete the form in Section 33 13 00a for each hydrostatic pressure test.

3.5 DISINFECTING PIPELINES

- A. General: All potable water pipelines shall be disinfected in accordance with the requirements of ANSI/AWWA C651 - Disinfecting Water Mains as modified herein.
- B. Prior to disinfecting the pipeline for potable water services and before placing into service for other water pipelines, flush the pipeline to remove any debris, rocks, or other foreign material that may have entered the pipe. For Pipeline <36-inch diameter, flushing shall be carried out such that the velocities in the pipe exceed 2.5 feet per second. For Pipelines >36-inch diameter pipelines shall be swept clean prior to flushing and flushing shall be provided at highest velocity available from the water source up to a maximum of 2.5 feet per second. Provide all required material, labor and equipment to complete flushing. Contractor shall provide the water for flushing. Make appropriate provision and preparations for disposal of flushing water, satisfying all local, state and federal rules, laws, regulations and ordinances.
- C. Continuous Feed Method: Disinfect in accordance with ANSI/AWWA C651 except that:
 - 1. The water in the pipe shall contain 50 mg/l free chlorine as measured at the pipeline extremities.
 - 2. After 24 hours of disinfection, the residual free chlorine shall be at least 25 mg/l at the pipeline extremities.
 - 3. Chlorinated water with greater than 25 mg/free chlorine may not be allowed to sit in the pipeline for periods of longer than 36 hours from initial chlorination. Upon successful completion of chlorination steps 1 and 2 above, the pipeline shall be immediately flushed of high chlorinated water.
- D. Slug Feed Method: Disinfect in accordance with ANSI/AWWA C651.

- E. Chlorinating Valves: During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily chlorinated water.
- F. Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for domestic use. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize thoroughly the chlorine residual remaining in the water. See the appendix of AWWA C651 for acceptable neutralization methods for heavily chlorinated water.
- G. Sampling Ports: The Contractor shall provide sampling ports along the pipeline as defined in AWWA C651. Taps may be made at manways and air valves to help facilitate the spacing requirement.
- H. Bacteriological Testing: After final flushing and before the pipeline is placed in service, two consecutive sets of samples shall be collected at least 24 hours apart by the Contractor from the end of the line, vaults, and at other locations as designated by the Engineer, and shall be tested by the Owner for bacteriological quality in accordance with the requirements of AWWA C651 and additional requirements specified herein. For this purpose, the pipe shall be refilled with fresh potable water and left for a period of 24 hours before the first set of bacteriological samples are collected. The second set of Bacteriological samples are then collected a minimum of 24 hours after the initial set of samples. If the initial disinfection fails to produce two satisfactory sets of bacteriological results or if other water quality is affected, the new main may be re-flushed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be re-chlorinated by the continuous-feed or slug method until satisfactory results are obtained that being two consecutive sets of acceptable samples taken 24 hours apart.
- I. Bacteriological Testing completed on Mondays through Thursdays may utilize the services of the JWCD laboratory. Bacteriological testing needing services Friday through Sunday or on holidays to be completed and paid for by the Contractor at an independent, certified, 3rd party laboratory approved by the Owner.

3.6 CONNECTIONS TO EXISTING SYSTEM

- A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed. Thorough flushing shall be started as soon as the connection is completed and shall be continued until discolored water is eliminated.

END OF SECTION

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HYDROSTATIC PRESSURE TEST RECORD



Client: _____ Project: _____

Pipeline/Location: _____ Project No.: _____ Date _____

Pipe Size: _____ Pipe Service and Material: _____

Test Location: _____

Begin Station _____

End Station _____

Appurtenances Tested: _____

Test Duration: _____

Start Time _____

End Time _____

Specification: _____

Test Pressure & gauge _____

Location: _____

Time	Ambient Temp. (F)	Pressure (PSIG)
_____	_____	_____
_____	_____	_____
_____	_____	_____

Remarks

Test Personnel: _____

Signature: _____ Date _____

Company Performing Test: _____

Owner/Engineer's Rep. Signature: _____ Date: _____

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DIVISION 40
PROCESS INTEGRATION

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**SECTION 40 05 00
PIPING, GENERAL**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, seismic restraints, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.
- B. The piping shown is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.
ANSI/AWWA C606	Grooved and Shouldered Joints
ANSI/AWS D1.1	Structural Welding Code
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile
ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints
ASTM D 792	Test Methods for Specific Gravity and Density of Plastics by Displacement
ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.3 CONTRACTOR SUBMITTALS

- A. Submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems, in accordance with the requirements in Section 01 33 20 – Submittal Procedures, and as indicated in the individual piping sections. The shop drawings shall include all necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports and seismic restraints necessary to accommodate the equipment and valves provided in a complete and functional system.
- B. All expenses incurred in making samples for certification of tests shall be borne by the Contractor at no increased cost to the Owner.
- C. Submit as part of the shop drawings a statement from the pipe fabricator certifying that all pipes will be fabricated subject to a recognized Quality Control Program. An outline of the program shall be submitted to the Engineer for review prior to the fabrication of any pipe.

1.4 QUALITY ASSURANCE

- A. Inspection: All pipe shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the Engineer shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.
- B. Tests: Except where otherwise indicated, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. Perform all tests at no additional cost to the Owner.
- C. Welding Requirements: All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.
- D. Welder Qualifications: All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing Work on the pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests. Furnish all material and bear the expense of qualifying welders at no increased cost to the Owner.
- E. NSF/ANSI 61 for Drinking Water System Components: All materials that will contact potable water shall comply with the requirements of the NSF/ANSI 61 Standard.

1.5 MANUFACTURER'S SERVICE REPRESENTATIVE

- A. Where the assistance of a manufacturer's service representative is advisable, in order to obtain perfect pipe joints, supports, or special connections, furnish such assistance at no additional cost to the Owner.

1.6 MATERIAL DELIVERY, STORAGE, AND PROTECTION

- A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

1.7 CLEANUP

- A. After completion of the Work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be handed over in a clean and functional condition.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Division 33 and this Section.
- B. Miscellaneous Small Pipes: Miscellaneous small pipes and fittings shall be provided by the Contractor in accordance with the requirements of Section 40 05 10 - Mill Piping - Exposed and Buried and this Section.
- C. Pipe Supports: All pipes shall be adequately supported in accordance with the requirements of Section 40 05 07 - Pipe Supports, and as indicated.
- D. Lining: All requirements pertaining to thickness, applications, and curing of pipe lining, are in accordance with the requirements of the applicable Sections of Divisions 9 and 33, unless otherwise indicated.
- E. Coating: All requirements pertaining to thickness, application, and curing of pipe coating, are in accordance with the requirements of the applicable Sections of Division 33, unless otherwise indicated. Pipes above ground or in structures shall be field-painted in accordance with Section 09 90 00 Protective Coatings and Linings or 09 90 10 - Pipeline Coatings and Linings.
- F. Pressure Rating: All piping systems shall be designed for the maximum expected pressure as defined in Section 33 13 00 - Water Pipeline Testing and Disinfection, or as indicated on the piping schedule, or as indicated on the Drawings.

2.2 PIPE FLANGES

- A. Flanges: Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-pound class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-pound class. However, AWWA flanges shall not be exposed to test pressures greater than 125 percent of rated capacity. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall

conform to ANSI B16.5 300-pound class. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207. Flanges for miscellaneous small pipes shall be in accordance with the standards specified for these pipes. Contractor to confirm flange compatibility of pipeline and adjoining equipment.

- B. Blind Flanges: Blind flanges shall be in accordance with ANSI/AWWA C207, or with the standards for miscellaneous small pipes. All blind flanges for pipe sizes 12 inches and over shall be provided with lifting eyes in form of welded or screwed eye bolts.
- C. Flange Coating: All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.
- D. Flange Bolts: Contractor shall supply all bolts and nuts in conformance with Section 05 50 00 – Metal Fabrications. Studs and bolts shall extend through the nuts a minimum of 1/4 inch. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts.
- E. Insulating Flanges: Insulated flanges shall have bolt holes 1/4 inch diameter greater than the bolt diameter.
- F. Insulating Flange Sets: Insulating flange sets shall be provided by the Contractor where shown. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2 inches or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2 inches, insulating sleeves and washers shall be two-piece and shall be made of polyethylene or phenolic. Steel washers shall be in accordance with ASTM A 325. Insulating gaskets shall be full-face.
- G. Insulating Flange Manufacturers, or Equal
 - 1. JM Red Devil, Type E
 - 2. Maloney Pipeline Products Co., Houston
 - 3. PSI Products, Inc., Burbank, California.
- H. Flange Gaskets: Contractor shall provide flange gaskets for all pipe flanges. Gaskets for flanged joints shall be full-faced, 1/16-inch thick compressed sheets of asbestos-free aramid fiber base, with nitrile binder and nonstick coating, suitable for temperatures to 700 degrees F, a pH of 1 to 11, and pressures to 1,000 psig. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted.
- I. Flange Gasket Manufacturers, or Equal
 - 1. TEADIT, Style 1161/1082 San
 - 2. Garlock, Style 3760 (NSF 61 approved)

2.3 THREADED INSULATING CONNECTIONS

- A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.
- B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other nonconductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

- A. Construction: Cast mechanical-type couplings shall be provided where shown. The couplings shall conform to the requirements of ANSI/AWWA C606. Bolts and nuts shall conform to the requirements of Section 05 50 00 – Metal Fabrications. All gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations to suit the highest expected pressure. To avoid stress on equipment, all equipment connections shall have rigid-grooved couplings, or harness sets in sizes where rigid couplings are not available, unless thrust restraint is provided by other means. The Contractor shall have the coupling Manufacturer's service representative verify the correct choice and application of all couplings and gaskets, and the workmanship, to assure a correct installation.
- B. Couplings for Steel Pipe, Manufacturers, or Equal
 - 1. Victaulic Style 44 with Type D Heavy Duty Grooved Adaptor Ends. Direct grooving of pipe is not permitted. Grooves shall be cut into grooved end adapters and not rolled.
- C. Ductile Iron Pipe Couplings, Manufacturers, or Equal
 - 1. Gustin-Bacon.
 - 2. Victaulic Style 31 (flexible or rigid grooving).
 - 3. Note: Ductile iron pipe couplings shall be furnished with flush seal gaskets.
- D. Couplings for PVC Pipe, Manufacturers, or Equal
 - 1. Gustin-Bacon.
 - 2. Victaulic Style 775.
 - 3. Note: Couplings for PVC pipe shall be furnished with radius cut or standard roll grooved pipe ends. Grooved end couplings shall be used on PVC pipe only for Schedule 80 vent piping at the vaults. Grooved end couplings shall not be used for PVC C905 water pipe.

2.5 SLEEVE-TYPE COUPLINGS

- A. Construction: Sleeve-type couplings shall be provided where indicated, in accordance with ANSI/AWWA C219 unless otherwise indicated, and shall be of steel with steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings. The middle ring shall be not less than 1/4 inch in thickness and shall be either 5 or 7 inches long for sizes up to and including 30 inches and 10 inches long for sizes greater than 30 inches, for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of

sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts shall conform to the requirements of Section 05 50 00 – Metal Fabrications. Buried sleeve-type couplings shall be epoxy-coated at the factory.

- B. Pipe Preparation: The ends of the pipe, where indicated, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64 inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.
- C. Gaskets: Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer.
 - 1. The rubber in the gasket shall meet the following specifications:
 - a. Color - Jet Black.
 - b. Surface - Nonblooming.
 - c. Durometer Hardness - 74 " 5.
 - d. Tensile Strength - 1,000 psi Minimum.
 - e. Elongation - 175 percent Minimum.
 - 2. The gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and fluid utilized.
- D. Insulating Couplings: Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.
- E. Restrained Joints: All sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall be in accordance with the requirements of the appropriate reference standard, or as shown.
- F. Manufacturers, or Equal
 - 1. Dresser, Style 38.
 - 2. Ford Meter Box Co., Inc., Style FC1 or FC3.
 - 3. Smith-Blair, Style 411.
 - 4. Baker, Series 200

2.6 FLANGED END CONNECTORS AND DISMANTLING JOINTS

- A. Flanged coupling adapters and dismantling joint couplings shall be in accordance with AWWA C219.
- B. Dismantling joints for connecting flanged pipe shall be AWWA C219 compliant. Provide studs and nuts to seal gasket separate and independent from tie-bar restraint system.

- C. All dismantling joints shall be the restrained type per AWWA M-11. Tie-bar restraint system shall conform to ASTM A193-B7 per AWWA M-11 and be designed to withstand the test pressure shown on the Drawings.
- D. All dismantling joints shall use standard flanges in accordance with AWWA C207. The thickness of the dismantling joint flanges shall be equal to or greater than the class of flange that is connected to as required by the test pressure as shown on the drawings. Buried flanges shall be wrapped with petroleum was tape per AWWA C217. Flanged coupling adapters and dismantling joints shall be epoxy lined and coated. Tie rods shall be 316 stainless steel.
- E. Manufacturers, or Equal
 1. Smith-Blair, Style 972 or 975
 2. Baker, Series DJ
 3. Romac DJ 400

2.7 FLEXIBLE CONNECTORS

- A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment, and where shown. Flexible connectors for service temperatures up to 180 degrees F shall be flanged, reinforced Neoprene or Butyl spools, rated for a working pressure of 40 to 150 psi, or reinforced, flanged duck and rubber, as best suited for the application. Flexible connectors for service temperatures above 180 degrees F shall be flanged, braided stainless steel spools with inner, annular, corrugated stainless steel hose, rated for minimum 150 psi working pressure, unless otherwise shown. The connectors shall be 9 inches long, face-to-face flanges, unless otherwise shown. The final material selection shall be approved by the manufacturer. Submit manufacturer's shop drawings and calculations.

2.8 EXPANSION JOINTS

- A. All piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement, without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be of stainless steel, monel, rubber, or other materials, best suited for each individual service. Submit detailed calculations and manufacturer's shop drawings, guaranteeing satisfactory performance of all proposed expansion joints, piping layouts showing all anchors and guides, and information on materials, temperature and pressure ratings.

2.9 PIPE THREADS

- A. All pipe threads shall be in accordance with ANSI/ASME B1.20.1.

2.10 AIR AND GAS TRAPS

- A. Air and gas pipes shall be sloping to low points, provided with drip legs, shutoff valves, strainers and traps. The traps shall be piped to the nearest drain. Air and gas traps shall be not less than 150-pound iron body float type with copper or stainless steel float. Bracket, lever, and pins shall be of stainless steel. Drain traps shall have threaded connections.

- B. Manufacturers, or Equal
 - 1. Armstrong Machine Works.
 - 2. Spirax Sarco, Inc.

PART 3 - EXECUTION

3.1 GENERAL

- A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of the applicable Sections of Division 33. The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints at screwed flanges shall be epoxy-coated, to assure continuous protection.
- B. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and rebars.
- C. Flanges shall be installed at least 6-inches from a wall. Fittings shall be installed with sufficient clearance for maintenance and removal and reinstallation.

3.2 FIELD TESTING

- A. All piping shall be tested in accordance with applicable standards and the contract documents.

END OF SECTION

**SECTION 40 05 07
PIPE SUPPORTS**

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall provide pipe supports, seismic restraints, hangers, guides, and anchors, complete, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be in accordance with Section 01 33 20 – Submittal Procedure.
- B. Shop Drawings: Shop drawings shall include the following information:
1. Drawings of pipe supports, restraints, hangers, anchors, and guides
 2. Calculations for special supports and anchors.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Code Compliance: Piping systems and pipe connections to equipment shall be properly anchored and supported to prevent undue deflection, vibration, dislocation due to seismic events and line pressures, and stresses on piping, equipment, and structures. Supports and parts thereof shall conform to the requirements of ASME B31.1 – Power Piping, except as supplemented or modified below. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code or local administration requirements.
- B. Structural Members: Wherever possible, pipes shall be supported from structural members. Where it is necessary to frame structural members between existing members, such supplementary members shall be provided at no additional cost to the Owner. All supplementary members shall be in accordance with the requirements of the building code and the American Institute of Steel Construction and shall be acceptable to the Engineer.
- C. Pipe Hangers: Pipe hangers shall be capable of supporting the pipe in all conditions of operation, allowing free expansion and contraction of the piping, and preventing excessive stress on equipment. Hangers shall have a means of vertical adjustment after erection. Hangers shall be designed to prevent becoming disengaged by any movement of the supported pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. Hanger rods shall be subject to tensile loading only.
- D. Hangers Subject to Horizontal Movements: At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit such movement. Where horizontal pipe movement is greater than 1/2-inch, or where the hanger rod deflection from the vertical is greater than 4 degrees from the cold to the hot position of the pipe, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.

- E. Spring-Type Hangers: Spring-type pipe hangers shall be provided for piping subject to vibration or vertical expansion and contraction, such as engine exhausts and similar piping. Spring-type hangers shall be sized to the manufacturer's printed recommendations and the loading conditions encountered. Variable spring supports shall be provided with means to limit misalignment, buckling, eccentric loading, or to prevent overstressing of the spring, and with means to indicate at all times the compression of the spring. Supports shall be capable of accommodating at least four times the maximum travel due to thermal expansion.
- F. Thermal Expansion: Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints permitting the piping to expand and contract freely in directions away from the anchored points. Components shall be structurally suitable to withstand loads imposed.
- G. Heat Transmission: Supports, hangers, anchors, and guides shall be so designed and insulated, that excessive heat will not be transmitted to the structure or to other equipment.
- H. Riser Supports: Where practical, risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.
- I. Freestanding Piping: Free-standing pipe connections to equipment such as chemical feeders and pumps shall be firmly attached to steel frames fabricated from angles, channels, or I-beams anchored to the structure. Exterior, free-standing overhead piping shall be supported on fabricated pipe stands consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps securing the pipes.
- J. Materials of Construction:
 - 1. General: Pipe support assemblies, including framing, hardware, and anchors, shall be steel construction, galvanized after fabrication, unless otherwise indicated.
 - 2. Submerged Supports: Submerged piping, as well as piping, conduits, and equipment in hydraulic structures within 24 inches of the water level, shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel, unless otherwise indicated.
 - 3. Corrosive: Piping in chemical and corrosive areas shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel or FRP, unless otherwise indicated.
- K. Point Loads: Any meters, valves, heavy equipment, and other point loads on PVC, FRP, and other plastic pipes, shall be supported on both sides, according to manufacturer's recommendations to avoid undue pipe stresses and failures. To avoid point loads, all supports on PVC, FRP, and other plastic piping shall be equipped with extra wide pipe saddles or galvanized steel shields.
- L. Noise Reduction: To reduce transmission of noise in piping systems, copper tubes in buildings and structures shall be wrapped with a 2-inch wide strip of rubber fabric or similar, suitable material at each pipe support, bracket, clip, or hanger.

2.2 SUPPORT SPACING

A. Supports for piping with the longitudinal axis in approximately a horizontal position shall be spaced to prevent excessive sag, bending, and shear stresses in the piping, with special consideration given where components such as flanges and valves impose concentrated loads. Pipe support spacing shall not exceed the maximum spans in the tables below. For temperatures other than ambient temperatures, or those listed, and for other piping materials or wall thicknesses, the pipe support spacings shall be modified in accordance with the pipe manufacturer's recommendations. Vertical supports shall be provided to prevent the pipe from being overstressed from the combination of all loading effects.

1. Support Spacing for Schedule 40 and Schedule 80 Steel Pipe

Nominal Pipe Diameter (inches)	Maximum Span (feet)
1/2	6
3/4 and 1	8
1 - 1/4 to 2	10
3	12
4	14
6	17
8 and 10	19
12 and 14	23
16 and 18	25
20 and Greater	30

2. Support Spacing for Welded Fabricated Steel Pipe

Maximum Spans for Pipe Supported in Minimum **120 degree** contact saddles (feet)

Nominal Pipe Diameter (inches)	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
24	33	37	41	43	45	47				
26	34	38	41	44	46	48				
28	34	38	41	44	47	49				
30	34	38	42	45	48	49				
32	34	39	42	45	48	50				
34	35	39	42	46	48	50				
36	35	39	43	46	49	51	55			
38	35	39	43	46	49	51	55			
40	35	40	43	47	49	52	56			
42	--	40	43	47	50	52	56			
45	--	40	44	47	50	53	57			
48	--	40	44	47	50	53	58	61		
51	--	41	44	48	51	53	58	62		
54	--	41	44	48	51	54	58	62		
57	--	41	44	48	51	54	59	63		
60	--	41	45	48	52	54	59	63	67	70
63	--	41	45	49	52	55	60	64	67	71
66	--	41	45	49	52	55	60	64	68	71
72	--	41	45	49	52	55	61	65	69	72

78	--	41	45	49	53	56	61	66	69	73
84	--	41	46	50	53	56	62	66	70	74
90	--	41	46	50	53	56	62	67	71	74
96	--	42	46	50	54	57	62	67	71	75

3. For steel pipe sizes not presented in this table, the support spacing shall be designed so that the stress on the pipe does not exceed 5,000 psi. Maximum deflection of pipe shall be limited to 1/360th of the span and shall be calculated by using the formula:

$$L = \sqrt{\frac{7500tD}{32t + D}}$$

Where: t = Thickness (inches)
 D = Diameter (inches)
 L = Maximum span (feet)

4. Support Spacing for Ductile-Iron Pipe:

Normal Pipe Diameter (inches)	Maximum Span (feet)
All diameters	Two supports per pipe length or 10 feet (one of the 2 supports located at joint)

5. Support Spacing for Copper Tubing:

Normal Pipe Diameter (inches)	Maximum Span (feet)
1/2 to 1 - 1/2	6
2 to 4	10
6 and greater	12

6. Support Spacing for Schedule 80 PVC Pipe:

Normal Pipe Diameter (inches)	Maximum Span at 100 degrees F (feet)
1/2	4
3/4	4.5
1	5
1 - 1/4	5.5
1 - 1/2	5.75
2	6.25
3	7.5
4	8.25
6	10
8	11
10	12.25
12	13.25

7. Support Spacing for Schedule 80 Polypropylene Pipe:

Normal Pipe Diameter (inches)	Maximum Span at 100 degrees F (feet)
1/2	3
3/4	3.5
1	3.75
1 - 1/4	4
1 - 1/2	4.25
2	4.5
3	5.5
4	6
6	7.25
8	8
10	8.75
12	9.5

8. Support Spacing for Fiberglass Reinforced Plastic (FRP) Pipe:

Normal Pipe Diameter (inches)	Maximum Span at 100 degrees F (feet)
2	8.8
3	10
4	11
6	12.7
8	13.4
10	14
12	15.4
14	16.2
16	17.3
16 and Greater	18

2.3 MANUFACTURED SUPPORTS

- A. Stock Parts: Where not specifically indicated, designs which are generally accepted as exemplifying good engineering practice and use stock or production parts, shall be utilized wherever possible. Such parts shall be locally available, new, of best commercial quality, designed and rated for the intended purpose.
- B. Manufacturers, or Equal
1. Basic Engineers Inc., Pittsburgh, PA.
 2. Bergen-Paterson Pipesupport Corp., Woburn, MA.
 3. Grinnell Corp. (Supply Sales Company), Cranston, RI
 4. NPS Products, Inc., Westborough, MA.
 5. Power Piping Company, Pittsburgh, PA.

2.4 COATING

- A. Galvanizing: Unless otherwise indicated, fabricated pipe supports other than stainless steel or non-ferrous supports shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM A 123 - Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. Other Coatings: Other than stainless steel or non-ferrous supports, all supports shall receive protective coatings in accordance with the requirements of Section 09 90 00 - Protective Coatings and Linings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Pipe supports, seismic restraints, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions and ASME B31.1 - Power Piping. Concrete inserts for pipe hangers and supports shall be coordinated with the form work.
- B. Appearance: Pipe supports and hangers shall be positioned to produce an orderly, neat piping system. Hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, without interference with other work.

3.2 FABRICATION

- A. Quality Control: Pipe hangers, supports, and seismic restraints shall be fabricated and installed by experienced welders and fitters, using the best welding procedures available. Fabricated supports shall be neat in appearance without sharp corners, burrs, and edges.

END OF SECTION

SECTION 40 05 10
MILL PIPING – EXPOSED AND BURIED

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish and install all exposed and buried mill piping (pipe diameter 6 inches and less) as shown and in accordance with Contract Documents. This section applies to all mechanical Work and associated piping systems.
- B. All work shall be in strict accordance with the International Plumbing Code, and codes of the State of Utah, City of Riverton, and any other authorities having jurisdiction. The Contractor shall have required certifications and be thoroughly familiar with the local codes. The Contractor shall obtain and pay for all necessary permits.
- C. This section outlines requirements the following small (pipe diameter 6 inches and less) mechanical piping and associated accessories:
 - 1. Small steel pipe
 - 2. Solvent welded PVC pipe and Valves
 - 3. CPVC pipe and Valves
 - 4. PVDF pipe
- D. The Contractor shall furnish hoses, hose racks and signage where indicated on the Drawings and as indicated herein.

1.2 REFERENCE STANDARDS

A. Commercial Standards

ANSI/ASME B16.3	Malleable Iron Threaded Fittings
ANSI/ASME B16.4	Gray Iron Threaded Fittings,
ASME B16.5	Pipe Flanges and Flanged Fittings,
ANSI B16.11	Forged Steel Fittings, Socket-Welding and Threaded
ANSI B16.12	Cast-Iron Threaded Drainage Fittings
ANSI/ASME B16.15	Cast Bronze Threaded Fittings, Classes 125 and 250
ANSI B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ANSI B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A 74	Specification for Cast Iron Soil Pipe and Fittings
ASTM A 105	Specification for Carbon Steel, Forgings for Piping Applications
ASTM A 106	Specification for Seamless Carbon Steel Pipe for High Temperature Service
ASTM A 312	Specification for Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A 518	Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM B 43	Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B 88	Specifications for Seamless Copper Water Tube
ASTM C 599	Specification for Conical Process Glass Pipe and Fittings.
ASTM D 1785	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2996	Specification for Filament-Wound Reinforced Thermosetting Resin Pipe
ASTM D 3222	Specification for Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding, Extrusion, and Coating Materials
ASTM D 4101	Specification for Propylene Plastic Injection and Extrusion Materials
ASTM F 441	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

B. Chlorine Institute Pamphlet 6 Piping Systems for Dry Chlorine

1.3 CONTRACTOR SUBMITTALS

A. For the materials and equipment items supplied under the provisions of this Section, submit copies of the manufacturer's product specifications and performance details according to the requirements of Section 01 33 20 - Submittal Procedures.

B. Product information for all valves shall be submitted in accordance with Section 40 05 51 - Valves, General.

PART 2 - PRODUCTS

2.1 SMALL STEEL PIPE (SYSTEMS 1, 2, 3 AND 6)

- A. Unless otherwise indicated, galvanized steel pipe and black steel pipe in sizes 6 inches in diameter and smaller shall conform to the requirements of ASTM A 53 or ASTM A 106, as called out in the piping schedule and shall be Schedule 40 or 80 as indicated. Galvanized steel pipe shall not be cement mortar lined unless otherwise indicated. Fittings for galvanized steel pipe shall be of galvanized malleable iron, with NPT or grooved ends. Black pipe may have welded joints, with standard or extra strong welding fittings, or fittings indicated. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.
1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
 2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
 3. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
 4. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1. Unions shall be as manufactured by Henry Valve Company; Vogt Valve Co.; or equal.
 5. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
 6. Joint Compound and Tape: Suitable for natural gas.
 7. Steel Flanges and Flanged Fittings: ASME B16.5.
 8. Gasket Material: Thickness, material, and type suitable for natural gas.

2.2 COPPER TUBING (SYSTEM 24)

- A. Hard Copper Tube and Fittings: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 5. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Elkhart Products Corporation; Industrial Division; NIBCO INC.; Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 6. Copper Push-on-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) NVent LLC.
 - b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.

- B. Soft Copper Tube and Fittings: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 2. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Elkhart Products Corporation; Industrial Division; NIBCO INC.; Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 HOSE BIBBS AND HYDRANTS

A. All hose bibbs and hydrants in exposed locations subject to freezing shall be the non-freeze type. Hose bibbs connected to a non-potable water supply shall be provided with plastic or stainless-steel warning signs "DO NOT DRINK," in clearly legible letters, and permanently attached at the hose bibb. Hose bibbs shall be provided with vacuum breakers as furnished by Crane Co., American Standard, or equal.

B. Manufacturers, or Equal:

Dwg. Callout	Fixture Type	Description
HB-1	Non-freeze Post-type	Exposed bronze hydrant, post-type, depth of bury to suit local conditions; minimum 4 feet. 1. Woodward Mfg. Co., Model Iowa Y1
HB-2	Non-freeze wall-type	Heavy duty bronze hydrant with nickel-bronze face, hinged cover, recessed box, and key. Length to suit wall. 1. Josam Mfg. Co., Series 71000 2. Jay R. Smith Mfg. Co., Fig. 5510/5511 3. Zurn Industries, Inc., Fig. Z-1300
HB-3	Hose valves	Heavy duty bronze hydrant, with composition disc, handwheel, cap and chain. Sizes 1 1/2-inch and 2 1/2 inch: 1. Fire-End and Croker Corp, Model 180 2. James Jones (Watts Regulator Co., Nos. J-383 and J-344, respectively Size 1-inch, without cap and chain: 1. Apollo (Conbraco Industries, Inc.), Model 70-805 2. Fire-End and Croker Corp, Model 180 Size 3/4-inch, without cap and chain: 1. Apollo (Conbraco Industries, Inc.) Model 70-804, or 78-104 2. Chicago Faucet No.7T

3. Ford Meter Box Co., Model B8H-233HB2
4. Woodford Manufacturing Co., Model Y24 or 24P

HB-4 Wall box type

Recessed, with nickel-bronze box, hinged cover, and key.

1. Josam Mfg. Co., Series 71020
2. Jay R. Smith Mfg. Co., Series 5710
3. Zurn Industries, Inc., Fig. Z-1345

2.4 WALL-MOUNTED HOSE RACKS

- A. The Contractor shall provide wall-mounted hose racks at locations indicated. Racks shall be all welded steel construction, of minimum 8-gage sheet steel, hot-dip galvanized after fabrication, and shall have a capacity to hold 100 feet of 3/4-inch or 1-1/2-inch hose. Where racks are located in the open, they shall be supported from two 2- by 2- by 1/4-inch galvanized steel angle posts set in a concrete base or as indicated.

2.5 HOSES AND NOZZLES

- A. The Contractor shall furnish the following lengths of hose:
1. 1 - 50 ft lengths of 3/4-inch diameter hose
 2. 1 - 75 ft lengths of 1-inch diameter hose
- B. Each length of hose shall be provided with male and female connectors and nozzle. Hoses shall be seamless extruded rubber with dacron cotton exterior designed for a working pressure of at least 200 psi.
- C. Nozzles shall be capable of complete shut-off and shall produce a solid straight stream and up to a 90-degree conical fog. Nozzle material shall be polished brass. Nozzles shall have rubber bumpers.
- D. Nozzle Manufacturers, or Equal:
1. W.D. Allen Mfg. Co., Illinois
 2. Fire-End and Crocker Corp., New York
 3. Halprin Supply Co., Illinois
 4. Western Fire Equipment Co., California

2.6 GASKETS AND BOLTS

- A. Except as otherwise indicated, gaskets for flanged joints shall be in accordance with the requirements of Section 40 05 00 - Piping, General.
- B. Except as otherwise indicated, bolts shall conform to the requirements of Section 05 50 00 - Metal Fabrications.

2.7 INSULATING CONNECTIONS

- A. Insulating bushings, unions, couplings or flanges, as appropriate, shall be used for joining pipes of dissimilar metals, and for piping systems where corrosion control and cathodic protection are involved, in accordance with the requirements of Section 22 00 00 –Plumbing Piping and Fittings.

2.8 PIPE SUPPORTS

- A. Pipe Supports, hangers, anchors, seismic restraints, and guides shall be in accordance with the requirements of Section 40 05 07 - Pipe Supports.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Small Steel Pipe: Buried galvanized or black steel pipe shall be coated as specified in Section 09 90 00 – Protective Coatings and Linings or provided with an extruded high density polyethylene coating with minimum thickness of 35 mils.
- B. Plastic Pipe: PVC, CPVC, and FRP pipe joints shall be solvent-welded in accordance with the manufacturer's instructions. Expansion joints or pipe bends shall be provided to absorb pipe expansion over a temperature range of 100 degrees F, unless otherwise indicated. Care shall be taken to provide sufficient supports, anchors, and guides, to avoid stress on the piping. Obtain the services of the pipe manufacturer, to instruct the pipe fitters in the correct way of making solvent welded and threaded joints. Only clean, fresh primer and solvent shall be used at all times at the recommended temperatures.
- C. Drain Traps: Drain traps shall be installed at low points in air and gas lines or elsewhere where indicated. Liquid outlets shall be piped to the nearest floor drain or open sump.
- D. Couplings: Pipe couplings shall be installed in strict accordance with the manufacturer's printed recommendations, using the correct style coupling and gasket for any given application.
- E. Gaskets for Flanged Joints: Gaskets shall be in accordance with the requirements of Section 40 05 00 - Piping, General.
- F. Insulating Connections: All insulating connections shall be installed in accordance with manufacturer's printed instructions. Care shall be exercised to prevent damage to insulating fittings, while making up the joints.

3.2 CONTINUITY BONDS

- A. Where required by the Contract Documents, all metallic pipe joints, except field-welded joints and insulating joints, shall be continuity bonded in accordance with the requirements of Section 40 05 00 - Piping, General.

END OF SECTION

**SECTION 40 05 50
MISCELLANEOUS VALVES**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide miscellaneous valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 05 51 - Valves, General, apply to this Section.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 40 05 51 and Section 01 33 20

PART 2 - PRODUCTS

2.1 AIR-VACUUM AND AIR-RELEASE VALVES

- A. Air and Vacuum Valves: Air and vacuum valves shall be per AWWA C512 and suitable for potable water. . 1-inch through 3-inch valves with NPT threaded inlet and outlet, 4-inch and larger valves with ANSI Class flanged inlet and outlet to match pressure rating shown on Drawings. Air and vacuum valves shall be capable of venting large quantities of air while pipelines are being filled and allowing air to re-enter while pipelines are being drained. They shall be of the size indicated, with flanged or screwed ends to match piping. Bodies shall be of high-strength cast iron or ductile Iron, fusion bonded epoxy lined and coated. The float, seat, all wetted parts and moving parts shall be constructed of Type 316 stainless steel. Seat washers and gaskets shall be of a material insuring water tightness with a minimum of maintenance. Valves shall be designed for minimum 150 psi water-working pressure, unless otherwise indicated.
- B. Air-Release Valves: Air-release valves shall vent accumulating air while system is in service under pressure and be of the size indicated. Valves shall meet the same general requirements as indicated for air and vacuum valves except that the vacuum feature will not be required. Valves shall be designed for a minimum water-working pressure of 150 psi, unless otherwise indicated.
- C. Combination Air Valves: Combination air valves shall combine the characteristics of air and vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting large quantities of air while a system is being filled or drained, respectively. Valves shall have the same general requirements as indicated for air and vacuum valves. Where valves are 2-inch or less the combination air valve may be single body style. Where combination air valves are 4-inch or larger dual body valves styles shall be provided.
- D. Manufacturers
 - 1. APCO (Valve and Primer Corporation)
 - 2. Crispin - Multiplex Manufacturing Company

3. GA Industries
4. Val-Matic (Valve and Manufacturing Corporation)
5. Engineer approved equal.

2.2 BACKFLOW PREVENTER VALVES

- A. General: Backflow preventers shall work on the reduced pressure principle. They shall consist of 2 spring-loaded check valves, automatic differential pressure relief valve, drain valves, and shut-off valves. The body material shall be bronze or cast iron for a working pressure of not less than 150 psi, with bronze or stainless steel trim. Drain lines with air gaps shall be provided. The backflow preventer valves shall be in accordance with AWWA C511 standard.
- B. The number and sizes of backflow preventors required are given on the Contract Drawing P&IDs.
- C. Manufacturers
 1. Cla-Val Company
 2. Febco (CMB Industries)
 3. Hersey Products
 4. Watts, ACV
 5. Wilkins Regulator Division (Zurn Industries)
 6. Engineer approved equal.

2.3 CORPORATION STOPS

- A. Unless otherwise indicated, corporation stops shall be made of solid brass for key operation, with screwed ends with corporation thread or iron pipe thread, as required. Note that corporation stops on special chemical diffuser ports shall be 316 stainless steel – unless indicated otherwise.
- B. Manufacturer
 1. Ford Meter Box Company, Inc.
 2. James Jones Company (Watts, ACV)
 3. Mueller Company
 4. Engineer approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Backflow preventers shall be installed in utility water lines where required by applicable codes or regulations, and where indicated on Contract Drawings.
- B. Valves shall be installed in accordance with the manufacturer's printed recommendations, and with Section 40 05 51.

- C. Backflow preventers, as well as air and vacuum release valves, shall have piped outlets to the nearest acceptable drain, firmly-supported, and installed in such a way as to avoid splashing and wetting of floors and obstruction of traffic.
- D. All air valves shall be installed and operational at the time of filling, draining, disinfecting or pressure testing of the pipeline.

END OF SECTION

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**SECTION 40 05 51
VALVES, GENERAL**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide valves, actuators, and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section shall apply to all valves and valve actuators except where otherwise indicated. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls indicated in other Sections of the Specifications.
- C. Where a valve is to be supported by means other than the piping to which it is attached, the Contractor shall obtain from the valve manufacturer a design for support and foundation. The design, including drawings and calculations sealed by an engineer, shall be submitted with the Shop Drawings. When the design is approved, the support shall be provided.
- D. Unit Responsibility: A single manufacturer shall be made responsible for coordination of design, assembly, testing, and furnishing of each valve; however, the Contractor shall be responsible to the Owner for compliance with the requirements of each valve section. Unless indicated otherwise, the responsible manufacturer shall be the manufacturer of the valve.
- E. Single Manufacturer: Where two or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 20 - Submittal Procedure.
- B. Shop Drawings: Shop Drawings shall contain the following information:
 - 1. Valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number.
 - 2. Complete information on valve actuator, including size, manufacturer, model number, limit switches, and mounting.
 - 3. Cavitation limits for control valves.
 - 4. Assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, handwheels, position indicators, limit switches, integral control systems, needle valves, and control systems.
 - 5. Complete wiring diagrams and control system schematics.
 - 6. Valve Labeling: A schedule of valves to be furnished with stainless steel tags, indicating in each case the valve location and the proposed wording for the label.
- C. Technical Manual: The Technical Manual shall contain the required information for each valve.
- D. Spare Parts List: A Spare Parts List shall contain the required information for each valve assembly, where indicated.

- E. Factory Test Data: Where indicated, signed, dated, and certified factory test data for each valve requiring certification shall be submitted before shipment of the valve. The data shall also include certification of quality and test results for factory-applied coatings.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. General: Valves and gates shall be new and of current manufacture. Shut-off valves 6-inches and larger shall have actuators with position indicators. Gate valves 18-inches and larger or where chain wheel is required, shall be furnished with spur gear and hand wheel. Buried valves shall be provided with valve boxes and covers containing position indicators and valve extensions. Manual shut-off valves mounted higher than 7-feet above working level shall be provided with chain actuators.
- B. Valve Actuators: Unless otherwise indicated, valve actuators shall be in accordance with Section 40 05 52 - Valve and Gate Actuators.
- C. Protective Coating: The exterior surfaces of all valves and the wet interior surfaces of ferrous valves of sizes 4-inches and larger shall be epoxy coated in accordance with Section 09 90 00 – Protective Coatings and Linings. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications. Flange faces of valves shall not be epoxy coated.
- D. Valve Labeling: Except when such requirement is waived by the construction manager in writing, a label shall be provided on shut-off valves and control valves except for hose bibbs and chlorine cylinder valves. The label shall be of 1/16-inch Type 316 stainless steel, minimum 1-inches by 2-inches in size, , and shall be permanently attached to the valve or on the wall adjacent to the valve as directed by the construction manager. Label shall have model numbers, ratings, valve number, size and all other pertinent valve information stamped or permanently affixed to the tag.
- E. Valve Testing: As a minimum, unless otherwise indicated or recommended by the reference Standards, valves 3-inches in diameter and smaller shall be tested in accordance with manufacturer's standard and 4-inches in diameter and larger shall be factory tested as follows:
 - 1. Hydrostatic Testing: Valve bodies shall be subjected to internal hydrostatic pressure equivalent to twice the water rated pressure of the valve. Metallic valves rating pressures shall be at 100 degrees F and plastic valves shall be 73 degrees, or at higher temperature according to type of material. During the hydrostatic test, there shall be no leakage through the valve body, end joints, or shaft seals, nor shall any part of the valve be permanently deformed. The duration shall be sufficient time to allow visual examination for leakage. Test duration shall be at least 10 minutes.
 - 2. Seat Testing: Valves shall be tested for leaks in the closed position with the pressure differential across the seat equal to the water rated pressure of the valve. The duration of test shall be sufficient time to allow visual examination for leakage. Test duration shall be at least 10 minutes. Leakage past the closed valve shall not exceed 1 fluid ounce per hour per inch diameter for metal seated valves and drop-tight for resilient seated valves.

3. Performance Testing: Valves shall be shop operated from fully closed to fully open position and reverse under no-flow conditions in order to demonstrate the valve assembly operates properly.
- F. Certification: Prior to shipment, the Contractor shall submit for valves over 12-inches in size, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, or ASTM.
 - G. Valve Marking: Valve bodies shall be permanently marked in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MATERIALS

- A. General: Materials shall be suitable for the intended application. Materials in contact with potable water shall be listed as compliant with NSF Standard 61. Materials not indicated shall be high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended. Unless otherwise indicated, valve and actuator bodies shall conform to the following requirements:
 1. Cast Iron: Close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 2. Ductile Iron: ASTM A 536 - Ductile Iron Castings, or to ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
 3. Steel: ASTM A 216 - Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service, or to ASTM A 515 - Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service.
 4. Bronze: ASTM B 62 - Composition Bronze or Ounce Metal Castings, and valve stems not subject to dezincification shall conform to ASTM B 584 - Copper Alloy Sand Castings for General Applications.
 5. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel.
 6. PVC: Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 12454.
 7. CPVC: Chlorinated Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 23447.
 8. NSF Standard 61: Materials shall be listed for use in contact with potable water.

2.3 VALVE CONSTRUCTION

- A. Bodies: Valve bodies shall be cast, molded (in the case of plastic valves), forged, or welded of the materials indicated, with smooth interior passages. Wall thicknesses shall be uniform in agreement with the applicable standards for each type of valve, without casting defects, pinholes, or other defects that could weaken the body. Welds on welded bodies shall be done by certified welders and shall be ground smooth. Valve ends shall be as indicated, and be rated for the maximum temperature and pressure to which the valve will be subjected.
- B. Valve End Connections: Unless otherwise indicated, valves 2-1/2 inches diameter and smaller may be provided with threaded end connections. Valves 3-inches and larger shall have flanged end connections.

- C. Bonnets: Valve bonnets shall be clamped, screwed, or flanged to the body and shall be of the same material, temperature, and pressure rating as the body. The bonnets shall have provision for the stem seal with the necessary glands, packing nuts, or yokes.
- D. Stems: Valve stems shall be of the materials indicated, or, if not indicated, of the best commercial material for the specific service, with adjustable stem packing, O-rings, Chevron V-type packing, or other suitable seal. Bronze valve stems shall conform to ASTM B 584, except that zinc content shall not exceed 16 percent.
- E. Stem Guides: Stem guides shall be provided, spaced 10-feet on centers unless the manufacturer can demonstrate by calculation that a different spacing is acceptable. Submerged stem guides shall be 304 stainless steel.
- F. Internal Parts: Internal parts and valve trim shall be as indicated for each individual valve. Where not indicated, valve trim shall be of Type 316 stainless steel or other best suited material.
- G. Nuts and Bolts: Nuts and bolts on valve flanges and supports shall be in accordance with Section 05 50 00 – Metal Fabrications.

2.4 VALVE ACCESSORIES

- A. Valves shall be furnished complete with the accessories required to provide a functional system.

2.5 SPARE PARTS

- A. The Contractor shall furnish the required spare parts suitably packaged and labeled with the valve name, location, and identification number. The Contractor shall also furnish the name, address, and telephone number of the nearest distributor for the spare parts of each valve. Spare parts are intended for use by the Owner, after expiration of the correction of defects period.

2.6 MANUFACTURERS

- A. Manufacturer's Qualifications: Valve manufacturers shall have a successful record of not less than 5 years in the manufacture of the valves indicated.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. General: Valves, actuating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as indicated. Gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe.
- B. Access: Valves shall be installed with easy access for actuation, removal, and maintenance and to avoid interference between valve actuators and structural members, handrails, or other equipment.

- C. Valve Accessories: Where combinations of valves, sensors, switches, and controls are indicated, the Contractor shall properly assemble and install such items so that systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on Shop Drawing submittals.

END OF SECTION

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**SECTION 40 05 52
VALVE AND GATE ACTUATORS**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide valve and gate actuators and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section shall apply to valves and gates except where otherwise indicated in the Contract Documents.
- C. Unit Responsibility: The valve or gate manufacturer shall be made responsible for coordination of design, assembly, testing, and installation of actuators on the valves and gates; however, the Contractor shall be responsible to the Owner for compliance of the valves, gates, and actuators with the Contract Documents.
- D. Single Manufacturer: Where 2 or more valve or gate actuators of the same type or size are required, the actuators shall be produced by the same manufacturer.
- E. The requirements of Section 26 00 00 - Electrical General Provisions apply to the Work of this Section.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 20 – Submittal Procedures and Section 40 05 51 - Valves, General.
- B. Shop Drawings: Shop Drawing information for actuators shall be submitted together with the valve and gate submittals as a complete package.
- C. Calculations: Selection calculations showing dynamic seating and unseating torques versus output torque of actuator.
- D. Technical Manuals: The Contractor shall furnish technical manuals for the butterfly valves, butterfly valve manual actuators, and butterfly valve electric motor actuators under one cover and in accordance with the requirements of Section 01 33 20 – Submittal Procedures.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise indicated, shut-off and throttling valves and externally actuated valves and gates shall be provided with manual or power actuators. The Contractor shall furnish actuators complete and operable with mounting hardware, motors, gears, controls, wiring, solenoids, handwheels, levers, chains, and extensions, as applicable. Actuators shall have the torque ratings equal to or greater than required for valve seating and dynamic torques, whichever is greater, and shall be capable of holding the valve in any intermediate position

between fully-open and fully-closed without creeping or fluttering. Actuator torque ratings for butterfly valves shall be determined in accordance with AWWA C504 - Rubber-Seated Butterfly Valves. Wires of motor-driven actuators shall be identified by unique numbers.

- B. **Manufacturers:** Where indicated, certain valves and gates may be provided with actuators manufactured by the valve or gate manufacturer. Where actuators are furnished by different manufacturers, the Contractor shall coordinate selection to have the fewest number of manufacturers possible.
- C. **Materials:** Actuators shall be current models of the best commercial quality materials and be liberally-sized for the required torque. Materials shall be suitable for the environment in which the valve or gate is to be installed.
- D. **Actuator Mounting and Position Indicators:** Actuators shall be securely mounted by means of brackets or hardware specially designed and sized for this purpose and be of ample strength. The word "open" shall be cast on each valve or actuator with an arrow indicating the direction to open in the counter-clockwise direction. Gear and power actuators shall be equipped with position indicators. Where possible, manual actuators shall be located between 48- and 60-inches above the floor or the permanent working platform.
- E. **Standard:** Unless otherwise indicated and where applicable, actuators shall be in accordance with AWWA C 540 - Power-Actuating Devices for Valves and Slide Gates.
- F. **Functionality:** Electric, pneumatic, and hydraulic actuators shall be coordinated with the power requirements of Division 26.
- G. **Fasteners:** Fasteners shall be in accordance with Section 05 50 00 - Metal Fabrications.
- H. **Protective Coatings:** Protective coatings shall be in accordance with Section 09 90 00 - Protective Coatings and Linings.

2.2 MANUAL ACTUATORS

- A. **General:** Unless otherwise indicated, valves and gates shall be furnished with manual actuators. Valves in sizes up to and including 4-inches shall have direct acting lever or handwheel actuators of the manufacturer's best standard design. Larger valves and gates shall have gear-assisted manual actuators, with an operating pull of maximum 60 pounds on the rim of the handwheel. Buried and submerged gear-assisted valves, gates, gear-assisted valves for pressures higher than 250 psi, valves 30-inches in diameter and larger, and where so indicated, shall have worm gear actuators, hermetically-sealed water-tight and grease-packed. Other valves 6-inches to 24-inches in diameter may have traveling nut actuators, worm gear actuators, spur or bevel gear actuators, as appropriate for each valve.
- B. **Buried Valves:** Unless otherwise indicated, buried valves shall have extension stems to grade, with square nuts or floor stands, position indicators, and cast-iron or steel pipe extensions with valve boxes, covers, and operating keys. Where so indicated, buried valves shall be in cast-iron, concrete, or similar valve boxes with covers of ample size to allow operation of the valve actuators. Covers of valve boxes shall be permanently labeled as required by the local Utility Company or the Engineer. Wrench nuts shall comply with AWWA C 500 - Metal - Seated Gate Valves for Water Supply Service.

- C. Chain Actuator: Manually-activated valves with the stem located more than 7-feet above the floor or operating level shall be provided with chain drives consisting of sprocket-rim chain wheels, chain guides, and operating chains provided by the valve manufacturer. The wheel and guide shall be of ductile iron, cast iron, or steel, and the chain shall be hot-dip galvanized steel or stainless steel, extending to 5-feet 6-inches above the operating floor level. The valve stem of chain-actuated valves shall be extra strong to allow for the extra weight and chain pull. Hooks shall be provided for chain storage where chains interfere with pedestrian traffic.
- D. Floor Stands: Valve actuator floor stands shall be cast iron or fabricated steel pedestals. The centerline of the actuator shall be approximately 42 to 48 inches above the base of the pedestal.
- E. Floor Boxes: Hot dip galvanized cast iron or steel floor boxes and covers to fit the slab thickness shall be provided for operating nuts in or below concrete slabs. For operating nuts in the concrete slab, the cover shall be bronze-bushed.
- F. Tee Wrenches: Buried valves with floor boxes shall be furnished with 2 operating keys or 1 key per 10 valves, whichever is greater. Tee wrenches sized so that the tee handle will be 2 to 4 feet above ground, shall fit the operating nuts.
- G. Manual Worm Gear Actuator: The actuator shall consist of a single or double reduction gear unit contained in a weather-proof cast iron or steel body with cover and minimum 12-inch diameter handwheel. The actuator shall be capable of 90 degree rotation and shall be equipped with travel stops capable of limiting the valve opening and closing. The actuator shall consist of spur or helical gears or worm gearing. The gear ratio shall be self-locking to prevent "back-driving." The spur or helical gears shall be of hardened alloy steel and the worm gear shall be alloy bronze. The worm gear shaft and the handwheel shaft shall be of 17-4 PH or similar stainless steel. Gearing shall be accurately cut with hobbing machines. Ball or roller bearings shall be used throughout. Output shaft end shall be provided with spline to allow adjustable alignment. Actuator output gear changes shall be mechanically possible by simply changing the exposed or helical gearset ratio without further disassembly of the actuator. Gearing shall be designed for a 100 percent overload. The entire gear assembly shall be sealed weatherproof. Manual worm gear actuators shall be Auma GS Series, Limatorque HBC Series, no "Or-Equals".
- H. Traveling-Nut Actuator: The actuator shall consist of a traveling-nut with screw (Scotch yoke) contained in a weatherproof cast iron or steel housing with spur gear and minimum 12-inch diameter handwheel. The screw shall run in 2 end bearings, and the actuator shall be self-locking to maintain the valve position under any flow condition. The screw and gear shall be of hardened alloy steel or stainless steel, and the nut and bushings shall be of alloy bronze. The bearings and gear shall be grease-lubricated by means of nipples. Gearing shall be designed for a 100 percent overload.
- I. Schedule for Manual Actuator Types: For a complete schedule of manual actuators required on project valves (6" diameter and larger), see Contract Drawing M-03.

2.3 ELECTRIC MOTOR ACTUATORS

A. General

1. Equipment Requirements: Where electric motor actuators are indicated, an electric motor-actuated valve control unit shall be attached to the actuating mechanism housing by means of a flanged motor adapter piece.
2. Gearing: The motor actuator shall include the motor, reduction gearing, reversing starter, torque switches, and limit switches in a weather-proof NEMA 4 assembly. The actuator shall be a single or double reduction unit consisting of spur or helical gears and worm gearing. The spur or helical gears shall be of hardened alloy steel, and the worm gear shall be alloy bronze. Gearing shall be accurately cut with hobbing machines. Power gearing shall be grease- or oil-lubricated in a sealed housing. Ball or roller bearings shall be used throughout. Actuator output speed changes shall be mechanically possible by simply removing the motor and changing the exposed or helical gearset ratio without further disassembly of the actuator.
3. Starting Device: Except for modulating valves, the unit shall be so designed that a hammer blow is imparted to the stem nut when opening a closed valve or closing an open valve. The device should allow free movement at the stem nut before imparting the hammer blow. The actuator motor must attain full speed before stem load is encountered.
4. Switches
 - a. Electronic Type Switches: Limit switches or valve position shall be sensed by a 15 bit, optical, absolute position encoder. The open and closed positions shall be stored in a permanent, non-volatile memory. The encoder shall measure valve position continuously, including both motor and hand wheel operation, with or without use of battery. An electronic torque sensor shall be furnished. The torque limit may be adjusted from 40 to 100 percent of rating in 1 percent increments. The motor shall be de-energized if the torque limit is exceeded. A boost function shall be included to prevent torque trip during initial valve unseating, and a "jammed valve" protection feature with automatic retry sequence shall be incorporated to de-energize the motor if no movement occurs. Valve actuators with electronic type switches shall be as manufactured by Limitorque or Auma Actuators, Inc.
 - b. The actuator shall be wired in accordance with the schematic diagram. Wiring for external connections shall be connected to marked terminals. One of 1-inch and one of 1.25-inch conduit connection shall be provided in the enclosing case. A calibration tag shall be mounted near each switch correlating the dial setting to the unit output torque. Switches shall not be subject to breakage or slippages due to over-travel. Traveling-nuts, cams, or micro switch tripping mechanisms shall not be used. Limit switches shall be of the heavy-duty open contact type with rotary wiping action.
5. Handwheel Operation: A permanently attached handwheel shall be provided for emergency manual operation. The handwheel shall not rotate during electrical operation. The maximum torque required on the handwheel under the most adverse conditions shall not exceed 60 lb.ft, and the maximum force required on the rim of the handwheel shall not exceed 60 lb. An arrow and either the word "open" or "close" shall be cast or permanently affixed on the handwheel to indicate the appropriate direction to turn the handwheel. A clutch lever shall be provided to put actuator into handwheel operation. Valves with electric motor actuators having stems more than 7-feet above the floor shall be provided with chain activator handwheels. The clutch lever shall be provided with a cable secured to the chain to allow disengagement for manual operation.

6. Motor: The motor shall be of the totally enclosed, non-ventilated, high-starting torque, low-starting current type for full voltage starting. It shall be suitable for operation at voltage listed in Contract Drawing M-03, 60 Hz current, and have Class F insulation and a motor frame with dimensions in accordance with the latest revised NEMA MG Standards. The observed temperature rise by thermometer shall not exceed 55 degrees C above an ambient temperature of 40 degrees C when operating continuously for 15 minutes under full rated load. With a line voltage ranging between 10 percent above to 10 percent below the rated voltage, the motor shall develop full rated torque continuously for 15 minutes without causing the thermal contact protective devices imbedded in the motor windings to trip or the starter overloads to drop-out. Bearings shall be of the ball type, and thrust bearings shall be provided where necessary. Bearings shall be provided with suitable seals to confine the lubricant and prevent the entrance of dirt and dust. Motor conduit connections shall be watertight. Motor construction shall incorporate the use of stator and rotor as independent components from the valve operation such that the failure of either item shall not require actuator disassembly or gearing replacement. . Two Class B thermal contacts or solid state thermistors imbedded within the motor windings shall be provided to protect against over-temperature damage. Each electric motor actuator shall be provided with a local disconnect switch or circuit breaker to isolate power from the motor and controller during maintenance activities.

B. Electric Motor Actuators

1. General: Where indicated, modulating electric motor actuators shall be the ac modulating type complete with a local control station with power disconnect switch or circuit breaker, provided with open/stop/close and local/off/remote selector switches on the actuator local control station, and open/close status lights.
2. Actuator Appurtenances: The actuator for each valve shall be provided with a padlockable disconnect switch, open and closed status lights, open, close and lockout stop pushbuttons, a local/off/remote selector switch, and other devices indicated. The disconnect switches in certain applications are required to be located remotely from the actuator body itself, as shown on the Contract Drawings. The local control station may also be provided as an integral part of the actuator or remotely as otherwise indicated or required to permit operation by a person at floor elevation and within sight of the valve actuator. The Contractor shall provide conduit and wiring between the actuator controls and the valve actuator for these applications.
3. Control Module: The control module shall be of the electronic solid-state ac type with control outputs for positioning the valve via 4 - 20 ma input signals.
4. Communication Module: Provide with additional communication card for Modbus TCP/IP feedback and control.
5. Starter: The actuator shall control a solid-state reversing starter designed for minimum susceptibility to power line surges and spikes. The solid-state starter and control module shall be rated for continuous modulating applications. Power supply shall be as listed on Contractor Drawing M-03. A disconnect switch shall be included with each actuator.
6. Construction: The control unit shall be microprocessor-based and shall contain an analog/digital converter, separate input-output switches, non-volatile random access memory for storage of calibration parameters and pushbutton calibration elements for field setup. Potentiometer adjustments shall contain a PID control function internally. In addition, the controller shall contain as standard feature a loss of command signal protection selectable to lock in last or lock in pre-set valve position

and a valve position output signal in 4 - 20 ma. As an alternative to the construction requirement, the motor shall be capable of modulating at a rate of 600 starts per hour at the 50 percent to 85 percent travel range of the valve. The system shall allow control of the open, close, or percent open function when the local/off/remote switch is in the remote position. Each actuator shall have a frequency shut down system which when pre-programmed, shall function as directed upon receipt of an ESD signal.

7. Open/Close Operating Speed: Unless otherwise indicated, electric actuators shall provide a full close to full open or full open to full close operating time range as listed below:
 - a. 78-inch Butterfly Valve at 11400 South: 24 minutes total
 - 1) Variable speed closing time
 - 2) First 80% closing in 12 minutes
 - 3) Final 20% closing to shut in 12 minutes
 - b. 36-inch Butterfly Valve at 11400 South – 21.5 minutes total
8. Schedule for Electric AC Actuator Type: For a complete schedule of electric actuators required on project valves (6" diameter and larger), see Contract Drawings.
9. Manufacturers:
 - a. For 78-inch Butterfly Valve:
 - 1) Auma, Sipos Seven Series 2SA7853 with worm gear model GS 500
 - 2) No equal
 - b. For 36-inch Butterfly Valve
 - 1) Auma, Sipos Seven Series 2SA7831 with worm gear model GS250
 - 2) No equal

PART 3 - EXECUTION

3.1 SERVICES OF MANUFACTURER

- A. Field Adjustments: Field representatives of manufacturers of valves or gates with pneumatic, hydraulic, or electric actuators shall adjust actuator controls and limit-switches in the field for the required function.

3.2 INSTALLATION

- A. Valve and gate actuators and accessories shall be installed in accordance with Section 40 05 51 - Valves, General. Actuators shall be located to be readily accessible for operation and maintenance without obstructing walkways. Actuators shall not be mounted where shock or vibrations will impair their operation, nor shall the support systems be attached to handrails, process piping, or mechanical equipment.
- B. Inspection, Startup, and Field Adjustment: An authorized representative of the manufacturer shall visit the Site and witness the following:
 1. Installation of the equipment for not less than two (2) Work Days
 2. Inspection, checking, and adjusting the equipment for not less two (2) Work Days.
 3. Startup and field-testing for proper operation for not less than two (2) Work Days.
- C. Instruction of Owner's Personnel: The authorized service representative shall visit the Site for not less than 2 Days to instruct the Owner's personnel in the operation and maintenance

of the equipment including step-by-step troubleshooting procedures with necessary test equipment.

END OF SECTION

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**SECTION 40 05 61
GATE VALVES**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide gate valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 05 51 - Valves, General apply to this Section.
- C. The requirements of Section 40 05 52 - Valve and Gate Actuators apply to this Section.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 20 – Submittal Procedures and Section 40 05 51 – Valves, General.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Buried valves shall be of the inside screw, non-rising stem type. The valve actuators shall be as indicated, with counter-clockwise opening stems, in accordance with Section 40 05 52 - Valve and Gate Actuators.
- B. Gate valves 18-inches and larger shall be provided with a bypass line and isolation valve.

2.2 RESILIENT-SEATED GATE VALVES

- A. Construction: Resilient-seated gate valves shall conform to AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service. The valves shall be suitable for a minimum design working water pressure of 150 psig see NTS, above, with flanged, bell and spigot, or mechanical joint ends. The valve body, bonnet, and disc shall be of cast iron or ductile iron and the disc or body shall be rubber-coated. Body and bonnet wall thickness shall be equal to or greater than the minimum wall thickness as listed in Table 1 of AWWA C515. The stem, stem nuts, glands, and bushings shall be bronze, with the stem seal per AWWA C515.
- B. Pressure Ratings:
 - 1. AWWA C515 valves 3- through 36-inch with outside screw-and-yoke (OS&Y) rising stem and 3- through 16-inch for non-rising-stem (NRS), shall be rated for 200 psig minimum design working water pressure.
- C. Protective Coating: Valves shall be factory epoxy coated in accordance with Section 09 90 00 – Protective Coatings and Linings . The Contractor shall submit a test report from a coating inspector that the coating is holiday-free. The Contractor shall be aware that it may retain the services of a third-party coating applicator tester to achieve the holiday-free requirement.

- D. Actuators: Unless otherwise indicated, resilient-seated gate valves shall have manual actuators in accordance with Section 40 05 52 – Valve and Gate Actuators.
- E. Manufacturers, or Equal
 - 1. Mueller Company
 - 2. M & H
 - 3. Clow

PART 3 - EXECUTION

3.1 GENERAL

- A. Gate valves shall be installed in accordance with the provisions of Section 40 05 51 – Valves, General. Care shall be taken that valves in plastic lines are well supported at each end of the valve.

END OF SECTION

**SECTION 40 05 62
PLUG VALVES**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide plug valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 05 51 - Valves, General apply to this Section.
- C. The requirements of Section 40 05 52 - Valve and Gate Actuators apply to this Section.
- D. Plug valves shall have undergone a proof-of-design test to demonstrate that the valve components operate at the service flow, pressure, temperature, and fluid conditions, free from binding, excessive noise, and premature failures. Proof-of-design test results shall be available to the Engineer on request. The proof-of-design test shall be conducted in accordance with the applicable provisions of AWWA C517.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 40 05 51 – Valves, General.

PART 2 - PRODUCTS

2.1 ECCENTRIC PLUG VALVES (1/2-INCH TO 72-INCHES)

- A. Construction: Eccentric plug valves shall be of the non-lubricated, eccentric plug design with cast iron bodies conforming to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings, with ANSI 125 lb. flanged ends for valves 3-inches and larger, and screwed or flanged ends for smaller sizes. The plugs and shafts shall be of cast iron or ductile iron conforming to ASTM A 536 - Ductile Iron Castings, and the plugs shall be lined with a resilient coating, best suited for the specific service. The body shall be epoxy coated and be lined with a suitable elastomer, where required for a special service, or it shall be epoxy-lined in accordance with Section 09 90 00 –Protective Coatings and Linings. The seats shall be of nickel or stainless steel welded to the body. Top and bottom shaft bearings shall be of permanently lubricated stainless steel or Teflon coated stainless steel. Grit seals of Teflon, Nylatron, or similar suitable material shall be at the top and bottom plug journals. Valves up to and including 20-inches in size shall have an unobstructed port area of not less than 80 percent of full pipe area, and not less than 70 percent for larger valves. Eccentric plug valves shall have a pressure rating of not less than 150 psi WOG, for bubble-tight shut-off in the standard flow direction, and 25 psi WOG in the reverse flow direction. When equipped with worm gear actuator, the pressure rating shall be 150 psi WOG in both directions. The stem seal shall consist of field adjustable packing, replaceable without removal of the actuator, or of self-adjusting U-cup packing.

- B. Actuators: Unless otherwise indicated, eccentric plug valves 3-inches and smaller shall have operating levers; larger valves shall have worm-gear actuators. Valve actuators shall be in accordance with Section 40 05 52 – Valve and Gate Actuators.
- C. Manufacturers, or Equal
 - 1. DeZurik Corporation
 - 2. Clow Valve Company
 - 3. Pratt Valve
 - 4. Victaulic

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plug valves shall be installed in strict accordance with the manufacturer's published recommendations and the applicable provisions of Section 40 05 51 – Valves, General.
- B. Eccentric Plug Valves: Unless otherwise directed, the following rules shall be observed for the installation of eccentric plug valves on sewage, sludge, or other liquid systems containing solids, silt, or fine sand:
 - 1. The valves shall be positioned with the stem in the horizontal direction.
 - 2. In horizontal pipelines, the plug shall swing upwards when opening, to permit flushing out of solids.
 - 3. The orientation of the valve shall prevent the valve body from filling up with solids when closed; however, where the pressure differential through the valve exceeds 25 psi, the higher pressure for valves without worm gear, electric, or air operators shall be through the valve to force the plug against the seat.
 - 4. Valves which may be closed for extended periods (stand-by, bypass, or drain lines) and valves with reversed flow (higher pressure on downstream side, forcing the plug away from its seat), shall be equipped with worm gear operators for the full range of sizes.
 - 5. For special applications or when in doubt, consult with the manufacturer prior to installation.

END OF SECTION

**SECTION 40 05 63
BALL VALVES**

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide ball valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 40 05 51 - Valves, General apply to this Section.
- C. The requirements of Section 40 05 52 - Valve and Gate Actuators apply to this Section.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 20 – Submittal Procedures and 40 05 51 - Valves, General.

PART 2 - PRODUCTS

2.1 METAL BALL VALVES (3-INCHES AND SMALLER)

- A. General: Unless otherwise indicated, general purpose metal ball valves in sizes up to 4-inches shall have actuators in accordance with Section 40 05 52 - Valve and Gate Actuators.
- B. Body: Ball valves up to and including 1.5-inches in size shall have bronze or carbon steel 2 or 3 piece bodies with screwed ends for a pressure rating of not less than 600 psi WOG. Valves 2-inches to 3-inches in size shall have bronze or carbon steel 2 or 3 piece bodies with flanged ends for a pressure rating of ANSI 125 psi or 150 psi unless otherwise indicated.
- C. Balls: The balls shall be solid chrome-plated brass or bronze, or stainless steel, with standard port (single reduction) or full port openings.
- D. Stems: The valve stems shall be of the blow-out proof design, of bronze, stainless steel, or other acceptable construction, with reinforced teflon seal.
- E. Seats: The valve seats shall be of teflon or Buna-N, for bi-directional service and easy replacement.
- F. Manufacturers, or Equal
 1. Conbraco Industries, Inc. (Apollo)
 2. ITT Engineered Valves
 3. Neles-Jamesbury, Inc.
 4. Watts Regulator
 5. Worcester Controls

PART 3 - EXECUTION

3.1 GENERAL

- A. Valves shall be installed in accordance with Section 40 05 51 – Valves, General. Care shall be taken that valves in plastic lines are well supported at each end of the valve.

END OF SECTION

**SECTION 40 05 64
BUTTERFLY VALVES (DOUBLE OFFSET)**

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall provide butterfly valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 11 00 00 – Equipment General Provisions apply to this Section.
- C. The requirements of Section 40 05 51 – Valves, General apply to this Section.
- D. The requirements of Section 40 05 52 – Valve and Gate Actuators apply to this Section.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 40 05 51 – Valves, General.
- B. Shop Drawings
 - 1. Complete Shop Drawings of butterfly valves and actuators.
 - 2. Drawings showing valve port diameter complete with dimensions, part numbers, and materials of construction.
 - 3. Certification of proof-of-design test from the valve manufacturer.
 - 4. Certification: The Contractor shall obtain written certification from the butterfly valve manufacturer, addressed to the Owner, stating that the butterfly valves and the valve operators will efficiently and thoroughly perform the required functions in accordance with these Specifications and as shown, and that the manufacturer accepts joint responsibility with the Contractor for coordination of all butterfly valves and valve operators, including motors, drives, controls, and services required for proper installation and operation of the completely assembled and installed units. The Contractor shall submit all such certificates to the construction manager.
 - 5. Technical Manuals: The Contractor shall furnish technical manuals for the butterfly valves, manual operators, and electric motor valve operators under one cover and in accordance with the requirements of Section 01 33 20 – Submittal Procedures.
 - 6. Valve Labeling: The Contractor shall submit a schedule of butterfly valves to be labeled indicating in each case the valve location and the proposed wording for the label.
 - 7. Field Procedures: Written instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to delivery of the butterfly valves and valve operators.

1.3 QUALITY ASSURANCE

- A. Valves shall be subjected to performance, leakage, and hydrostatic tests in accordance with procedures and acceptance criteria established by AWWA C504.

PART 2 - PRODUCTS

2.1 BUTTERFLY VALVES 4-INCH AND LARGER – CLASS 150B AND 250B

- A. General: The butterfly valve shall be designed expressly for waterworks applications and shall be of the double offset design whereby the elastomeric seal is not compressed with the valve in the open position. Zero, single and API based triple offset butterfly valve designs are not acceptable. Butterfly valves for water working pressures up to 150 psi shall conform to ANSI/AWWA C504 Class 150B. Butterfly valves for water working pressures greater than 150 psi shall conform to the design requirements of ANSI/AWWA C-504, Class 250B. Valves shall be of the size and class indicated in the valve schedule or in the plans. All valves unless noted otherwise, shall be sized for bi-directional water service, full rated pressure and a line velocity of 16 feet per second and suitable for higher linebreak velocities of 50 fps. Lifting lugs will be provided for all valves 24" and larger.
- B. Flanges: Class 150B flanged valves shall have ANSI B16.1 Class 125-pound flanges. Class 250B flanged valves shall comply with ANSI B16.1 Class 250 up through 48-inch unless otherwise noted or if mating to ductile iron pipe. Above 48-inch, flange outside diameter, number of bolts, diameter of bolt circle, and diameter of bolts shall comply with ANSI/AWWA C 207 Class E.
- C. Body: Valve bodies shall be ductile iron, ASTM A536 65-45-12 or A536 60-40-18. Cast gray iron is not allowed due to near zero elongation and as it vulnerable to shear stress. The valve body shall include integrally cast support feet top and bottom. It shall be mechanically equipped with a fastened stainless steel stamped or engraved tag indicating manufacturer and reference build data. Valves 54-inch and larger shall include two tags diametrically opposed. The valve build data shall be made available upon request by the customer and shall be retained by the manufacturer for no less than 20 years unless noted longer. The entire valve body and flanges shall be epoxy corrosion coat protected except for the valve shaft bores.
- D. Disc: The disc shall be ductile iron ASTM A536 65-45-12 or ASTM A536 60-40-18. The entire disc and all its wetted surfaces shall be coated without exception. The disc's elastomeric seal retainer shall be 304 or 316 stainless steel. Neither bronze nor carbon steel is acceptable. Both the disc and elastomeric seal retainer shall have recesses designed to retain a dual shouldered seal under extreme localized velocities, at full differential opening and/or linebreak closing. The disc shall be mechanically fastened to the valve shaft by using Polygon "no fail" connection or equivalent stainless steel key connection or the disc shall be mechanically fastened to the valve shaft using tangential stainless steel shaft pins of type 316 or higher alloy. Disc pins shall extend completely through the valve and shall be mechanically fastened. The disc shall be completely coated except for the disc shaft bores.
- E. Shaft: Valve shafts shall be dual stub shafts of stainless steel ASTM A240 or A276, Type 316, 304, 431 or 420. The valve shaft material and thickness shall be suitable for the applications pressure and velocity without the use of its safety factors. Shafts may not be turned down to fit drive splines without accompanying torsional strength reduction calculations and its effect on the safety factor.
- F. Elastomeric Seal and Seal Ring: Valve seals shall be EPDM, secured to a completely coated valve disc by a 316 stainless steel, continuous non-segmented seal ring and secured by 316 stainless steel fasteners. The seal shall not scallop, cold flow or tear at localized velocities less than 300 fps. The elastomeric seal shall not be penetrated by fasteners. The valve shall

be bi-directionally leak free. The elastomeric seal shall be double shouldered and extend no greater than 0.25 inches past the disc edge to seat the valve. The seal shall be designed to flex in either flow direction. The elastomeric seal shall be field replaceable and adjustable in line. It shall not require special skills or tools to replace the seat. Seat methods which do not comply or use either irreplaceable vulcanized seals or which use hardened epoxy or grout in a dovetailed groove are not acceptable.

- G. **Metallic Seat:** The metallic valve seat shall be located in the valve body. It shall be a highly wear resistant stainless steel alloy. There shall be no gap between the valve body and metallic body seat and consequently no potential for corrosion or lifting of the seat. The seat shall be applied through a high alloy weld overlay process or other manufacturing technique. Metallic seats shall not be mechanically retained by fasteners.
- H. **Shaft Seals:** Shaft seals shall not need periodic manual adjustment. They shall be multi-O-ring seals protecting both the OD and ID of the shaft bearings. They shall prevent pressurized system water from entering the uncoated valve disc hub and valve body shaft bore. The valve shaft shall remain non-wetted and unpressurized. The non-wetted shaft shall allow the actuator to be removed without dewatering the pipeline. It shall prevent debris and system pressurized water from entering into the uncoated valve body shaft bore. It shall prevent waters or contaminated media, external to the valve, from entering through the valve shaft under vacuum/ negative pressure conditions in the pipeline, or hydrostatic pressure conditions external to the valve. Neither manual pulldown packing glands nor braided packing are allowed. The outer shaft seals shall be a replaceable cartridge type, bolted to the valve body. Packing shall not be held in place with an adapter plate or by the valve actuator.
- I. **Shaft Bearings:** Valve shaft bearings shall be corrosion resistant, self-lubricating sleeve type made of bronze, stainless steel or stainless steel backed PTFE. Bearing choice and consequent bearing friction shall be correctly added to valve input torque requirements.
- J. **Strength:** The proportion and dimensions of all parts of the valve and actuator shall be designed to withstand, without failure, the stresses occurring under the testing and operating conditions. The maximum allowable stress in any material shall not exceed 1/5 of the ultimate tensile strength or 1/3 of the minimum yield strength. Class 150B valves shall be rated to 150 psi and Class 250B valves shall be rated to 250 psi applied to one side of the disc with zero pressure applied to the other side of the disc while in the closed position, without damage or permanent deformation to any part of the valve, seat, disc or shaft. The valve shall be capable of withstanding such pressures in both directions.
- K. **Safety Disc Pinning:** Where noted herein, where noted on the plans or in the bid documents, an integrated safety locking device shall be incorporated. The valve shall have an externally lockable disc in the closed position. Calculations shall be provided to verify that the disc cannot rotate even with the full stall output torque of the actuator. The disc shall remain in the zero leak sealed closed position even if the entire actuator is removed for safety or maintenance. With the actuator and or the adapter plate removed, the valve will not leak through the stem. The locking device shall be handwheel operated; stainless steel wetted construction, pad lockable and suitable for lockout/tag out safety procedures.
- L. **Manual Actuators:** Actuators shall conform to Section 40 05 57 – Valve and Gate Actuators and to ANSI/AWWA C 540, subject to the following requirements. All actuators shall be self-locking and shall hold the valve disc in the closed, open and any intermediate position without creeping or fluttering. All actuators shall incorporate a mechanical stop-limiting device to prevent over travel of the disc. Unless direct buried or otherwise indicated, all manually actuated butterfly valves shall be equipped with a handwheel and external position indicator.

The number of turns for direct buried valves shall be a minimum of 1.4 times the nominal valve size with no fewer than 25 turns. The valve manufacturer shall be responsible for mounting and testing the actuator. Screw-type (traveling nut) actuators are not permitted due to their inconsistent output torques through the 90 degree stroke. All manual direct buried service actuators shall be designed for a 300 foot-pound input torque against the closed and open travel stops. The owner reserves the right to field verify.

- M. Worm-Gear Actuators: All valves including submerged and buried valves, shall be equipped with top tier AWWA worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the housing. Buried service valves shall be 90% or greater, grease packed. Submerged service valves in potable water applications shall be 100% grease filled with FDA approved food grade grease. Documentation for the selected grease for submerged service valves shall accompany submittals. The owner reserves the right to field verify grease levels. Non-complying gears shall be remedied by the factory, verified by the customer and signed off by both parties. Gears are recommended to be Auma and are required to be of an equal or better quality. No name or unbranded actuators will not be accepted.
- N. Hardware: All fasteners and hardware in non-wetted areas shall be type 316 Stainless Steel.
- O. Coatings and Linings: The manufacturer is required to have and follow a system of valve preparation and coating which assures a quality, holiday free application and which maximizes the available multi-decade protection the coating offers. Submit holiday test prior to shipment. Products for linings to be NSF 61 certified.

The manufacturer must provide their written system of valve preparation and coating. This document shall include the methodologies used (quality compliance, QC) as well as post application review (quality assurance, QA).

- 1. Valves 48-inch and smaller: All external and internal surfaces except for the seating surface shall be 400 degree F plus, heat bonded fusion coated. Coating damaged in shipping or installation shall be noted and properly repaired to the satisfaction of the utility or its authorized agent.
 - 2. Valves 54-inch and larger shall be epoxy lined and coated in accordance with System No. 1. per Specification Section 09 90 00 Protective Coatings and Linings. Coating damaged in shipping or installation shall be noted and properly repaired to the satisfaction of the utility or its authorized agent.
- P. Manufacturers, No Equal
 - 1. VAG Armaturen, EKN Double Offset
 - 2. Av-Tek, DEX Double Offset

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator. Installation shall be in accordance with Section 40 05 51 – Valves, General.
- B. Contractor shall use the provided lifting lugs to move all project valve(s). The use of chains, lifting straps, rope or any type other strapping through the valve body is strictly prohibited.

Correct lifting procedures shall be the Contractor's responsibility. As necessary, consultation with the valve manufacturer is recommended. The contractor shall be responsible for all damage and project delays resulting from improper lifting and moving procedures, these shall include but shall not be limited to pulling the valve body out of round, gouges, scratches, displacing the gear box, etc.

- C. Butterfly valves 36-inch and larger must be inspected and certified by the manufacturer that the final installation meets all the manufacturers requirements, and that the actuator and disc have not changed positions from that as successfully tested at the factory.
- D. Strict care shall be taken to ensure valves are not installed under stress. In no instance shall adjacent mating flanges be forced into position. A progressive and proper star cross pattern shall be used to tighten valve flange mating bolts

END OF SECTION

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**SECTION 40 05 64.10.10
BUTTERFLY VALVES**

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall provide butterfly valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. Butterfly valves in this Section (40 05 54.10) apply only to valves for Irrigation Service. Butterfly valves for potable water service are to be double offset type per Section 40 05 64 – Butterfly Valves (Double Offset).
- C. The requirements of Section 40 05 51 - Valves, General apply to this Section.
- D. The requirements of Section 40 05 52 - Valve and Gate Actuators apply to this Section.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 40 05 51 – Valves, General.
- B. Shop Drawings
 - 1. Complete Shop Drawings of butterfly valves and actuators.
 - 2. Drawings showing valve port diameter complete with dimensions, part numbers, and materials of construction.
 - 3. Certification of proof-of-design test from the valve manufacturer.
 - 4. Certification: The Contractor shall obtain written certification from the butterfly valve manufacturer, addressed to the Owner, stating that the butterfly valves and the valve operators will efficiently and thoroughly perform the required functions in accordance with these Specifications and as shown, and that the manufacturer accepts joint responsibility with the Contractor for coordination of all butterfly valves and valve operators, including motors, drives, controls, and services required for proper installation and operation of the completely assembled and installed units. The Contractor shall submit all such certificates to the construction manager.
 - 5. Technical Manuals: The Contractor shall furnish technical manuals for the butterfly valves, manual operators, and electric motor valve operators under one cover and in accordance with the requirements of Section 01 33 20 – Submittal Procedures.
 - 6. Valve Labeling: The Contractor shall submit a schedule of butterfly valves to be labeled indicating in each case the valve location and the proposed wording for the label.
 - 7. Field Procedures: Written instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to delivery of the butterfly valves and valve operators.

1.3 QUALITY ASSURANCE

- A. Valves shall be subjected to performance, leakage, and hydrostatic tests in accordance with procedures and acceptance criteria established by AWWA C504.

PART 2 - PRODUCTS

2.1 RUBBER SEATED BUTTERFLY VALVES (AWWA)

- A. General: Butterfly valves for water working pressures up to 250 psi shall conform to ANSI/AWWA C504 - Rubber Seated Butterfly Valves, subject to the following requirements. Valves shall be of the size and class indicated. Flanged valves shall have Class 150 or Class 250 flanges conforming to ANSI B16-1.
- B. Manual Actuators: Actuators shall conform to Section 40 05 52 - Valve and Gate Actuators and to ANSI/AWWA C540 - Power Actuating Devices for Valves and Sluice Gates, subject to the following requirements. Unless otherwise indicated, all manually-actuated butterfly valves shall be equipped with a handwheel and 2-inch square actuating nut and position indicator. Screw-type (traveling nut) actuators will not be permitted for valves 30 inches in diameter and larger.
- C. Worm Gear Actuators: Valves, 30 inches and larger, as well as all submerged and buried valves, shall be equipped with worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the housing.
- D. Manufacturers, or Equal
 1. De Zurik Corporation.
 2. Kennedy Valve.
 3. Mueller

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator. Installation shall be in accordance with Section 40 05 51 – Valves, General.

END OF SECTION

**SECTION 40 73 13
PRESSURE GAUGES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Instruments for instrumentation and control systems that are to be permanently installed.

B. Related Sections:

1. Contract Documents are a single integrated document, and as such all Divisions and Sections apply. It is the responsibility of the Contractor and its Sub-Contractors to review all sections to insure a complete and coordinated project.

1.2 REFERENCES

- A. All instruments shall comply with the latest edition and standards of the Instrumentation Systems and Automation Society..

1.3 DEFINITIONS

A. Definitions of terms and other electrical considerations as set forth in the:

1. NEC: National Electrical Code.
2. IEEE: Institute of Electrical and Electronic Engineers.
3. ISA: Instrumentation Systems and Automation Society.
4. NFPA: National Fire Protection Association.

1.4 SYSTEM DESCRIPTION

- A. Furnish all instruments as identified on the P&IDs, instrument lists, and instrument data sheets.
- B. Install and connect all instruments as per the manufacturer's recommendations for the particular installation.
- C. Calibration of instruments will be performed by the Instrumentation and Control Systems Contractor (ICSC).

1.5 SUBMITTALS

- A. Furnish complete submittals in accordance with Sections 01 33 20.

B. Product Data:

1. Complete manufacturer's brochures identify instrument construction, accuracy, ranges, materials, and options.
2. Completed instrument data sheets including catalog number and source for determining catalog number.
3. Manufacturer's installation instructions.

- C. Shop Drawings:
 - 1. Mechanical connection diagrams.
 - 2. Sensor mounting requirements with dimensions and elevations.
 - 3. Electrical connection diagrams.
- D. Test Reports:
 - 1. Certified factory and field calibration data sheets for instruments and devices that require set-up and calibration.
 - a. Including factory calibration for each instrument with stated accuracy.
- E. Operating Manuals:
 - 1. Certified factory and field calibration data sheets for instruments and devices that require set-up and calibration.
 - a. Including factory calibration for each instrument with stated accuracy.
 - 2. Complete installation, calibration, and testing manuals.
- F. Record Drawings:
 - 1. Complete field calibration sheets, including range, span.

1.6 QUALITY ASSURANCE

- A. All instruments of similar nature must be furnished by the same manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store all instruments in a dedicated storage structure with space conditioning to meet the recommended storage requirements provided by the manufacturer.
 - 1. Any instruments that are not stored in strict conformance with the manufacturer's recommendation shall be replaced at no additional costs to the Owner.

1.8 PROJECT/SITE CONDITIONS

- A. All instruments must be compatible for the installed site conditions including but not limited to material compatibility, site altitude, installed temperature and humidity conditions.

1.9 WARRANTY

- A. Furnish manufacturer's standard warranty, modified to agree with the Contract Documents.

1.10 MAINTENANCE

- A. Provide all necessary materials, fluids, etc. for calibration purposes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Ashcroft 1279 w/ Performance Plus.
- B. NoShok 600/700 Series.

C. Dwyer Series 765 or Series 7000B.

D. Wika USA XSEL Series.

E. Or, Engineer Approved Equals.

2.2 MANUFACTURED UNITS

A. Pressure, Vacuum, Compound Gauges.

1. General.

- a. Furnish and install pressure and vacuum gauges as specified, complete, including all fittings, snubbers, connections, gaskets, supports, and accessories in the locations shown or specified, in accordance with the Contract Documents.
- b. Pressure gauges shall be provided whether or not shown on the plans:
 - 1) On suction and discharge connection to all pumps.
 - 2) On discharge connection from blowers and compressors.
 - 3) On each side of pressure reducing valves.
 - 4) In other locations as shown on the P&IDs and/or mechanical plans.
- c. Vacuum gauges shall be provided whether or not shown on the plans:
 - 1) On all supply side educator-type chemical feeders.
 - 2) In other locations as shown on the P&IDs and/or mechanical plans.
- d. Sleeve pressure gauges.
 - 1) Shall be provided where shown on the plans.
 - 2) Pressure shall be sensed by a flexible sleeve contained in a flanged cast iron or steel spool or wafer body, and transmitted to the gauge through a captive fluid.
 - 3) Sleeve shall be of BUNA-A and fabricated so as to isolate the body from the process liquid.
 - 4) Gauges shall be calibrated to read in applicable units.
 - 5) Accuracy of $\pm 1\%$ - 150% of the working pressure of the system to which they are connected

2. Construction:

- a. Gauges shall be industrial quality type with Type 316 stainless steel movement.
- b. Phenolic case.
- c. Liquid filled.
- d. Unless otherwise shown or specified, gauges shall have:
 - 1) A 4-1/2-inch dial.
 - 2) 1/2-inch threaded connection.
 - 3) Type pulsation dampener adapter.
 - a) Pulsation Dampener as manufactured by:
 - b) Cajon Co.
 - c) Weksler Instruments, Corp.
 - d) Ashcroft.
 - e) Or, Engineered Approved Equal.
 - 4) A block and bleed valve - 1/2 inch national pipe thread process connection and bleed/calibrate valve between block valve and outlet port.
- e. Gages shall be calibrated to read in applicable engineering units.

- f. Accuracy of $\pm 0.5\%$ - 150 % of the working pressure or vacuum of the pipe or vessel to which they are connected.
- g. All gauges shall be vibration and shock resistant.
- 3. Diaphragm seals:
 - a. Gauges attached to system involving chemical solutions, corrosive fluids, sludge, sewage, or other liquids containing solids shall be equipped with diaphragm seals.
 - b. In addition diaphragm seals shall be provided and included at the locations shown.
 - c. Seals shall have clamped housings.
 - d. All seals shall have 1/2 inch NPT flushing connection and fluid fill connection.
 - e. Diaphragm Seals as manufactured by:
 - 1) Ashcroft Type 101.
 - 2) Ametek Type S Series.
 - 3) NoShok Type 10/10H.
 - 4) Or, Engineer Approved Equal.
- 4. Gauges general as manufactured by:
 - a. Ashcroft Type 1279 w/ Plus Performance.
 - b. Dwyer Series 7000B.
 - c. Wika XSEL Model 212.34 (213.34 as required).
 - d. Ametek Model 1929.
 - e. NoShok 700 Series.
 - f. Or, Engineer Approved Equal.
- 5. Gauges sleeve pressure as manufactured by:
 - a. Red Valve Co., Inc.
 - b. Onyx.
 - c. NoShok Type 40.
 - d. Or, Engineer Approved Equal.
- 6. Snubbers as manufactured by:
 - a. Ashcroft, Model 311.
 - b. Dwyer, Series PS.
 - c. NoShok, Model 5025/5050
 - d. Or, Engineer Approved Equal.
- 7. Pulsation dampeners as manufactured by:
 - a. Cajon Co.
 - b. Weksler Instruments, Corp.
 - c. Ashcroft.
 - d. Or, Engineer Approved Equal.

2.3 ACCESSORIES

- A. Gauges shall be liquid filled or have some equivalent anti-vibration/-bounce technology.

2.4 SOURCE QUALITY CONTROL

- A. All instruments and/or representative instruments shall be calibrated to in facilities and with instruments traceable to the National Bureau of Standards.
 - 1. Provide complete documentation covering the traceability of all calibration instruments.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the complete set of plans, the process fluids, pressures, and temperatures and furnish instruments that are compatible with installed process condition.

3.2 PREPARATION

- A. Coordinate the installation with all trades to insure that the mechanical system has all necessary appurtenances. Weld-o-lets, valves, orientation, etc. for proper installation of the instruments.

3.3 INSTALLATION

- A. All instruments shall be installed in strict conformance with the manufacture's recommendations.
 - 1. It is the Contractor's responsibility to install all instruments in conformance with manufacturer's recommendations.
 - 2. It is the Contractor's responsibility to notify the Engineer of any installation conditions that may be shown at variance with the manufacturer's recommendations
 - 3. Install two 2-valve instrument manifolds for each gauge pressure transmitter.
 - 4. Bolt 3-valve manifolds at non-flange diaphragm type differential pressure transmitters in place of standard flange adapters.
 - 5. Install root valves at process taps except insertion elements.
 - 6. Install gauge valves on process connections to instruments where multiple instruments are connected to one tap or where root valves are not readily accessible.
 - 7. All gauges shall be installed with the face in the vertical position.
 - 8. In strict accordance with the manufacturers printed instructions.
 - 9. At the locations shown on the drawings, when so shown.
 - 10. Care shall be taken to minimize the effect of water hammer or vibrations on the gauges.
 - 11. In extreme cases, and with the approval of the Engineer, gauges may be mounted independently, with flexible connectors.

3.4 FIELD QUALITY CONTROL

- A. The ICSC shall perform Calibration and Loop Validation Testing.

3.5 ADJUSTING

- A. All instruments shall be field verified.

3.6 DEMONSTRATION

- A. Performance of all instruments shall be demonstrated to the Engineer prior to commissioning.

3.7 PROTECTION

- A. All instruments shall be fully protected after installation and before commissioning. The Contractor shall replace any instruments damaged prior to commissioning.
 - 1. The Engineer shall be the sole party responsible for determining the corrective measures.

3.8 SCHEDULES

- A. The following instrument data sheets are included as a guideline for the supply of the instruments. These sheets are not complete and the instrument selection shall be the Contractor's responsibility. Changes may be made to the instrument materials, ranges, etc. as part of the submittal review. The Contractor shall provide documented evidence for a differential plus or minus that results from these changes.
- B. The Contractor shall supply complete instrument data sheets for each and every instrument and submit this information in accordance with Paragraph 1.5 of this section.
 - 1. Instrument data sheets shall be furnished in both hard copy and electronic format.

END OF SECTION

SECTION 40 73 26
PRESSURE-TRANSMITTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Instruments for instrumentation and control systems that are to be permanently installed.

B. Related Sections

1. Contract Documents are a single integrated document, and as such all Divisions and Sections apply. It is the responsibility of the Contractor and its Sub-Contractors to review all sections to insure a complete and coordinated project.

1.2 REFERENCES

- A. All instruments shall comply with the latest edition and standards of the Instrumentation Systems and Automation Society.

1.3 DEFINITIONS

A. Definitions of terms and other electrical considerations as set forth in the:

1. NEC: National Electrical Code.
2. IEEE: Institute of Electrical and Electronic Engineers.
3. ISA: Instrumentation Systems and Automation Society.
4. NFPA: National Fire Protection Association.

1.4 SYSTEM DESCRIPTION

- A. Furnish all instruments as identified on the P&IDs, instrument lists, and instrument data sheets.

- B. Install and connect all instruments as per the manufacturer's recommendations for the particular installation.

- C. Calibration of instruments will be performed by the Instrumentation and Control Systems Contractor (ICSC).

1.5 SUBMITTALS

- A. Furnish complete submittals in accordance with Sections 01 33 20.

B. Product Data:

1. Complete manufacturer's brochures identify instrument construction, accuracy, ranges, materials, and options.
2. Completed instrument data sheets including catalog number and source for determining catalog number.
3. Manufacturer's installation instructions.

- C. Shop Drawings:
 1. Mechanical connection diagrams.
 2. Sensor transducer mounting requirements with dimensions and elevations.
 3. Electrical connection diagrams.
- D. Test Reports:
 1. Certified factory and field calibration data sheets for instruments and devices that require set-up and calibration.
 - a. Including factory calibration for each instrument with stated accuracy.
- E. Operating Manuals:
 1. Certified factory and field calibration data sheets for instruments and devices that require set-up and calibration.
 - a. Including factory calibration for each instrument with stated accuracy.
 2. Complete installation, calibration, and testing manuals.
- F. Record Drawings:
 1. Complete field calibration sheets, including range, span, PLC/PAC I/O address, register, and scaling coefficients.

1.6 QUALITY ASSURANCE

- A. All instruments of similar nature must be furnished by the same manufacturer.
- B. Manufacturer's representative shall be responsible for proving transmitter operation and 4-20 ma loop accuracy.
- C. Instruments shall be manufactured at facilities certified to the quality standards of ISO Standard 9001 - Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store all instruments in a dedicated van or structure with space conditioning to meet the recommended storage requirements provided by the manufacturer.
 1. Any instruments that are not stored in strict conformance with the manufacturer's recommendation shall be replaced at no additional costs to the Owner.

1.8 PROJECT/SITE CONDITIONS

- A. All instruments must be compatible for the installed site conditions including but not limited to material compatibility, site altitude, installed temperature and humidity conditions.

1.9 WARRANTY

- A. Furnish manufacturer's standard warranty, modified to agree with the Contract Documents.

1.10 MAINTENANCE

- A. Provide all necessary materials, fluids, etc. for calibration purposes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. As identified on the instrument list.
- B. Hardware Commonality:
 - 1. All instruments, which utilize a common measurement principle, for example, d/p cells, pressure transmitters, level transmitters that monitor hydrostatic head, shall be furnished by a single Manufacturer.
 - 2. All panel-mounted instruments shall have matching style and general appearance.
 - 3. Instruments performing similar functions shall be of the same type, model, or class, and shall be from a single Manufacturer.

2.2 EQUIPMENT

- A. Pressure Transmitters Direct
 - 1. General
 - a. Pressure transmitters shall be 2-wire devices.
 - b. Continuously adjustable span, zero and damping adjustments.
 - c. Integral LCD meter scaled in engineering units.
 - d. Solid state circuitry.
 - e. Accuracy shall be $\pm 0.20\%$ of span.
 - f. Process wetted materials as identified on Instrument Data Sheets.
 - g. Body material as identified on Instrument Data Sheets.
 - h. Process connections shall be 1/2-inch NPT.
 - i. Diaphragm seals shall be provided and included at the locations shown.
 - j. Rangeability: 20:1.
 - k. Integral transient protection.
 - l. Factory calibrated for span and range.
 - 2. Ranges:
 - a. As noted on the Instrument Data Sheets
 - 3. As manufactured by:
 - a. Rosemount Model 3051.
 - b. Endress+Hauser Cerabar Series.
 - c. Kobold PAS Heavy-Duty Series.
 - d. Foxboro IGP/IAP Series.
 - e. Azbil AT9000 Series.
 - f. Or, Engineer Approved Equals.
- B. Pressure Transmitters - Differential
 - 1. General
 - a. Continuously adjustable span, zero and damping adjustments.
 - b. Integral LCD meter scaled in engineering units.
 - c. Solid state circuitry.
 - d. Accuracy shall be ± 0.20 percent of span.
 - e. Process wetted materials as identified on Instrument Data Sheets.
 - f. Body material as identified on Instrument Data Sheets.
 - g. Process connections shall be 1/2-inch NPT.
 - h. Diaphragm seals shall be provided and included at the locations shown.

- i. Rangeability: 20:1.
 - j. Integral transient protection.
 - k. Factory calibrated for span and range.
- 2. Ranges:
 - a. As noted on the Instrument Data Sheets
- 3. As manufactured by:
 - a. Rosemount Model 3051.
 - b. Endress+Hauser Deltabar Series.
 - c. Kobold PAD Heavy-Duty Series.
 - d. Foxboro IDP Series.
 - e. Azbil AT9000 Series.
 - f. Or, Engineer Approved Equals.

2.3 SOURCE QUALITY CONTROL

- A. All instruments and/or representative instruments shall be calibrated to in facilities and with instruments traceable to the National Bureau of Standards.
 - 1. Provide complete documentation covering the traceability of all calibration instruments.
 - 2. Provide 3 copies of calibration curve – One with the instrument, one to the engineer and a third copy in the O&M located with its corresponding ISA data sheet. Calibration curve shall be matched by instrument tag.
- B. Manufacturer’s representative shall be responsible for proving flow meter operation and 4-20 mA loop accuracy.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the complete set of plans, the process fluids, pressures, and temperatures and furnish instruments that are compatible with installed process condition.

3.2 PREPARATION

- A. Coordinate the installation with all trades to insure that the mechanical system has all necessary appurtenances, weld-o-lets, valves, upstream diameters, downstream diameters, etc. for proper installation of the instruments.

3.3 INSTALLATION

- A. All instruments shall be installed in strict conformance with the manufacture’s recommendations.
 - 1. It is the Contractor’s responsibility to install all instruments in conformance with manufacturer’s recommendations.
 - 2. It is the Contractor’s responsibility to notify the Engineer of any installation conditions that may be shown at variance with the manufacturer’s recommendations

3.4 FIELD QUALITY CONTROL

- A. The ICSC shall calibrate all instruments in the field during the Calibration and Loop Validation Tests as identified in Section 40 61 00.

3.5 ADJUSTING

- A. All instruments shall be field calibrated to match the installed conditions.

3.6 CLEANING

- A. All instrument enclosures shall be vacuumed clean after calibration and before commissioning.

3.7 DEMONSTRATION

- A. Performance of all instruments shall be demonstrated to the Engineer prior to commissioning.
- B. All instrument calibration shall be witnessed by the Owner's Representative.
- C. Each and every instrument shall be tested during the Loop Validation Tests and the Owner's Representative shall witness the response in the PLC/PAC control system and associated registers.

3.8 PROTECTION

- A. All instruments shall be fully protected after installation and before commissioning. The Contractor shall replace any instruments damaged prior to commissioning.
 - 1. The Engineer shall be the sole party responsible for determining the corrective measures.

3.9 SCHEDULES

- A. The following instrument data sheets are included as a guideline for the supply of the instruments. These sheets are not complete and the instrument selection shall be the Contractor's responsibility. Changes may be made to the instrument materials, ranges, etc. as part of the submittal review. The Contractor shall provide documented evidence for a differential plus or minus that results from these changes.
- B. The Contractor shall supply complete instrument data sheets for each and every instrument and submit this information in accordance with paragraph 1.5 of this section.
 - 1. Instrument data sheets shall be furnished in both hard copy and electronic format.

END OF SECTION

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**SECTION 40 75 99
INSTRUMENT LIST**

PART 1 - GENERAL

1.1 INSTRUMENT LIST

A. Instrument list is shown on the following page.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

Instrument List (11400 South, 12600 South, 13400 South Vaults)			
Tag	Location - Vault	Device	Description
126-SW-CL	12600 South*	Chlorine Residual Analyzer	Analytical Technologies Inc. or Engineer Approved Equal: Probe Cl2 sensor assembly ATI-0294, free Cl2 membranes 05-0005, Cl2 electrolyte 09-0011, flow cell ATI-0196, and residual Chlorine monitor Q45H-62 for free Chlorine. Refer to Drawings E-04 and E-05 for 12600 South and E-06 and E-07 for 13400 South.
134-SW-CL	13400 South		
134-JA-CL			
126-SW-PH	12600 South*	pH and Temperature Analyzer	Stratos MS Memosens Digital Transmitter for pH and Temperature or Engineer Approved Equal: 120 VAC Power Input, Two outputs 4 to 20 mA, one for pH and one for temperature, Item #A405N. SE 555 Memosens Digital Glass Combination pH/Temperature Sensor Item #SE 555X/1-NMSN. Cable Item #CA/MS-005NAA. Universal mount kit, "Stratos Mount Kit". CSS Static Immersion Holder, Item #CSS 120-P-N00-1-1. Refer to Drawings E-04 and E-05 for 12600 South and E-06 and E-07 for 13400 South.
134-SW-PH	13400 South		
134-JA-PH			
134-SW-TB	13400 South	Turbidity Analyzer	Hach online Laser Turbidimeter P/N TU5300 sc with an Auto Cleaning Head Option or Engineer Approved Equal: 120 VAC power input. Analyzer shall have a Hach SC200 interface box and a flowmeter option. Device shall have two outputs 4 to 20 mA, one for turbidity and one for flow. Refer to Drawings E-06 and E-07.
134-JA-TB			
126-SW-PG	12600 South*	Pressure Gauge	Ashcroft 1279 with Performance Plus, or Engineer Approved Equal. Refer to Specification 40 73 13.
126-JA-PG			
134-SW-PG	13400 South		
134-JA-PG			
114S-PI-01	11400 South		
114S-PI-02			
114S-PIT-01	11400 South	Pressure Indicating Transmitter	Model Rosemount Model 3051, or as shown in specification. Refer to Specification 40 73 26.
114S-ZS-01	11400 South	Hatch Intrusion Switch	Model Schneider Electric class 9007 or engineer-approved equal.
114S-ZS-02	11400 South		
114S-LSH-01	11400 South	Flood Switch	Model GEMS sensor level switch LS-270 series P/N 43765.

* In addition to new instrumentation at 12600 South, existing JA-2 instrumentation is being relocated, See Drawings M-05 and M-07.

END OF SECTION

APPENDIX A

**GEOTECHNICAL INVESTIGATION – JWCD
SOUTHWEST AQUEDUCT REACH 2, RB&G
ENGINEERING, INC., JUNE 2024**

GEOTECHNICAL INVESTIGATION

JVWCD SOUTHWEST AQUEDUCT REACH 2

Salt Lake County, Utah

*Prepared for:
Bowen Collins & Associates*

June 2024

RB&G
ENGINEERING, INC.

June 4, 2024

Bowen Collins & Associates
Attn: Jason Leuttinger, P.E.
154 East 14075 South
Draper, UT 84020

Re: Geotechnical Investigation – JWCD Southwest Aqueduct Reach 2

Dear Mr. Leuttinger:

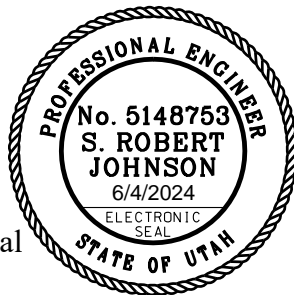
A Geotechnical Investigation has been completed for the Jordan Valley Water Conservancy District Southwest Aqueduct Reach 2 project in Salt Lake County, Utah. The results of this study are summarized in the report transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.

S. Robert Johnson, P.E., Principal



GEOTECHNICAL INVESTIGATION

JVWCD Southwest Aqueduct Reach 2

Salt Lake County, Utah

*Prepared for:
Bowen Collins & Associates*

June 2024

RB&G ENGINEERING, INC.

JVWCD SOUTHWEST AQUEDUCT REACH 2

Salt Lake County, Utah

Geotechnical Investigation

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UNCONFINED COMPRESSION TESTS

JVWCD SOUTHWEST AQUEDUCT REACH 2

Salt Lake County, Utah

Geotechnical Investigation

1 INTRODUCTION

This report outlines the findings of a geotechnical investigation performed for the proposed Jordan Valley Water Conservancy District (JVWCD) project, located primarily in the city of Riverton, Salt Lake County, Utah. RB&G Engineering is serving as a geotechnical consultant to Bowen Collins & Associates, who has been retained by JVWCD for design of the project.

Figure 1 is a Vicinity Map showing the approximate location of the project relative to the surrounding area. The primary purpose of this investigation was to evaluate the characteristics of the subsurface soils throughout the alignment to provide geotechnical information for pipeline design.

1.1 PROJECT DESCRIPTION

The project will include the installation of approximately 10,500 feet of 66-inch diameter welded steel pipeline within existing JVWCD easements along 3200 West Street between approximately 13400 South and 11800 South Streets. The project location and vicinity are shown on Figure 1. Figures 2a through 2f show the approximate locations of borings completed for the project.

2 GEOLOGICAL AND EXISTING CONDITIONS

2.1 REGIONAL GEOLOGY

The Wasatch Front consists of a series of down dropped valleys which extend from Utah Valley to the south through the Salt Lake Valley, Davis, Ogden and Weber Counties to the north. The Salt Lake Valley is a large sediment filled basin bounded by the Traverse Mountains to the north, the Oquirrh Mountains to the west, and the abruptly climbing Wasatch Mountains to the east. The valley is the result of Basin and Range extensional faulting associated with the Salt Lake City segment of the Wasatch Fault Zone, which trends predominately north-south near the base of the

Wasatch Mountains. The Wasatch Fault is classified as a normal, down to the west, fault. The valley floor contains thousands of feet of alluvium and lacustrine (lake-bottom) soil deposits.

During the Pleistocene (23,000 to 11,000 years ago), the climate became much colder and wetter compared to recent historical conditions. Glaciation was common at high altitudes, while lower altitudes experienced more rain. During this time, Lake Bonneville (the largest of the Pleistocene lakes) began spreading over much of northern and central Utah and extended into several valleys of southeastern Idaho. The lake experienced several cycles of regression and transgression during a 3,500-year period before reaching an elevation of about 5,090 feet (msl) and breaching into the Snake River Plain near Zenda, Idaho (Bonneville Phase). The lake stabilized at the Red Rock Pass threshold at an elevation of approximately 4,740 feet (Provo Phase) about 14,500 years ago. During Lake Bonneville times, thousands of feet of clay, silt, sand and gravel were deposited within the valleys along the Wasatch Front. Changes to a drier and warmer climate eventually resulted in the overall regression of the lake to the modern-day levels of the Great Salt Lake and Utah Lake.¹

2.2 GEOLOGY OF PROJECT AREA

A geologic map of the project area is shown on Figure 3.² It will be noted from Figure 3 that the surficial soils throughout the entirety of the project area have been mapped as fine-grained lacustrine deposits (Qlf). This map unit is described as consisting primarily of soils such as laminated silt, clayey silt, and sandy silt with isolated pebbles, cobbles, and thin lenses of sand and gravel. The exposed thickness of these surface deposits identified by geologic studies is in the range of 1 to 40 feet.

2.3 GEOLOGIC HAZARDS

Based upon geologic mapping of the project area, the water pipeline alignment does not cross known faults. The project alignment is located about 6.6 miles to the west of the mapped surface expression of the Wasatch fault zone (WFZ). The West Valley fault zone is located about 8 miles north of the project. The Oquirrh fault zone is about 12 miles to the west of the project area. Geologic hazards applicable to the project include ground shaking, subsidence, and liquefaction during a seismic event on the Wasatch fault zone or other fault systems in the vicinity. Seismic hazards are discussed in further detail in the next section of this report.

¹ *Major Levels of Great Salt Lake and Lake Bonneville*, Utah Geological Survey Map 73, by D.R. Currey, G. Atwood, and D.R. Mabey, April 1984.

² *Geologic Map of the Midvale Quadrangle, Salt Lake County, Utah*, Utah Geological Survey Map 177, by F.D. Davis, 2000.

2.4 FAULTING AND SEISMICITY

Ground shaking, subsidence, and liquefaction are among potential seismic hazards that apply to the project area and much of the Salt Lake Valley. The potential for the project to be affected by surface rupture associated with a mapped fault is low.

The WFZ is characterized as an active normal fault with down to the west displacement. The Salt Lake Section section of the WFZ can generate earthquake magnitudes in the order of 7.2, however, a simultaneous rupture of multiple segments of the WFZ could theoretically produce an earthquake with a magnitude of 7.5.

Earthquake considerations applicable to the project, including site class and mapped ground acceleration values, are discussed in Section 5.3 of this report.

2.5 EXISTING SITE CONDITIONS

The project alignment follows 3200 West Street from south to north. The natural topography of the project area is relatively flat, with an overall ground slope averaging between 1 and 2 percent down to the east. The existing ground surface profile along 3200 West is relatively level south of 12600 South and north of 12100 South, with about 20 feet of fall traveling north over the approximately ½-mile distance between 12600 and 12100 South.

The proposed pipeline would be located beneath the 3200 West asphalt-paved roadway for much of its length, except for an unpaved stretch where 3200 West is interrupted between Thorngrove Circle (approx. 12500 South) and Emery Forest Lane (12330 South). Land use along 3200 West is mostly residential. In general, the pavements in the area are in fair to good condition with evidence of longitudinal, transverse, and localized areas of alligator cracks, many of which have been sealed. There is a section between 13400 South and Coupe Deville Lane / Blue Heeler Way (13220 South) that has newer asphalt with no visible cracks.

Most of the section of the alignment between Thorngrove Circle and Emery Forest Lane is on land owned by the Salt Lake County Water Conservancy District. From Thorngrove Circle to 12600 South the alignment is unpaved and includes a small park landscaped with grass on the south end followed by a gravel strip running along the east side of a car wash, with boulders placed throughout the gravel strip. From 12600 South to just north of Elmwood Drive the alignment is located within the fenced Bureau of Reclamation easement. This easement has an asphalt paved trail running most of its length, with grass on either side of the trail. Between Elmwood Drive and Emery Forest Lane the alignment passes through a residential property that is landscaped with grass and trees.

A trenchless crossing is anticipated where the alignment crosses 12600 South, and where the alignment crosses under an existing JVWCD water line near 12075 South.

3 GEOTECHNICAL EXPLORATION METHODS

3.1 SUBSURFACE EXPLORATIONS

Geotechnical borings were planned for 16 locations along the proposed pipeline alignment to evaluate the subsurface soil and water conditions. Our client subsequently determined that Boring 12 would not be necessary, so this boring number was not used. The boring locations are shown on Figure 2 and logs depicting conditions encountered and interpreted from the borings are included in the appendix. Each of the boring numbers includes the prefix “24-BH” to indicate that the borehole was completed in the year 2024. This prefix is generally omitted from the discussion that follows.

The geotechnical borings for the project were performed using CME 55 rotary drill rigs, with a tri-cone rock bit and NW casing or and HQ casing advancer system used to advance the borings. Water was used as the drilling fluid. During the subsurface exploration, sampling was generally conducted at 3-foot depth intervals in the upper 21 feet and at 5-foot intervals at greater depths. Both disturbed and undisturbed samples were obtained during the field explorations. The boring logs are included in the appendix to this report.

Disturbed samples were obtained by driving a 2-inch or 2.5-inch (O.D.) split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. NWJ drill rods were used during the drilling and sampling. The hammers used for sampling are tested annually as outlined in ASTM D 4633. Based on the most recent of these tests, the ratio of actual energy delivered to the theoretical maximum energy of a 140-pound weight after a 30-inch free fall averages 0.76 for the automatic trip hammer on the 08-CME-55 drill rig and 0.87 for the hammer on the 20-CME-55 drill rig.

The number of hammer blows required to drive the sampling spoon through each 6-inch increment of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows recorded while driving the sampling spoon through 12 inches, is defined as the penetration value, N . Sampler refusal (more than about 50 blows required to drive through a 6-inch interval) was encountered at some depths, in which case the number of blows corresponding to the observed penetration is shown on the boring log.

Penetration values corrected for overburden and hammer energy provide a good indication of the in-place density of sandy soil; however, they only provide an indication of the relative stiffness of cohesive soil, since the penetration resistance of soil of this type is a function of moisture content. Corrections applied to the blow counts recorded in the field to calculate the corrected standard penetration (N_1)₆₀ values shown on the boring logs were as follows:

- Sampler size correction for 2.5-inch OD sampler (where applicable): multiply by 0.938.
- Hammer energy correction from 76% or 87% average measured hammer energy ratio to 60% standard energy ratio: multiply by 1.27 and 1.45, respectively.

- Overburden correction: multiply by $C_N = (P_a / \sigma'_v)^{0.5} \leq 1.7$

where: P_a = atmospheric pressure, approximated as 2,000 psf,

σ'_v = effective vertical stress, calculated using assumed average total soil unit weights of 115 pcf above the water table and 120 pcf below the water table, and hydrostatic pore pressure calculated from the measured or estimated groundwater level.

The Standard Penetration Test (SPT) corrections listed above are basic corrections based on generalized interpretations and assumptions. More refined and/or additional corrections may be appropriate for specific design applications.

Considerable care must be exercised in interpreting the penetration value in gravelly-type soil, particularly where the size of the granular particles exceeds the inside diameter of the sampling spoon. If the spoon can be driven through the full 18 inches with reasonable sample recovery, the penetration value generally provides a good indication of the in-place density of gravelly-type soil.

Relatively undisturbed samples of intact soil were obtained within the borings by pushing thin walled (Shelby) sampling tubes into the subsurface soil using the hydraulic pressure on the drill rig. The tubes had nominal outside diameters of 2.75 inches and nominal wall thickness of 0.06 inch. The depths at which Shelby tube samples were obtained are identified on the boring logs.

Miniature vane shear tests, which provide an indication of the undrained shearing strength of cohesive soil, were performed during the field explorations. The results of these tests are shown on the boring logs as “torvane” values in units of tons per square foot.

Soil samples were classified visually in the field and reviewed in the laboratory according to the Unified Soil Classification System. A description of the Unified Soil Classification System is included in the appendix, and the symbols designating soil types according to this system are presented on the boring logs.

Piezometers for groundwater monitoring were installed to a depth of 30 feet in Borings 7, 8, 15, and 16. The piezometers consist of one-inch diameter PVC pipes, with a 10-ft slotted section (0.02-inch slot widths) between depths of 20 and 30 feet. The annular space around the slotted section of pipe was filled with 10/20 silica sand, and bentonite hole plug chips were used to fill the annulus above and below the sand filter zone. A riser-type cover was installed over the piezometer at Boring 7. Flush-mount covers were installed over the other three piezometers, which were located in areas of existing pavement. A slotted PVC pipe was also placed temporarily in Boring 9 after drilling to allow short-term monitoring of groundwater levels.

3.2 LABORATORY TESTING

Laboratory tests performed during this investigation to define the characteristics of the subsurface soils included in-place dry unit weight (ASTM D 7263), natural moisture content (ASTM D 2216),

Atterberg limits (ASTM D 4318), grain size analysis (ASTM C 117, C 136), unconfined compressive strength (ASTM D 2166), direct shear (ASTM D 3080) and one-dimensional consolidation (ASTM D 2435). Electrochemical testing, including soil pH, resistivity, and percentages of sulfates, chlorides, and soluble salts in the soil were also conducted on selected samples.

Grain size analysis and Atterberg limits were used to evaluate soil classification designations. Density and moisture content determinations were conducted to evaluate in-place conditions. Consolidation, unconfined compression, and direct shear tests were performed to assess soil compressibility and strength characteristics for design. The results of laboratory tests performed during this investigation are presented on the boring logs and summarized on tables and plots located in the appendix.

4 SUBSURFACE SOIL AND WATER CONDITIONS

The table below lists approximate ground surface elevations (from Google Earth), exploration depths, and groundwater levels for the test holes completed during this study. It should be understood that the elevations estimated from Google Earth are only approximate and will not typically be consistent with the survey datum nor the level of survey accuracy required for detailed design and construction of the project.

TABLE 1 SUMMARY OF TEST HOLES

Test Hole Number	Approximate Ground Surface Elevation (ft)	Exploration Depth (ft)	Groundwater Measurements		
			Depth to Groundwater (ft)	Approx. Groundwater Elevation (ft)	Water Level Measurement Date
24-BH-01	4563	26.5	Not Measured	N/A	4/1/2024
24-BH-02	4560	22.5	Dry	N/A	4/1/2024
24-BH-03	4558	22.5	Dry	N/A	4/2/2024
24-BH-04	4561	22.5	Dry	N/A	4/2/2024
24-BH-05	4565	22.5	Dry	N/A	4/2/2024
24-BH-06	4567	22.5	Dry	N/A	4/1/2024
24-BH-07	4565	41.5	29.3*	4536*	5/23/2024
24-BH-08	4564	41.5	Dry to 30.5'	N/A	5/23/2024
24-BH-09	4559	22.5	Dry to 21.4'	N/A	5/23/2024
24-BH-10	4554	22.5	Not Measured	N/A	4/5/2024
24-BH-11	4552	22.5	Not Measured	N/A	4/5/2024
24-BH-13	4548	41	Dry to 30'	N/A	5/23/2024
24-BH-14	4548	41	Dry to 30'	N/A	5/23/2024
24-BH-15	4551	22.5	Not Measured	N/A	4/8/2024
24-BH-16	4554	22	15	4539	4/8/2024

*Water detected at bottom of 24-BH-07 appears to be wet soil, and not likely groundwater.

Borings were drilled in the existing 3200 West roadway, except for Borings 7, 8, and 9 which were located on the county water conservancy district property. The existing asphalt pavement thickness measured in the borings varied between 3 and 5 inches. The asphalt pavement was underlain by granular fill ranging from about 6 inches to 2 feet thick. The fill beneath the pavement classified

predominantly as silty sand with gravel (USCS symbol SM), and occasionally as silty gravel with sand (GM), gravel with silt and sand (GP-GM), clayey sand with gravel (SC), and sand with silt and gravel (SP-SM).

The shallow subgrade soils, whether beneath the pavement section or at the existing ground surface, classified as lean clay (CL) with varying amounts of sand in 14 of the 15 borings. Boring 13 was the outlier in this respect, with the subgrade consisting of silty sand (SM). The lean clay in the other 14 borings extended to depths of about 5 to 11 feet below the existing ground surface. Below the initial subgrade deposits, the borings encountered interbedded layers of lean clay (CL), silty clay (CL-ML), silt (ML, plastic and nonplastic), gravels (GM, GP-GM, GP, and GC), and sands (SM, SP-SM, and SC-SM). Dense sands and gravels are encountered more often with depth, especially below 20 feet. In general, cohesive soils (clays and silts) are more prevalent in the southern part of the alignment, and dense gravels tend to be encountered more frequently in the northern section of the alignment.

Properties of the native subgrade soils determined from field and laboratory testing are summarized briefly in the following subsections.

4.1 CLAY

Plasticity, gradation, and strength properties of the tested lean clay, sandy lean clay, lean clay with sand, and sandy silty clay (CL and CL-ML) samples obtained during the subsurface explorations are summarized below.

TABLE 2 PROPERTIES OF CLAY SAMPLES

Soil Property	No. of Tests	Range	Average
Dry Unit Weight (pcf)	12	67.2 – 110.7	92.0
Moisture Content (%)	19	16.1 - 55.6	27.6
Liquid Limit (%)	19	23 - 48	33
Plasticity Index (%)	19	4 – 25	14
Gravel Content (%)	6	0 - 8	2
Sand Content (%)	6	22 - 44	30
Silt/Clay Content (%)	6	56 – 77	68
Undrained Shear Strength from Torvane (psf)	58	200 – 3560	1262
Unconfined Compressive Strength (psf)	8	361 – 3766	1895

One-dimensional consolidation testing was performed on seven relatively undisturbed samples of lean clay obtained from the project borings. The results of these tests indicate the cohesive soils along the alignment are moderately compressible at load intensities exceeding about 1 tsf. The consolidation test specimens were initially loaded to 0.5 tsf in their as-received moisture condition, after which each specimen was inundated and allowed to absorb moisture. None of the tested samples exhibited significant volume change upon wetting. This observation suggests the cohesive soils do not have notable potential for moisture sensitivity problems such as collapse or expansion.

4.2 SILT

Plasticity, gradation, and strength properties of the tested silt and silt with sand (ML) samples obtained during the subsurface explorations are summarized below.

TABLE 3 PROPERTIES OF SILT SAMPLES

Soil Property	No. of Tests	Range	Average
Dry Unit Weight (pcf)	3	79.4 – 99.0	88.9
Moisture Content (%)	5	17.1 – 44.6	26.0
Liquid Limit (%)	3	22 – 44	29
Plasticity Index (%)	3	2 – 16	7
Gravel Content (%)	2	0 – 2	1
Sand Content (%)	2	38 – 50	44
Silt/Clay Content (%)	2	50 – 60	55
Undrained Shear Strength from Torvane (psf)	3	300 – 1020	773
Unconfined Compressive Strength (psf)	1	605	605

Direct shear testing was performed on three specimens of plastic silt with sand cut from the Shelby tube sample obtained at a depth of 15 feet in Boring 14. The test results indicated a friction angle of approximately 38 degrees with approximately 350 psf cohesion. We do not recommend using these test results for design, as they are unusually high for plastic silt and unlikely to be representative of in-place drained soil strengths for this material type.

4.3 SAND

The results of laboratory classification and strength tests performed on samples of sand with silt, sand with silt and gravel, clayey sand, clayey sand with gravel, silty clayey sand, silty sand, and silty sand with gravel (SP-SM, SC, SC-SM, and SM) are tabulated below.

TABLE 4 PROPERTIES OF SAND SAMPLES

Soil Property	No. of Tests	Range	Average
Moisture Content (%)	9	9 - 25	14.5
Gravel Content (%)	9	1 - 38	19
Sand Content (%)	9	39 – 67	49
Silt/Clay Content (%)	9	7 – 49	32

One SC-SM sample was identified as containing plastic fines. Atterberg limits testing of this sample indicates a liquid limit of 28 and a plasticity index of 7.

4.4 GRAVEL

USCS classifications of the predominantly gravelly soil types tested in the laboratory included gravel with silt and sand, and silty gravel with sand (GP-GM and GM). Tested properties of these samples included the following.

TABLE 5 PROPERTIES OF GRAVEL SAMPLES

Soil Property	No. of Tests	Range	Average
Moisture Content (%)	2	6.7 - 9.4	8.1
Gravel Content (%)	2	48 - 49	49
Sand Content (%)	2	35 - 42	39
Silt/Clay Content (%)	2	10 - 16	13

4.5 CORROSION POTENTIAL AND CONTAMINANTS

Electrochemical properties were tested for nine samples. The results of these tests are summarized below.

TABLE 6 ELECTROCHEMICAL PROPERTIES TESTED SAMPLES

Boring Number	Sample Depth (ft)	Soil Type	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	Soluble Salts (%)
24-BH-01	6-7.5	CL	8.4	810	70	239	0.90
24-BH-04	3-4.5	CL	8.7	1100	27	177	2.28
24-BH-07	9-10.5	SM	8.0	1700	169	< 12	0.40
24-BH-08	21-22.5	CL	8.5	1500	214	19	1.15
24-BH-13	6-7.5	SM	8.4	1400	40	45	0.65
24-BH-13	9-10.5	CL	8.0	1700	23	61	1.27
24-BH-14	12-13.5	CL	8.4	1200	15	82	2.71
24-BH-14	21-22.5	GP-GM	8.0	3800	13	16	0.47
24-BH-16	9-10.5	CL	8.2	510	78	916	1.39

The tested pH, resistivity values, and sulfate contents are typical of natural soils in the Salt Lake valley. The resistivity values are generally low and correspond to relatively aggressive potential for corrosion of steel placed in contact with the soil. The sample tested from Boring 16 had an elevated chlorides content, which further suggests potential for accelerated corrosion of metal infrastructure installed in the ground.

The tested water-soluble sulfate contents indicate a sulfate exposure class S0 in accordance with the American Concrete Institute Structural Concrete Building Code (ACI 318-14). No special concrete requirements are indicated by ACI 318-14 for soils in this category.

No visual evidence or odors indicative of contamination were observed in the samples obtained during this investigation.

5 ENGINEERING ANALYSIS & RECOMMENDATIONS

5.1 TRENCH CONSTRUCTION RECOMMENDATIONS

It is anticipated that the pipeline construction will be performed within open trenches, except for potential trenchless crossings of 12600 South between Borings 7 and 8 and a second, deeper

trenchless crossing beneath an existing pipeline near borings 13 and 14. Due to site constraints, it is anticipated that shoring will be required for excavations within or adjacent to existing roadway alignments.

5.1.1 EXCAVATION

Trench excavation should comply with OSHA safety standards. For un-shored excavations, the cohesive soils in the project area generally vary between OSHA Type A and B type soils, which can generally accommodate slopes of $\frac{3}{4}H:1V$ or $1H:1V$ (horizontal to vertical), respectively, for excavation slopes up to 20 feet deep.

Some softer cohesive soils, including most of the clay and silt in Boring 1 and selected clay layers identified as “soft” or “very soft” in Borings 14, 15, and 16, fall under OSHA Type C soils, as does much of the sandy and silty soil encountered in the upper 15 to 30 feet of the soil profile. OSHA allows excavations in Type C soils to be sloped as steep as $1.5H:1V$ in excavations as deep as 20 feet. Excavations deeper than about 5 feet will often be in a Type A or Type B over Type C scenario, which will generally limit slopes in un-shored excavations to be no steeper than $1.5H:1V$.

It should be noted that OSHA requires daily inspections of excavations by a competent person as well as inspections prior to the start of work, as needed throughout the shift, after every rainstorm, and after other hazard increasing occurrences (OSHA 1926.651(k)(1)). The competent person is responsible for classifying soil and rock deposits in accordance with OSHA 1926 Subpart P Appendix A.

Shoring for the project should be designed by an experienced engineer licensed in the State of Utah. Shoring design is typically performed by an engineer working for the contractor selected to construct the project. This approach allows the shoring design to utilize materials and equipment readily available to the contractor. It is recommended that the shoring design be reviewed by an experienced engineer on behalf of the Owner prior to installation. Lateral earth pressures that may be considered for shoring design are discussed in Section 5.2 of this report.

5.1.2 DEWATERING

Groundwater, and indications thereof, were not encountered within 30 feet of the existing ground surface. Dewatering on a significant scale is not likely to be necessary for the project; however, it is possible that some collection and removal of water perched on clayey soil layers will be required.

5.1.3 BACKFILL

The trench for the proposed pipeline will be excavated beneath the existing roadway. Lean clay and sandy soils obtained from the project excavations and used as backfill can adequately support

the roadway provided the fill soil is properly moisture conditioned, placed, and compacted. We recommend that soil used to backfill the trenches be moisture conditioned to within 2% of the optimum moisture content as determined by ASTM D 698 (standard proctor), the backfill be placed in loose lifts not exceeding 12 inches, and the soil be compacted to an in-place unit weight equal to at least 95% of the maximum laboratory density determined by ASTM D 698. We recommend the trench backfill be compacted to at least 92% of the maximum laboratory density in open areas where structures or pavement will not be constructed.

Unfortunately, the in-place moisture content of much of the existing cohesive soil within the likely excavation zone is significantly greater than the optimum moisture content. Moisture conditioning these soils will require drying the soil to within 2% of the optimum moisture content. Moisture conditioning could be accomplished by spreading the soil and allowing it to dry to near optimum moisture content, or by using lime or other additives to absorb the excess moisture. Alternatively, the trenches could be backfilled with imported granular fill to facilitate moisture-conditioning and compaction.

If imported soil is used as trench backfill above the pipe zone, it is recommended that this soil be granular with less than 30% fines. We recommend the backfill have a maximum size of 3 inches and less than 30% retained on the ¾ inch sieve. The fraction finer than a No. 40 sieve should have a plasticity index less than 6. Granular fill placed in locations where structures or pavement will be constructed should be compacted to at least 95% of ASTM D1557. We recommend that granular fill be compacted to at least 92% of ASTM D1557 at locations where structures or pavement will not be constructed.

We recommend that bedding and backfill within the pipe zone comply with the more stringent of APWA and JWCD standards. Construction of the pavement sections at the top of the trenches, including subbase, base, and pavement materials, should meet the more stringent of APWA or Riverton City standards. Utah Department of Transportation standards should be met for any work that may impact state routes or other UDOT facilities.

5.2 LATERAL EARTH PRESSURES

The following equation can be used to compute lateral earth pressures:

$$P = \frac{1}{2} \gamma K H^2$$

Where

- P = total lateral force on wall, plf
- K = earth pressure coefficient
- γ = unit weight of soil (125 pcf)
- H = height of retained soil against wall

The earth pressure coefficient used in designing earth retaining structures for the project will depend upon the amount of shear resistance mobilized within the retained soil. Active lateral earth pressures can typically be assumed in design of retaining systems that are relatively flexible and can deflect at least 0.2 percent of the wall height at the top of the wall. For the native soils at this project site, we recommend an active earth pressure coefficient of 0.42 be used to calculate the lateral earth pressures. If the project includes flexible retaining systems that will only retain granular compacted fill, an active earth pressure coefficient of 0.30 can be used for design.

If earth retaining structures are rigid and/or restrained such that deflections will be less than 0.2 percent of the wall height during backfilling, and the backfill is granular soil, we recommend an at-rest earth pressure coefficient of 0.50 be used to calculate the lateral earth pressure. This condition may be appropriate for the design of manholes or other rigid structures that will be backfilled with granular soil.

If passive earth pressure will be relied upon to restrain lateral movement, we recommend a coefficient of 2.4 be used for the native soils at the site. The passive earth pressure coefficient can be increased to 3.3 if granular compacted backfill is used to restrain lateral movement.

The resultant earth pressure force for the conditions described above can be assumed to act horizontally at a vertical distance above the base of the wall equal to $1/3$ of the height of the retained or resisting soil mass.

If seismic design is required for project retaining structures, the additional active earth pressure due to the Maximum Considered Earthquake (MCE) may be estimated using a coefficient of 0.29 or 0.22 for native soils or granular backfill respectively. The seismic ground motion will also reduce the available passive resistance. This reduction may be accounted for as an earth pressure acting in the direction opposite the passive resistance and computed using a coefficient of 0.6. The pressure diagrams for these incremental seismic forces may be roughly approximated as inverted triangles, such that the resultant forces of the seismic components act at heights of approximately $2H/3$ above the base of the wall.

All of the above recommendations assume the surface of the soil retained behind the structure or shoring is essentially horizontal (i.e., no backslope). It should also be recognized that the pressures calculated by the above equation are earth pressures only and do not include hydrostatic pressures. Where hydrostatic pressures may exist behind a retaining structure, we recommend either the wall be designed to resist hydrostatic pressure, or that a drainage system be placed behind the wall to prevent the development of hydrostatic pressures.

5.3 SEISMIC CONSIDERATIONS

Based upon conditions encountered in the project borings and our experience in the project vicinity, which includes borings and shear wave velocity testing to depths of 100 feet, the site can be classified as Site Class D for seismic design in accordance with ASCE 7.

Mapped probabilistic peak ground acceleration (PGA) values and spectral acceleration (SA) values for periods of 0.2 and 1.0 second have been calculated for the intersection of 12600 S and 3200 W (latitude 40.5224, longitude -111.9672) using the USGS U.S. Seismic Design Maps with the ASCE 7-22 design standard. The seismic design parameters are tabulated below.

**TABLE 7 SITE CLASS D DESIGN AND
MCE GROUND MOTION VALUES**

Period	Design	MCE
PGA (0 sec)	n/a	0.60 g (PGAM)
0.2 sec SA	0.97 g (SDS)	1.45 g (SMS)
1.0 sec SA	0.70 g (SD1)	1.05 g (SM1)

We do not anticipate at this time that seismic design will be a significant aspect of the project. However, we can provide more detailed geotechnical/seismic recommendations for use with ASCE 7-16 or ASCE7-22 if needed.

5.3.1 MITIGATION OF SEISMIC HAZARDS

The potential for liquefaction of loose to medium-dense sand and silt deposits is very low, since the water table is more than 30 feet below the ground surface. No known active faults are mapped near enough to the proposed pipeline to pose major or unique hazards in terms of fault surface rupture or subsidence. No special design provisions or mitigation of liquefaction or lateral spread hazards are recommended for the project.

5.4 OTHER DESIGN AND CONSTRUCTION CONSIDERATIONS

While Type I or Type II cement is acceptable, it is recommended that Type II or Type V cement be used for concrete in contact with the native soils due to its increased resistance to sulfate attack.

Soils at the bottoms of excavations may be too soft to provide an adequate working surface in some areas. Stabilization methods will depend upon conditions encountered. Moderately soft areas may be stabilized by over-excavating to a depth of about twelve inches, placing a 4-ounce non-woven geotextile separation fabric and a geogrid (or alternatively a higher-strength woven geotextile, and backfilling with well-graded sandy gravel fill compacted to least 90% of the maximum laboratory density determined using ASTM D 1557. Very soft areas may be stabilized by pressing 3” to 8” angular to sub-angular cobble rock or broken concrete into the subgrade in

lifts no thicker than 12 inches at a time. If the subgrade is not stable after pressing in two 12-inch lifts of cobbles or broken concrete, we recommend the subgrade be left undisturbed for 24 to 48 hours to allow soil pore water pressures to dissipate before attempting further stabilization. Where cobbles are used for subgrade stabilization, excess rock that cannot be tamped into the subgrade should be removed to avoid leaving voids between cobbles. If voids are left between cobbles, migration of soil particles into the voids over time could result in settlement of the pipeline, trench backfill, and surface elements such as pavements.

6 LIMITATIONS AND CLOSURE

The findings and recommendations presented in this report are the results of geotechnical explorations and analyses conducted for design of the project. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist at the site which could not be defined during the explorations described herein.

If conditions are encountered during construction which differ from those presented in this report, it is requested that RB&G Engineering be informed in order that appropriate action may be taken.

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FIGURES

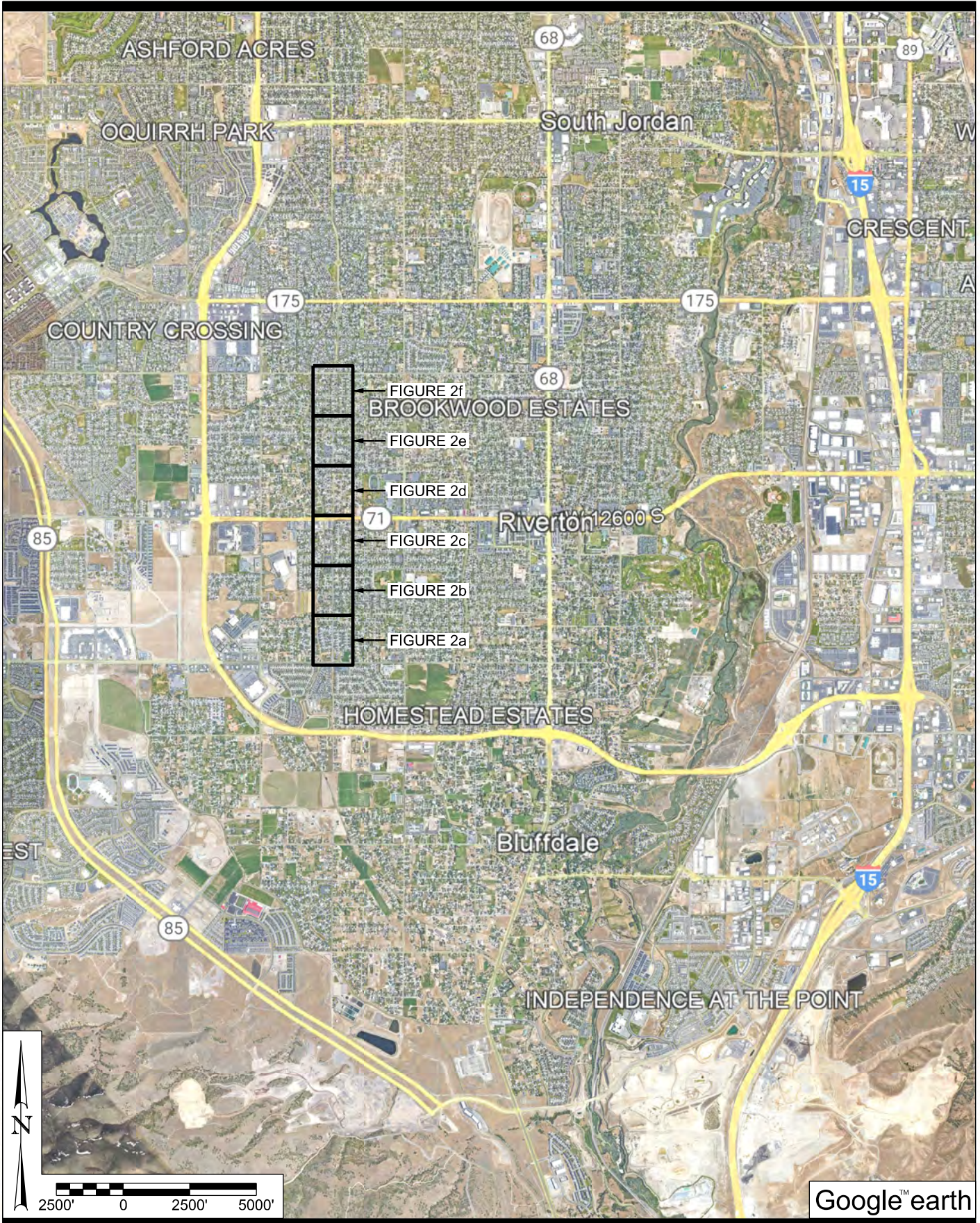
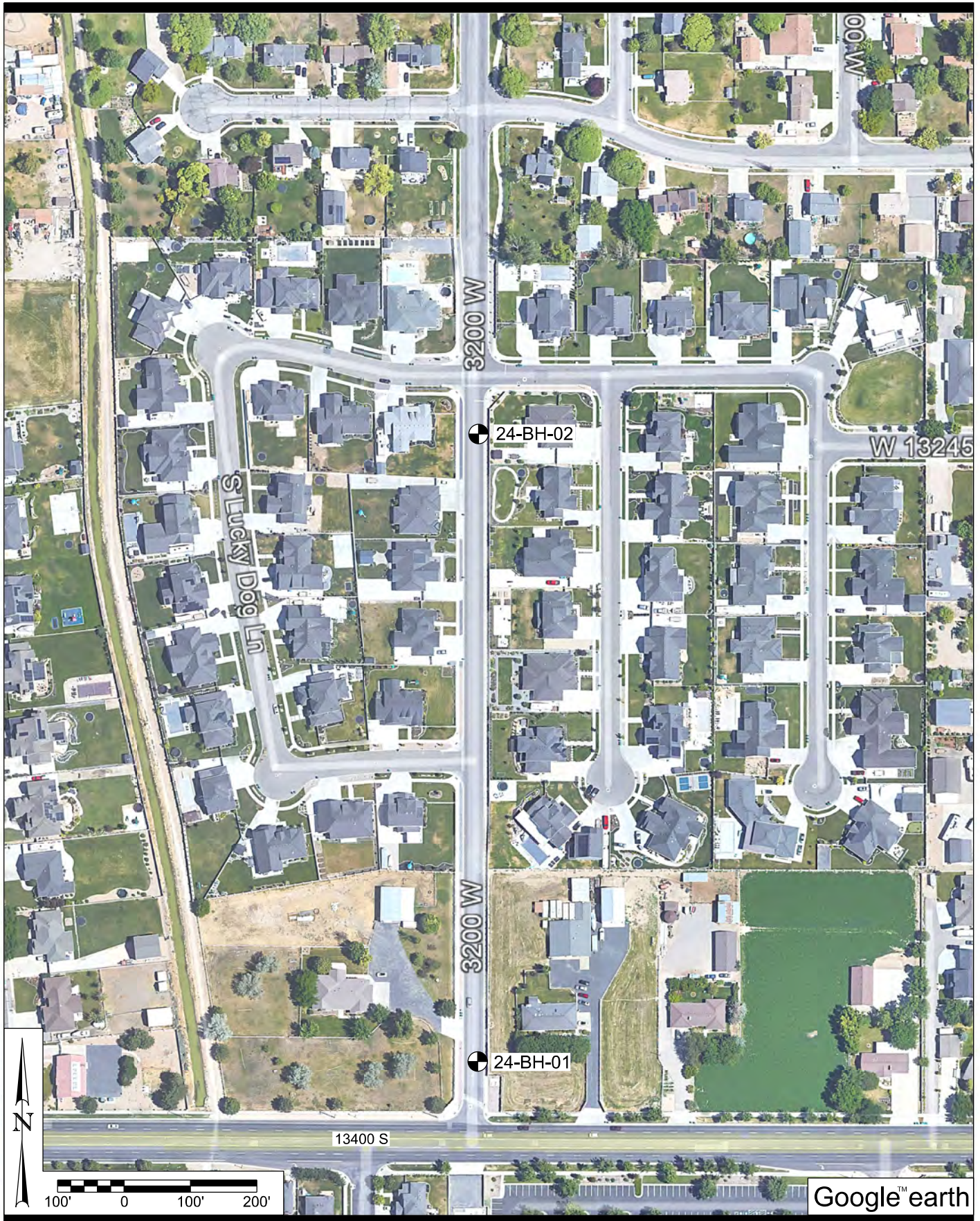


Figure 1 VICINITY MAP
 JWCD SW Aqueduct Reach 2
 Riverton, Salt Lake County, Utah



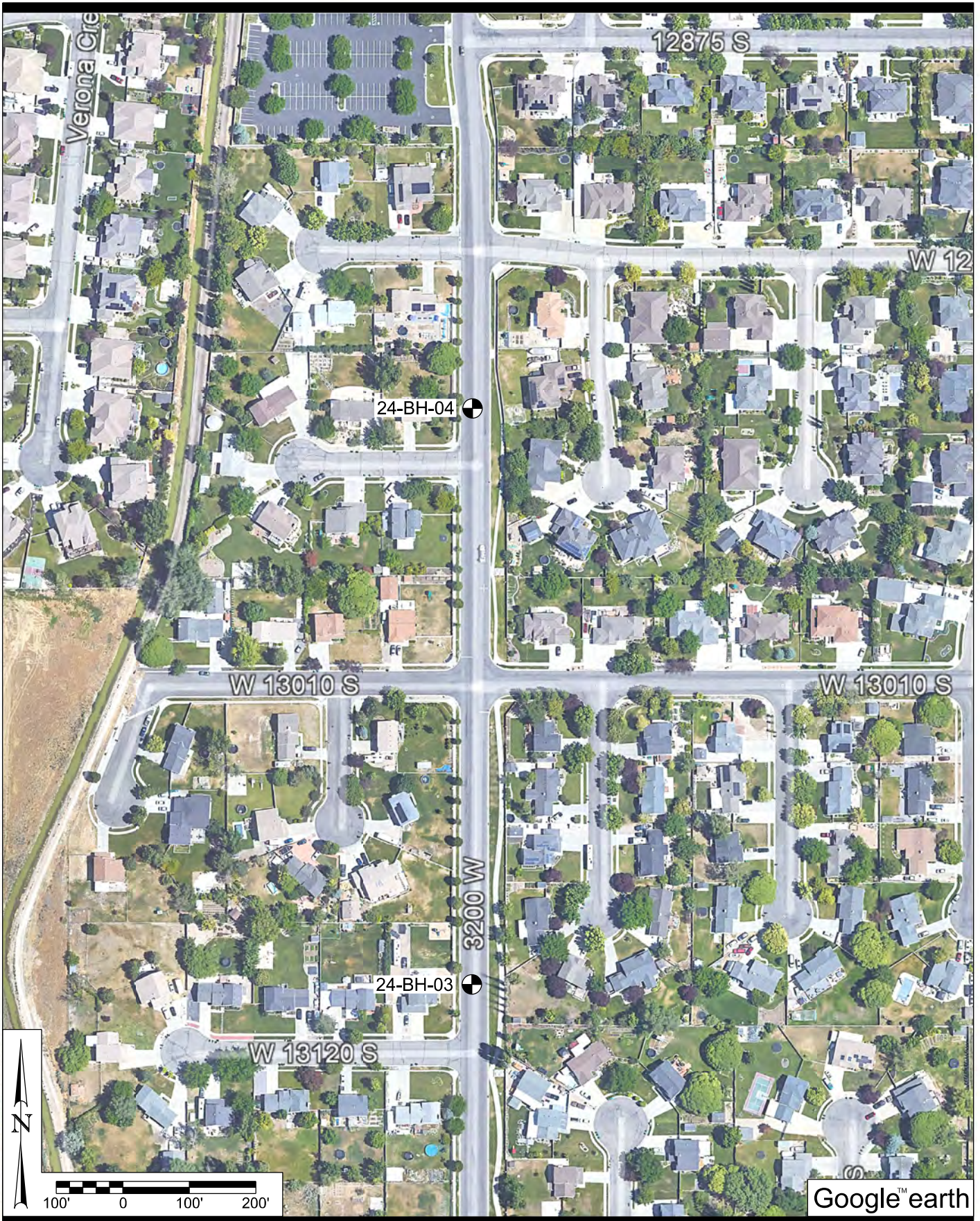


Figure 2b SITE PLAN & TEST HOLE LOCATIONS

*JVWCD SW Aqueduct Reach 2
 Riverton, Salt Lake County, Utah*



Figure 2c SITE PLAN & TEST HOLE LOCATIONS

JVWCD SW Aqueduct Reach 2
 Riverton, Salt Lake County, Utah

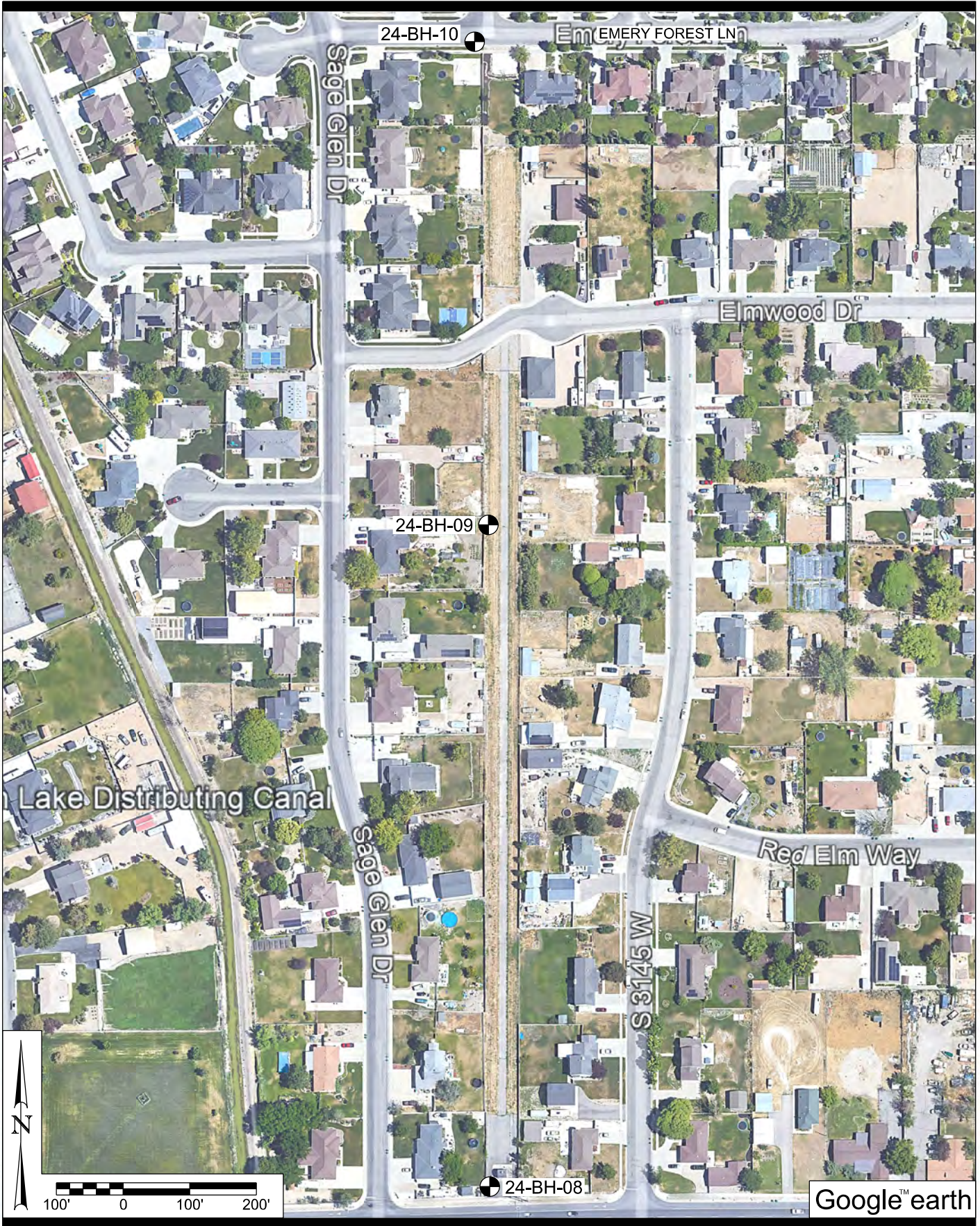


Figure 2d SITE PLAN & TEST HOLE LOCATIONS

JVWCD SW Aqueduct Reach 2
 Riverton, Salt Lake County, Utah



Figure 2e SITE PLAN & TEST HOLE LOCATIONS

*JVWCD SW Aqueduct Reach 2
Riverton, Salt Lake County, Utah*



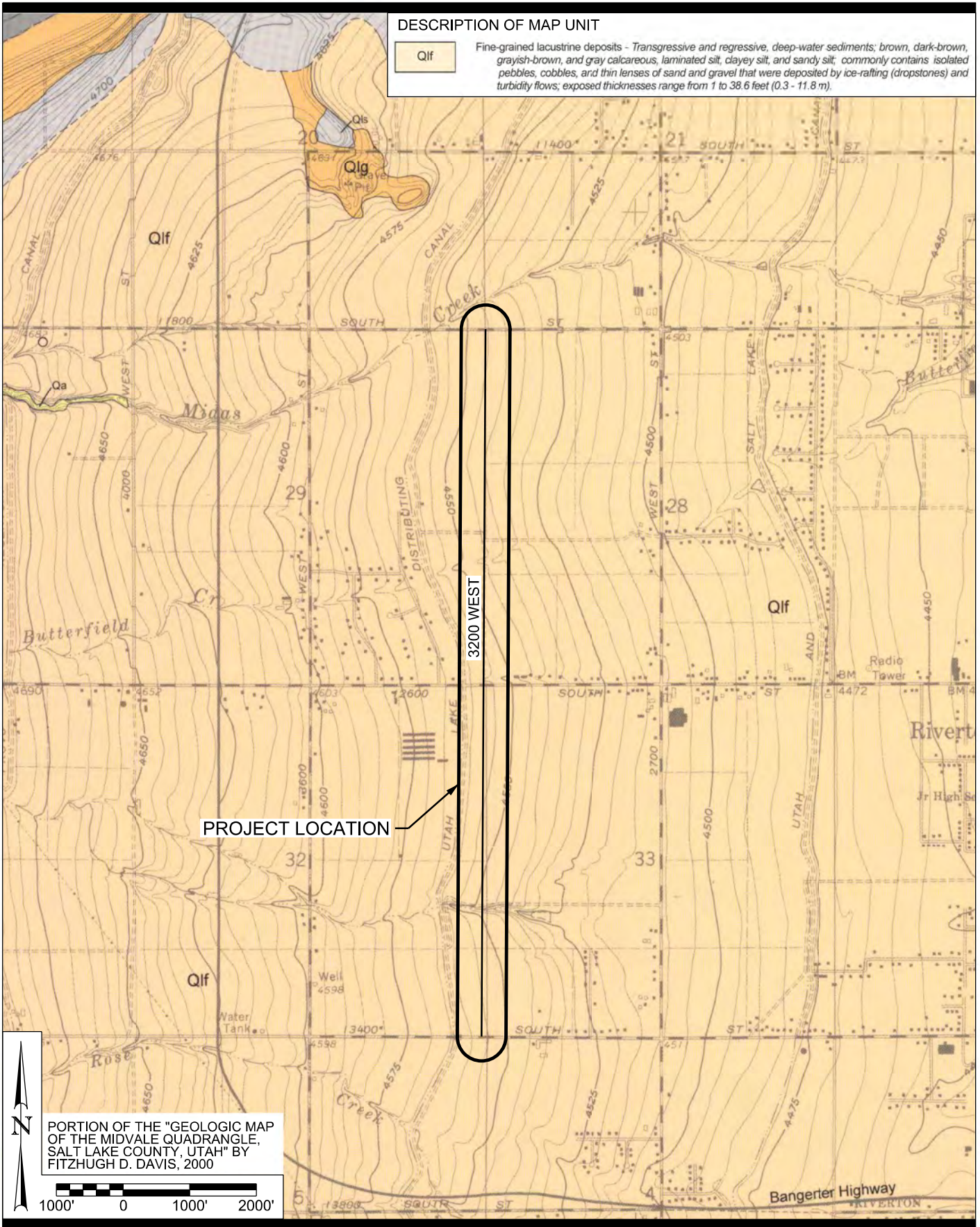
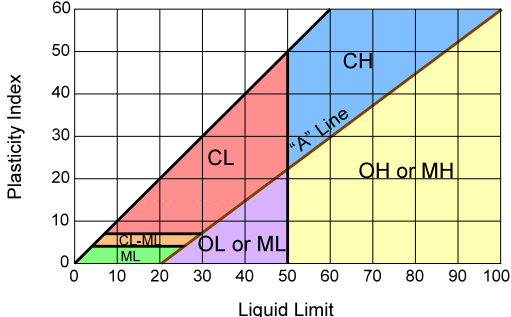


Figure 3 GEOLOGIC MAP & UNIT DESCRIPTION
 JWVCD SW Aqueduct Reach 2
 Riverton, Salt Lake County, Utah

APPENDIX

Unified Soil Classification System

Major Divisions		Group Symbols	Typical Names	Laboratory Classification Criteria			
COARSE-GRAINED SOILS <i>more than half of material is larger than No. 200 sieve</i>	Gravels <i>more than half of coarse fraction is larger than No. 4 sieve size</i>	Clean Gravels <i>little or no fines</i>	GW Well graded gravels, gravel-sand mixtures, little or no fines	<i>For laboratory classification of coarse-grained soils</i> $C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	Determine percentage of gravel and sand from grain-size curve.		
		Gravels With Fines <i>appreciable amount of fines</i>	GP Poorly graded gravels, gravel-sand mixtures, little or no fines			Not meeting all gradation requirements for GW	
		GM*	d Silty gravels, poorly graded gravel-sand-silt mixtures				Atterberg limits below "A" line, or PI less than 4
			u			Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols	
	Sands <i>more than half of coarse fraction is smaller than No. 4 sieve size</i>	Clean Sands <i>little or no fines</i>	GC Clayey gravels, poorly graded gravel-sand-clay mixtures	Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5% GW, GP, SW, SP 5% to 12% Borderline cases requiring use of dual symbols**	Atterberg limits above "A" line, or PI greater		
			SW Well graded sands, gravelly sands, little or no fines			$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
		Sands with Fines <i>appreciable amount of fines</i>	SP Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW		
			SM*			d Silty sands, poorly graded sand-silt mixtures	Atterberg limits below "A" line, or PI less than 4
						u	
			SC Clayey sands, poorly graded sand-clay mixtures			Atterberg limits above "A" line, or PI greater	
FINE-GRAINED SOILS <i>more than half of material is smaller than No. 200 sieve</i>	Silts and Clays <i>liquid limit is less than 50</i>	ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	<i>For laboratory classification of fine-grained soils</i>				
		CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays					
		OL Organic silts and organic silt-clays of low plasticity					
	Silts and Clays <i>liquid limit is greater than 50</i>	MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts					
		CH Inorganic clays of high plasticity, fat clays					
		OH Organic clays of medium to high plasticity, organic silts					
		Pt Peat and other highly organic soils					

*Division of **GM** and **SM** groups into subdivisions of **d** and **u** for roads and airfields only. Subdivision is based on Atterberg limits; suffix **d** used when liquid limit is 28 or less and the PI is 6 or less, the suffix **u** used when liquid limit is greater than 28.

***Borderline classification*: Soils possessing characteristics of two groups are designated by combinations of group symbols. (For example **GW-GC**, well graded gravel-sand mixture with clay binder.)

DRILL HOLE LOG

BORING NO. 24-BH-01

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.50812° N, LONG: 111.96725° W

DATE STARTED: 4/1/24

DRILLING METHOD: 08-CME-55 / HQ CASING ADVANCER

DATE COMPLETED: 4/1/24

DRILLER: T.K., K.C.

GROUND ELEVATION: _____



DEPTH TO WATER - INITIAL: ▽ N.M. AFTER 24 HOURS: ▼ N.M.

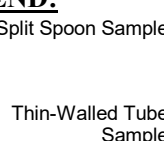
LOGGED BY: M.S.H., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
			15	12,8,7,(33) T 1.31	GP-GM CL	lt. brown, moist, med. dense 3" ASPHALT GRAVEL W/SILT & SAND (fill) brown, moist, very stiff								
			12	0/18", (0) T < 0.10	CL	brown, wet, very soft LEAN CLAY								
	5		16	Pushed T 0.15	CL	brown, wet, very soft to firm	74.4	42.4	32	10				CT UC 361 psf
			11	1,2,2,(9) T 0.35	CL	brown, wet, firm LEAN CLAY W/SAND								Chem.
	10		13	T 0.15 1,2,2,(7)	CL SC	brown, very moist, soft brown, wet, loose CLAYEY SAND								
			12	Pushed T 0.15	ML	brown, wet, soft SANDY SILT plastic	88.3	22.4	22	2				UC 605 psf
	15		13	3,2,3,(7)	CL	brown, very moist, soft SANDY LEAN CLAY								
			12	4,4,12,(23)	SC-SM	brown, wet, med. dense SILTY CLAYEY SAND								
	20		14	3,4,5,(12)	SC-SM	brown, wet, med. dense		25.0	28	7	3	51	46	
			15	Pushed T 0.10	SC-SM CL	brown, wet brown, wet, very soft SANDY LEAN CLAY								
	25		12	9,13,20,(37)	SM	brown, wet, dense SILTY SAND W/GRAVEL								
						BOTTOM OF HOLE								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N₆₀) Value
- Torque Value (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torque Value (tsf)
- Pocket Penetrometer (tsf)

- #### OTHER TESTS
- UC = Unconfined Compression
 - CT = Consolidation
 - DS = Direct Shear
 - UU = Unconsolidated, Undrained
 - CU = Consolidated, Undrained
 - Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
 - Hyd. = Hydrometer
 - DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-02

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.51071° N, LONG: 111.96724° W

DATE STARTED: 4/1/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 4/1/24

DRILLER: S.W., MAX H.

GROUND ELEVATION: _____

DEPTH TO WATER - INITIAL: ∇ DRY'

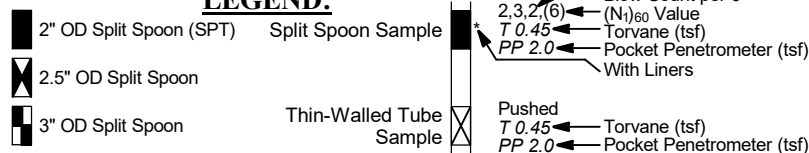
AFTER 24 HOURS: ∇ N.M.

LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample		Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)				See Legend	USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	
					3.5" ASPHALT								
				13	9,8,4,(26) T 1.13	GM brown, moist SC red, moist CL brown, moist, very stiff							
				15	Pushed T 0.70	CL dk. brown, wet, stiff	89.8	30.9	31	12			CT
	5					SANDY LEAN CLAY							
				13	0,1,2,(6) T 0.50	CL dk. brown, wet, firm							
				16	2,2,2,(7) T 0.65	CL lt. brown, very moist, stiff							
	10					LEAN CLAY W/SAND							
				6	Pushed	SM lt. brown, very moist							
				10	18,15,4,(29)	SM gray, very moist, med. dense	14.2		NP	29	46	25	
	15					SILTY SAND W/GRAVEL							
				16	2,2,2,(5) T 1.13	CL lt. brown, moist, very stiff							
						GRAVELLY LEAN CLAY W/SAND							
				15	22,33,36,(84)	GP-GM lt. brown, very moist, very dense							
	20					GRAVEL W/SILT & SAND possible cobbles							
				12	16,26,20,(52)	GM lt. brown, very moist, dense							
						SILTY GRAVEL W/SAND possible cobbles							
						BOTTOM OF HOLE							

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:



OTHER TESTS
 UC = Unconfined Compression
 CT = Consolidation
 DS = Direct Shear
 UU = Unconsolidated, Undrained
 CU = Consolidated, Undrained
 Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
 Hyd. = Hydrometer
 DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-03

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.51341° N, LONG: 111.96728° W

DATE STARTED: 4/2/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 4/2/24

DRILLER: S.W., J.H.

GROUND ELEVATION: _____




DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

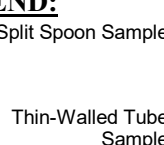
LOGGED BY: T.D., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
			18	8,6,16,(49) T 1.78	SP-SM CL	3" ASPHALT SAND W/SILT & GRAVEL (fill) brown, moist, med. dense dk. brown, moist, very stiff SANDY LEAN CLAY								
	5		12	2,3,7,(24) T 1.63	CL	LEAN CLAY W/SAND dk. brown, very moist, very stiff								
			12	Pushed T 0.50	CL	gray, wet, firm	72.1	55.6	45	20				UC 1,362 psf
	10		16	1,3,3,(11) T 0.51	ML	SILT W/SAND plastic gray-brown, very moist, stiff								
			7	2,4,3,(11) T 0.62	CL	LEAN CLAY W/SAND brown, moist, stiff								
	15		1	Pushed	CL	SANDY LEAN CLAY W/GRAVEL brown, moist								
			10	16,20,19,(55)	GP-GM	GRAVEL W/SILT & SAND possible cobbles brown, very moist, dense								
	20		12	4,5,7,(15) T 1.00	CL	SANDY LEAN CLAY trace gravels brown, moist, stiff		22.6	37	21				
			17	0/12",3,(4) T 0.50	CL	SANDY LEAN CLAY brown, moist, firm								
						BOTTOM OF HOLE								

DH LOG-V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N)₆₀ Value
- Torque (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torque (tsf)
- Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-04

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.51579° N, LONG: 111.96727° W

DATE STARTED: 4/2/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 4/2/24

DRILLER: S.W., J.H.

GROUND ELEVATION: _____




DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.


LOGGED BY: T.D., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
						4.5" ASPHALT								
			17	3,2,2,(9) T 0.75	SM	dk. brown, moist, v. loose SILTY SAND W/GRAVEL (fill)								
					CL	dk. brown, moist, stiff LEAN CLAY								
			14	Pushed T 0.44	CL	gray, moist, firm SANDY LEAN CLAY								Chem.
	5				ML	brown-gray, moist SANDY SILT plastic								
			13	1,2,5,(15)	SM	brown, very moist, med. dense SILTY SAND								
	10		10	6,6,4,(18)	SM	brown, very moist, med. dense SILTY SAND silty clay lenses	8.9		NP	1	56	43		
			11	Pushed T 0.41	CL	brown, moist, firm LEAN CLAY W/SAND	100.4	17.6	29	14				CT
	15		9	19,21,25,(65)	GM	brown, very moist, dense SILTY GRAVEL W/SAND possible cobbles								
			13	21,23,26,(60)	GP-GM	brown, wet, dense GRAVEL W/SILT & SAND possible cobbles								
	20		10	8,35,46,(91)	GP-GM	brown, wet, very dense								
						BOTTOM OF HOLE								

DH LOG-V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N₆₀) Value
- T 0.45 ← Torvane (tsf)
- PP 2.0 ← Pocket Penetrometer (tsf) With Liners
- Pushed T 0.45 ← Torvane (tsf)
- PP 2.0 ← Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay

RB&G
ENGINEERING, INC.

DRILL HOLE LOG

BORING NO. 24-BH-05

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.51800° N, LONG: 111.96728° W

DATE STARTED: 4/1/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 4/2/24

DRILLER: S.W., MAX H., J.H.

GROUND ELEVATION: _____



DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

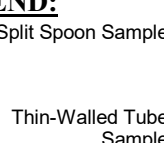
LOGGED BY: C.P., T.D., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
						4" ASPHALT SAND W/SILT & GRAVEL (fill)								
			15	5,2,2,(9)	SP-SM	lt. brown, moist								
					CL	brown, moist, soft								
			8	Pushed T 1.25	CL	lt. brown, moist, very stiff	94.6	22.5						
						SANDY LEAN CLAY								
			12	T 0.63 1,2,1,(6)	CL	brown, moist, stiff								
					ML	brown-gray, moist, loose								
						SANDY SILT plastic								
			9	6,4,4,(14)	SM	gray-orange, moist, med. dense								
						SILTY SAND								
			14	Pushed T 0.50	CL	brown, moist, firm	99.2	21.6	26	11				UC 1,280 psf
						SANDY LEAN CLAY								
			11	11,15,30,(64)	GM	brown, moist, dense								
						SILTY GRAVEL W/SAND possible cobbles								
			13	41,22,24,(56)	GP-GM	brown, moist, dense								
						GRAVEL W/SILT & SAND possible cobbles								
			11	13,31,29,(68)	GP-GM	brown, moist, dense								
						BOTTOM OF HOLE								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N₆₀) Value
- T 0.45 ← Torvane (tsf)
- PP 2.0 ← Pocket Penetrometer (tsf) With Liners
- Pushed T 0.45 ← Torvane (tsf)
- PP 2.0 ← Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-06

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.52020° N, LONG: 111.96728° W

DATE STARTED: 4/1/24

DRILLING METHOD: 08-CME-55 / HQ CASING ADVANCER

DATE COMPLETED: 4/1/24

DRILLER: T.K., J.H.

GROUND ELEVATION: _____




DEPTH TO WATER - INITIAL: ∇ N.M. AFTER 24 HOURS: ▼ DRY'

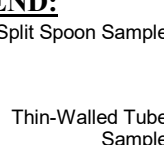
LOGGED BY: M.S.H., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
						5" ASPHALT								
			8	7,7,9,(35)	SM	lt. brown, moist, dense SILTY SAND W/GRAVEL (fill)								
			18	6,3,4,(15) T 0.50	CL	gray, moist, firm LEAN CLAY								
	5					SAND W/SILT & GRAVEL								
			11	Pushed	SP-SM	lt. brown, moist								
			14	20,32,31,(99+)	GP-GM	lt. brown, moist, very dense GRAVEL W/SILT & SAND possible cobbles		6.7		NP	48	42	10	
						SILTY SAND								
	10		6	3,2,3,(9)	CL	brown, moist, firm LEAN CLAY W/SAND								
						SILTY SAND trace gravels								
			17	Pushed	SM	brown, moist								
						GRAVEL W/SILT & SAND possible cobbles								
	15		14	5,24,26,(71)	GP-GM	lt. brown, moist, dense								
						SANDY SILT								
						SANDY LEAN CLAY W/GRAVEL		91.4	26.9	45	25			CT UC 2,001 psf
	20		12	Pushed T 0.41	CL	brown, moist, firm								
						SILTY CLAYEY GRAVEL W/SAND possible cobbles								
			14	17,31,22,(64)	GC-GM	lt. brown, moist, dense								
						BOTTOM OF HOLE								

DH LOG-V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N₆₀) Value
- Torque Value (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torque Value (tsf)
- Pocket Penetrometer (tsf)

- #### OTHER TESTS
- UC = Unconfined Compression
 - CT = Consolidation
 - DS = Direct Shear
 - UU = Unconsolidated, Undrained
 - CU = Consolidated, Undrained
 - Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
 - Hyd. = Hydrometer
 - DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-07

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.52208° N, LONG: 111.96727° W

DATE STARTED: 3/21/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 35'

DATE COMPLETED: 3/22/24

DRILLER: S.W., J.H.

GROUND ELEVATION: _____

DEPTH TO WATER - INITIAL: ▽ 20.7'

AFTER 24 HOURS: ▼ 29.3' 5/23/24**

LOGGED BY: T.D., M.S.H., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
			13	5,7,10,(37) PP 4.25	CL	dk. brown, moist, hard SANDY LEAN CLAY W/GRAVEL								
	5		14	Pushed T 0.67	CL	gray, wet, stiff LEAN CLAY W/SAND		46.1	44	16				CT
			10	Pushed	ML	gray, very moist SANDY SILT plastic								
			13	6,6,5,(21)	ML	gray, very moist, med. dense								
	10		14	8,9,10,(32)	SM	brown, very moist, dense SILTY SAND								Chem.
			17	3,3,7,(15)	SM CL	brown, very moist brown, moist, stiff SANDY LEAN CLAY								
	15		GC	brown, moist		CLAYEY GRAVEL W/SAND								
			13	4,4,7,(15)	CL	brown, moist, stiff LEAN CLAY W/SAND		20.4	36	22				
			14	T 0.38 3,9,50,(76)	CL GM	brown, moist, firm brown, moist, very dense SILTY GRAVEL W/SAND slightly plastic fines, possible cobbles								
	20		14	Pushed T 0.88	CL	brown, moist, stiff SANDY LEAN CLAY								
			13	13,6,6,(13) T 0.35	SC-SM CL	brown, moist brown, moist, firm LEAN CLAY								
	30		12	Pushed T 0.36	CL	brown-gray, moist, firm to stiff SANDY LEAN CLAY	110.7	16.1	30	13	0	44	56	UC 3,766 psf
			15	16,18,24,(40)	ML	brown, wet, dense SANDY SILT								
	40		16	13,13,15,(23) T 1.13	CL	gray, moist, very stiff SANDY LEAN CLAY								
						BOTTOM OF HOLE								
	45					Note: Standpipe piezometer installed to depth of 30'. **Wet soil at bottom on 5/23/24.								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

- 2" OD Split Spoon (SPT) Split Spoon Sample
- 2.5" OD Split Spoon
- 3" OD Split Spoon

Thin-Walled Tube Sample

- Blow Count per 6" (N₆₀) Value
- Torvane (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torvane (tsf)
- Pushed Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-08

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.52253° N, LONG: 111.96719° W

DATE STARTED: 3/20/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 40'

DATE COMPLETED: 3/21/24

DRILLER: S.W., A.K., J.H.

GROUND ELEVATION: _____




DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ DRY to 30'

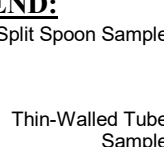
LOGGED BY: T.D., M.N.H., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
			6	6,3,4,(15)	SP-SM	black-dk. brown, moist, med. dense 4" ASPHALT SAND W/SILT & GRAVEL (ASPHALT MILLINGS) (fill)								
			11	Pushed	CL	gray, wet								
	5		6	3,3,4,(15) PP 2.75	CL	brown, moist, very stiff								
			6	0/12",3,(6) T 0.35	CL	lt. brown, very moist, firm								
	10		10	3,2,4,(10)	SP-SM	brown, wet, loose								
			12	8,12,14,(38)	SP-SM	brown, wet, dense		9.2		NP	26	67	7	
	15		5	12,7,5,(16)	SP-SM	brown, wet, med. dense								
			14	3,6,6,(16)	CL-ML	brown, moist, stiff		19.6	23	4	0	35	65	
	20		18	2,3,3,(7) T 0.40	CL	lt. brown, wet, firm								
			0	Pushed	-	no recovery								Chem.
						GRAVELS (driller's observation)								
	25		15	6,5,6,(12)	ML	brown, wet, med. dense		25.7		NP	0	50	50	
						SANDY SILT clay lenses								
	30		9	14,16,25,(39)	SP-SM	brown, wet, dense								
						SAND W/SILT & GRAVEL								
	35		11	32,43,39,(72)	SP-SM	brown, wet, very dense								
						SAND W/SILT & GRAVEL								
	40		12	36,53,39,(76)	GM	brown, wet, very dense								
						SILTY GRAVEL W/SAND possible cobbles								
						BOTTOM OF HOLE								
	45					Note: Standpipe piezometer installed to depth of 30'. No water encountered at 30' on 5/23/24.								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N₆₀) Value
- T 0.45 Torvane (tsf)
- PP 2.0 Pocket Penetrometer (tsf) With Liners
- Pushed T 0.45 Torvane (tsf)
- PP 2.0 Pocket Penetrometer (tsf)

- #### OTHER TESTS
- UC = Unconfined Compression
 - CT = Consolidation
 - DS = Direct Shear
 - UU = Unconsolidated, Undrained
 - CU = Consolidated, Undrained
 - Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
 - Hyd. = Hydrometer
 - DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-09

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.52525° N, LONG: 111.96719° W

DATE STARTED: 3/20/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 3/20/24

DRILLER: S.W., A.K.

GROUND ELEVATION: _____




DEPTH TO WATER - INITIAL: ▽ 13.7' AFTER 24 HOURS: ▼ DRY 5/23/24


LOGGED BY: T.D., J.B.






Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
			10	2,3,7,(22) T 1.73	CL	dk. brown, moist, very stiff LEAN CLAY W/SAND trace gravels								
			13	3,3,5,(19) T 0.45	CL	lt. brown, very moist, firm LEAN CLAY								
	5		0	Pushed	-	no recovery SILTY SAND								
			15	10,30,30,(99+)	SP-SM	brown, moist, very dense SAND W/SILT & GRAVEL								
	10		14	5,6,8,(23) T 0.25	CL-ML	brown, moist, firm SANDY SILTY CLAY	20.5	27	6	8	22	70		
			9	9,9,24,(48)	GM	brown, moist, med. dense SILTY GRAVEL W/SAND slightly plastic fines, possible cobbles								
	15		15	11,5,5,(13) T 0.50	CL	brown, moist, stiff SANDY LEAN CLAY W/GRAVEL								
			15		CL	brown, moist, stiff SANDY LEAN CLAY								
	20		3	19,9,8,(21)	GP	brown, wet, loose GRAVEL W/SAND likely sluff, poor sample								
			16	Pushed T 0.98	CL	brown, moist, stiff LEAN CLAY W/SAND	98.9	20.1	30	12	0	23	77	CT UC 2,690 psf
						BOTTOM OF HOLE								
	25					Note: Temporary slotted PVC pipe placed to bottom of boring for "After 24 Hours" water level measurement shown.								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

-  Blow Count per 6" (N₆₀) Value
-  Torvane (tsf)
-  Pocket Penetrometer (tsf) With Liners
-  Pushed Torvane (tsf)
-  Pushed Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CJ = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-10

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.52724° N, LONG: 111.96727° W

DATE STARTED: 4/5/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 4/5/24

DRILLER: S.W., A.K.

GROUND ELEVATION: _____




DEPTH TO WATER - INITIAL: ▽ N.M. AFTER 24 HOURS: ▼ N.M.

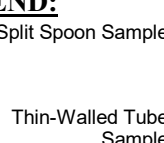
LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
						4" ASPHALT								
			10	13,13.5,(40)	SM	lt. brown, sl. moist, dense SILTY SAND W/GRAVEL (fill)								
			18	2,2.2,(9) T 0.50	CL	gray, wet, firm LEAN CLAY W/SAND trace gravels								
	5		15	12,17,21,(81)	SM	brown to gray, very moist, very dense SILTY SAND W/GRAVEL								
			6	Pushed T 0.86	CL	gray, moist, stiff LEAN CLAY W/GRAVEL	98.0	25.0	38	18				UC 2,270 psf
	10		9	23,13,7,(33)	GC	gray, moist, med. dense CLAYEY GRAVEL W/SAND possible cobbles								
			7	25,15,9,(35)	GP-GM	brown, moist, med. dense GRAVEL W/SILT & SAND possible cobbles								
	15		11	Pushed	CL	gray, moist SANDY LEAN CLAY								
			17	5,6,4,(13)	ML	gray-brown, wet, med. dense SANDY SILT								
	20		18	2,1,2,(4)	CL-ML	gray-brown, wet, soft SANDY SILTY CLAY plastic		24.4	23	5	4	28	68	
						BOTTOM OF HOLE								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N)₆₀ Value
- Torvane (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torvane (tsf)
- Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay

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DRILL HOLE LOG

BORING NO. 24-BH-11

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.52909° N, LONG: 111.96728° W

DATE STARTED: 4/5/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 4/5/24

DRILLER: S.W., A.K.

GROUND ELEVATION: _____

DEPTH TO WATER - INITIAL: ▽ N.M.


AFTER 24 HOURS: ▼ N.M.

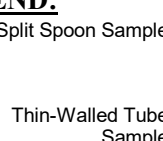
LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
						3.5" ASPHALT								
			8	12,8,2,(22)		SM lt. brown, moist, med. dense SILTY SAND W/GRAVEL (fill)								
			6	2,2,1,(7) T 0.35		CL gray, moist, firm GRAVELLY LEAN CLAY W/SAND								
	5													
			18	Pushed T 0.50		CL brown-gray, moist, firm LEAN CLAY W/SAND	67.2	51.0	48	22				
			7	3,18,22,(71)		GM gray, moist, dense SILTY GRAVEL W/SAND clay seams, possible cobbles								
	10													
			13	12,10,26,(53)		SC-SM brown, moist, very dense SILTY CLAYEY SAND W/GRAVEL		11.9	25	7	35	40	25	
			4	36,42,49,(99+)		GP-GM brown, moist, very dense GRAVEL W/SILT & SAND possible cobbles								
			10	28,15,7,(27) T 0.42		GP-GM brown, moist								
						CL brown, moist, firm SANDY LEAN CLAY W/GRAVEL								
	20													
			12	22,39,50,(99+)		GM gray, very moist, very dense SILTY GRAVEL W/SAND possible cobbles								
						BOTTOM OF HOLE								

DH LOG-V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N)₆₀ Value
- T 0.45 Torvane (tsf)
- PP 2.0 Pocket Penetrometer (tsf) With Liners
- Pushed T 0.45 Torvane (tsf)
- PP 2.0 Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay

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DRILL HOLE LOG

BORING NO. 24-BH-13

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.53184° N, LONG: 111.96729° W

DATE STARTED: 4/3/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 40'

DATE COMPLETED: 4/3/24

DRILLER: S.W., J.H.

GROUND ELEVATION: _____

DEPTH TO WATER - INITIAL: ▽ 33.1' AFTER 24 HOURS: ▼ DRY TO 30'

LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
			18	6,7,6,(29)	SM	lt. brown, moist brown, moist, med. dense								
			8	2,1,2,(7) T 0.31	SM	brown, moist, loose								
	5		17	Pushed	SM	brown, moist								Chem.
	10		14	1,2,1,(5) T 0.52	CL	dk. brown, moist, stiff								Chem.
	15		11	5,6,18,(38)	SM	dk. brown, moist, dense	16.2		NP	10	48	42		
	20		12	10,23,30,(70)	SM	brown, moist, very dense								
	25		12	4,4,6,(13) T 0.25	CL	brown, moist, firm	20.9	27	12	2	28	70		
	30		0	10,7,10,(20)	-	no recovery								
	35		13	32,27,22,(51)	GC	brown, moist, dense								
	40		17	3,8,24,(30)	CL ML	gray, moist brown, wet, dense	31.7	40	21					
			13	23,29,17,(41)	GP-GM ML	red, wet brown, wet, dense								
			8	54,60/4"	GM	brown, wet, very dense								
						BOTTOM OF HOLE								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

- 2" OD Split Spoon (SPT) Split Spoon Sample
- 2.5" OD Split Spoon
- 3" OD Split Spoon

- Thin-Walled Tube Sample

- Blow Count per 6" (N)₆₀ Value
- Torvane (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torvane (tsf)
- Pushed Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-14

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.53202° N, LONG: 111.96703° W

DATE STARTED: 4/4/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 30'

DATE COMPLETED: 4/4/24

DRILLER: S.W., J.H.

GROUND ELEVATION: _____

DEPTH TO WATER - INITIAL: ▽ 23.8' AFTER 24 HOURS: ▼ DRY TO 30'

LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
			17	6,6,3,(20) T 0.87	SM CL	orange, moist black, moist, stiff								
			13	Pushed T 0.35	CL	gray, wet, firm								
	5		16	1,2,3,(11) T 0.10	CL	gray, wet, very soft								
	10		9	5,6,7,(22)	SM	gray, moist, med. dense	17.5		NP	10	41	49		
			12	4,3,3,(9) T 0.65	CL	brown-gray, moist, stiff							Chem.	
	15		12	Pushed T 0.50	ML	brown, very moist, firm	19.4	22	3				DS	
	20		14	31,32,44,(92)	GM	brown, very moist, very dense								
			16	18,41,42,(94)	GP-GM	brown, wet, very dense							Chem.	
	25		12	13,12,15,(28)	SM	brown, moist, med. dense	12.1		NP	38	39	23		
	30		6	4,2,4,(6) T 0.60	CL	gray, moist, stiff								
	35		12	9,15,14,(29)	ML SM	gray, wet orange, wet, med. dense	17.1		NP	2	38	60		
	40		9	37,60/3"	GP-GM	brown to red, wet, very dense								
						BOTTOM OF HOLE								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

- 2" OD Split Spoon (SPT) Split Spoon Sample
- 2.5" OD Split Spoon
- 3" OD Split Spoon

- Thin-Walled Tube Sample

- Blow Count per 6" (N)₆₀ Value
- Torvane (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torvane (tsf)
- Pushed Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay



DRILL HOLE LOG

BORING NO. 24-BH-15

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.53442° N, LONG: 111.96701° W

DATE STARTED: 4/8/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 4/8/24

DRILLER: S.W., A.K.

GROUND ELEVATION: _____

DEPTH TO WATER - INITIAL: ∇ N.M. AFTER 24 HOURS: ∇ N.M.

LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
						4" ASPHALT								
			16	9,9,6,(33) T 1.50	SM	lt. brown, sl. moist, dense								
					CL	black, moist, very stiff								
			7	Pushed T 0.75	CL	dk. brown, moist, stiff		20.0	27	8				CT
	5					SANDY LEAN CLAY								
			15	1,2,2,(9) T 0.25	CL	dk. brown to gray, very moist, soft								
			10	1,3,4,(13) T 0.20	CL	brown & gray, very moist, soft								
			12	15,38,41,(99+)	GM	brown, moist, very dense								
						SILTY GRAVEL W/SAND possible cobbles								
			9	29,33,23,(74)	GM	lt. brown, moist, dense								
			8	Pushed	ML	brown, moist								
			13	26,34,36,(84)	GM	brown, moist, very dense		9.4	NP	49	35	16		
						SANDY SILT trace gravels								
			10	13,30,41,(80)	GM	brown, moist, very dense								
						SILTY GRAVEL W/SAND possible cobbles								
						BOTTOM OF HOLE								

DH LOG-V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24



LEGEND:

- 2" OD Split Spoon (SPT) Split Spoon Sample
- 2.5" OD Split Spoon
- 3" OD Split Spoon

Thin-Walled Tube Sample

- Blow Count per 6" (N₆₀) Value
- Torque (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torque (tsf)
- Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 24-BH-16

PROJECT: JWCD SW AQUEDUCT REACH 2

SHEET 1 OF 1

CLIENT: BOWEN, COLLINS & ASSOCIATES

PROJECT NUMBER: 202301-040-23-01

LOCATION: APPROX. LAT: 40.53676° N, LONG: 111.96700° W

DATE STARTED: 4/8/24

DRILLING METHOD: 20-CME-55 / NW CASING TO 20'

DATE COMPLETED: 4/8/24

DRILLER: S.W., A.K.

GROUND ELEVATION: _____

DEPTH TO WATER - INITIAL: ▽ 15.0'




AFTER 24 HOURS: ▼ N.M.

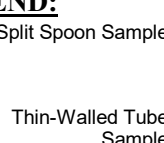
LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests
			Type	Rec. (in)	See Legend				USCS (AASHTO)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
						4" ASPHALT								
			18	11,14,12,(57)		SM lt. brown-brown, sl. moist, very dense SILTY SAND W/GRAVEL (fill)								
			12	2,3,5,(19) T 1.53		CL dk. brown, very moist, very stiff LEAN CLAY W/SAND								
	5		13	Pushed T 0.65		CL dk. brown, wet, stiff	94.8	23.7	24	8				UC 1,426 psf
			18	1,2,2,(7) T 0.23		CL gray, very moist, soft LEAN CLAY W/SAND silt lenses								Chem.
			10	5,9,7,(25)		SM brown-red, wet, med. dense SILTY SAND trace gravels		15.2		NP	18	52	30	
			14	41,44,43,(99+)		GC-GM brown, wet, very dense SILTY CLAYEY GRAVEL W/SAND possible cobbles								
			12	6,7,23,(39)		GC white, wet, med. dense CLAYEY GRAVEL W/SAND possible cobbles								
			8	27,69/6"		GP-GM lt. brown, wet, very dense GRAVEL W/SILT & SAND possible cobbles								
						BOTTOM OF HOLE								

DH LOG V8-2014-1 JWCD SW AQUEDUCT.GPJ US EVAL.GDT 6/4/24

LEGEND:

-  2" OD Split Spoon (SPT) Split Spoon Sample
-  2.5" OD Split Spoon
-  3" OD Split Spoon

-  Thin-Walled Tube Sample

- Blow Count per 6" (N)₆₀ Value
- Torque (tsf)
- Pocket Penetrometer (tsf) With Liners
- Pushed Torque (tsf)
- Pocket Penetrometer (tsf)

OTHER TESTS

- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
- Hyd. = Hydrometer
- DC = Dispersive Clay



Table 1

SUMMARY OF TEST DATA

PROJECT LOCATION

JVWCD SW Aquaduct Reach 2
see site plan

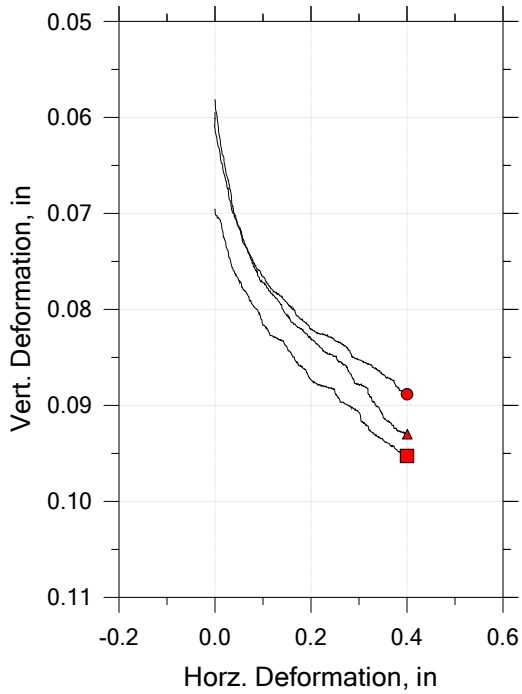
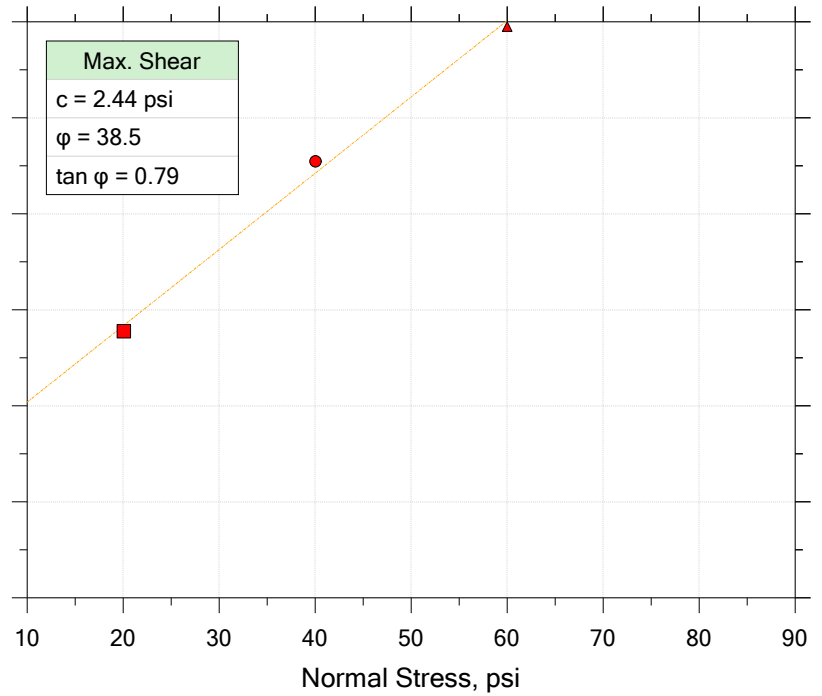
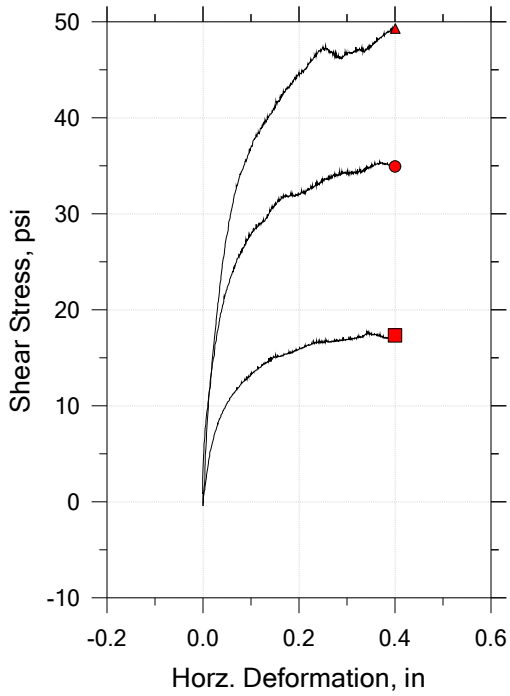
PROJECT NO. FEATURE

202301-040 - Task 23-01
66" Pipeline

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	IN-PLACE		UNCONFINED OR UU TRIAXIAL COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			PERCENT FINER THAN 0.005 mm	UNIFIED SOIL CLASSIFICATION SYSTEM
		DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY		
24-BH-01	4.5-6	74.4	42.4	UC 361	32	22	10					CL
	12-13.5	88.3	22.4	UC 605	22	20	2					ML
	18-19.5		25.0		28	21	7	3	51	46		SC-SM
24-BH-02	3-4.5	89.8	30.9		31	19	12					CL
	12.5-14		14.2				NP	29	46	25		SM
24-BH-03	6-7.5	72.1	55.6	UC 1,362	45	25	20					CL
	18-19.5		22.6		37	16	21					CL
24-BH-04	9-10.5		8.9				NP	1	56	43		SM
	12-13.5	100.4	17.6		29	15	14					CL
24-BH-05	3-4.5	94.6	22.5									
	12-13.5	99.2	21.6	UC 1,280	26	15	11					CL
24-BH-06	7-8.5		6.7				NP	48	42	10		GP-GM
	18-19.5	91.4	39.2	UC 2,001	45	20	25					CL
24-BH-07	3-4.5	79.4	44.6		44	28	16					ML
	15-16.5		20.4		36	14	22					CL
	30-31.1	110.7	16.1	UC 3,766	30	17	13	0	44	56		CL
24-BH-08	12-13.5		9.2				NP	26	67	7		SP-SM
	18-19.5		19.6		23	19	4	0	35	65		CL-ML
	25-26.5		25.7				NP	0	50	50		ML
24-BH-09	9-10.5		20.5		27	21	6	8	22	70		CL-ML
	21-22.5	98.9	20.1	UC 2,690	30	18	12	0	23	77		CL
24-BH-10	9-9.5	98.0	25.0	UC 2,277	38	20	18					CL
	21-22.5		24.4		23	18	5	4	28	68		CL-ML
24-BH-11	6-7.5	67.2	51.0		48	26	22					CL
	12-13.5		11.9				NP	35	40	25		SM
24-BH-13	12-13.5		16.2				NP	10	48	42		SM
	18-19.5		20.9		27	15	12	2	28	70		CL
	30-31.5		31.7		40	19	21					CL
24-BH-14	9-10.5		17.5				NP	10	41	49		SM
	15-16.5	99.0	20.2		22	19	3					ML
	25-26.5		12.1				NP	38	39	23		SM
	35-36.5		17.1				NP	2	38	60		ML
24-BH-15	3-4.5	106.9	21.0		27	19	8					CL
	18.7-20.2		9.4				NP	49	35	16		GM
24-BH-16	6-7.5	94.8	23.7	UC 1,426	24	16	8					CL
	12-13.5		15.2				NP	18	52	30		SM

NP=Non-Plastic

Direct Shear Test

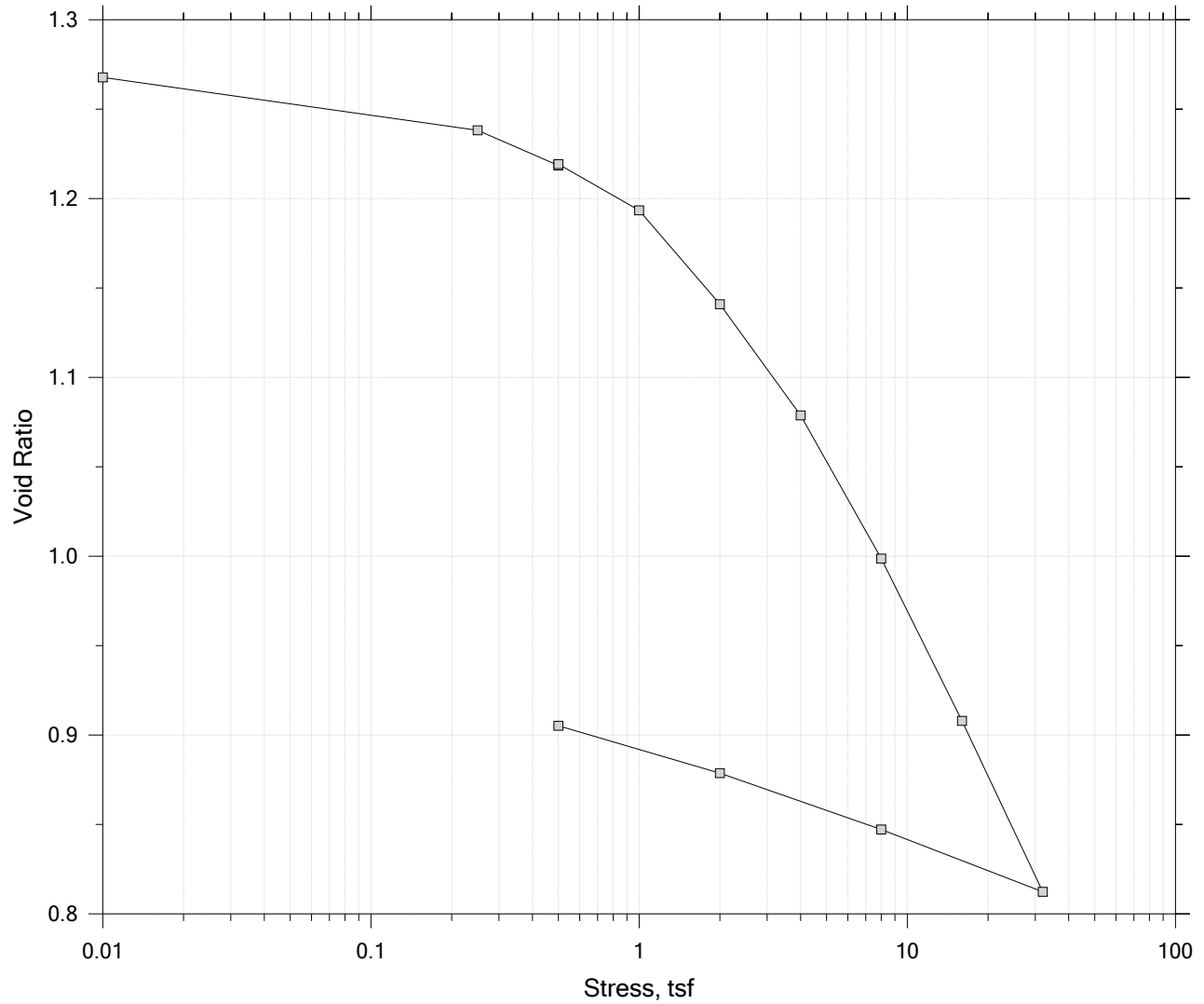


Symbol	■	●	▲	
Test No.	20 psi	40 psi	60 psi	
Sample No.	1	2	3	
Shape	Circular	Circular	Circular	
Initial	Dimension, in	2.37	2.36	2.37
	Area, in ²	4.4115	4.3744	4.4115
	Height, in	0.902	0.98	0.98
	Moisture Content	19.99	20.20	20.30
	Dry Density, pcf	96.20	101.6	99.15
	Saturation, %	71.77	82.66	78.30
Final	Void Ratio	0.75218	0.65972	0.7
	Consol. Height, in	0.83244	0.92057	0.92183
	Consol. Void Ratio	0.61705	0.55906	0.59909
	Moisture Content, %	19.99	20.20	20.30
Final	Dry Density, pcf	107.6	111.7	109.5
	Saturation, %	95.19	107.08	101.75
	Void Ratio	0.56709	0.50924	0.53864
	Normal Stress, psi	20.065	40.023	59.999
Max. Shear Stress, psi	17.78	35.47	49.526	
Ult. Shear Stress, psi	17.338	34.953	49.323	
Time to Failure, min	548	608	639	
Disp. Rate, %/min	0.00063	0.00063	0.00063	

	Project Name: JWVCD	Location: see site plan	Project Number: 202301-40-21-01
	Boring Number: 23-BH-14	Tester: LP	Checker:
	Sample Number: 1	Test Date: 4-19-2024	Depth: 15-16.5
	Test Number: 20 psi	Preparation: Shelby Tube	Elevation: NA
	Client:	Classification:	Group Symbol:
	Description: Silt (plastic) ML		
	Remarks:		

Consolidation Test

Summary Report

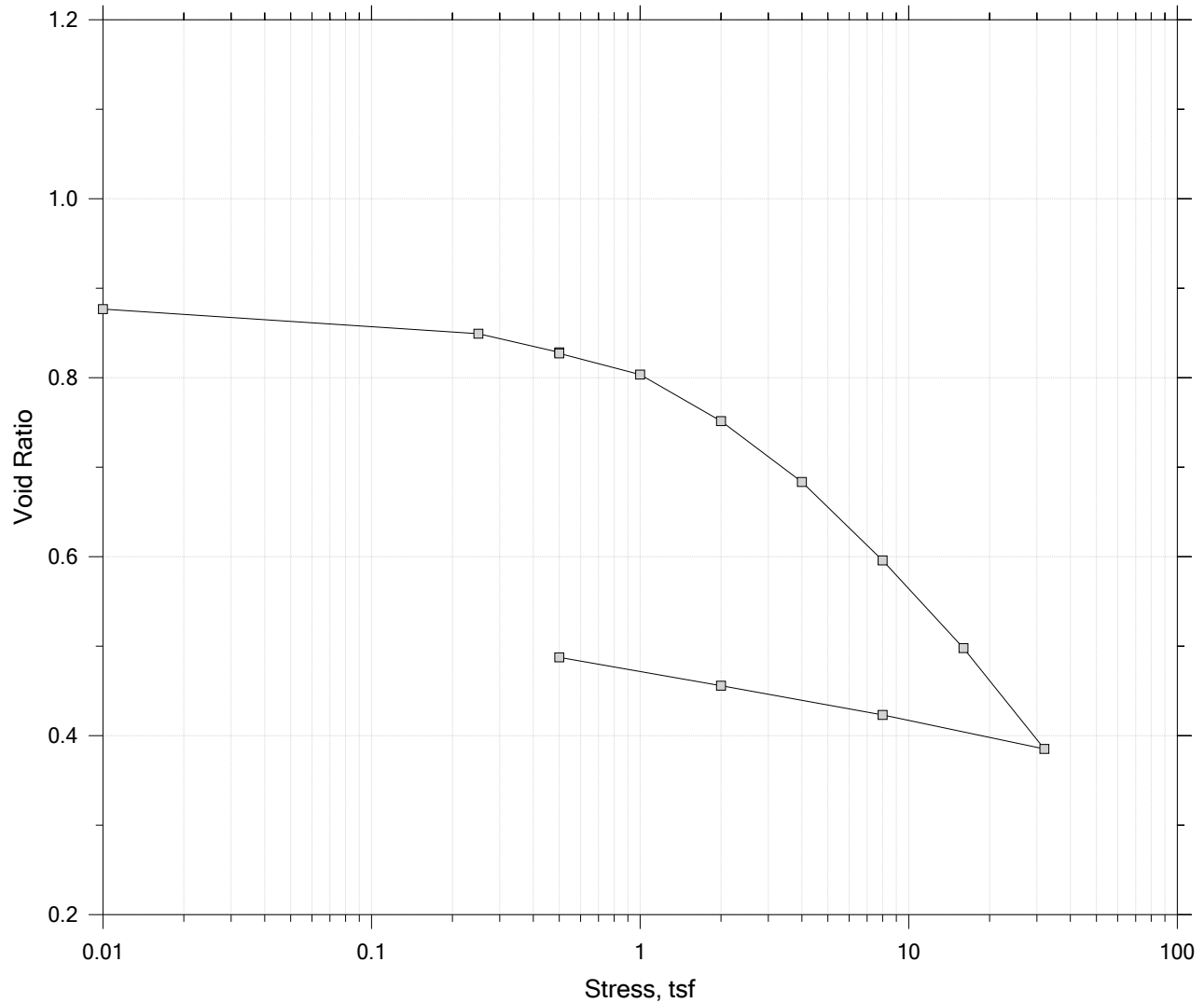


				Before Test	After Test	
Current Vertical Effective Stress, tsf: ---				Water Content, %	42.41	28.92
Preconsolidation Stress, tsf: ---				Dry Unit Weight, pcf	74.35	88.464
Compression Ratio: ---				Saturation, %	90.38	86.26
Specimen Diameter, in: 2.37		Specimen Height, in: 0.93		Void Ratio	1.27	0.91
LL: 32	PL: 22	PI: 10	GS: 2.70	Back Pressure, tsf	0.29837	0.30067

Project Name: JVWCD Aquaducts	Location: see site plan	Project Number: 202301-40-23-01
Boring Number: 23-BH-01	Tester: LP	Checker:
Sample Number: 1	Test Date: 4/17/2024	Depth: 4.5-6'
Test Number: 1	Preparation: Shelby Tube	Elevation:
Description: Lean Clay CL		
Remarks: Load Frame #68. Collapse Swell. Water added at start of Step 4.		
Displacement at End of Increment		

Consolidation Test

Summary Report

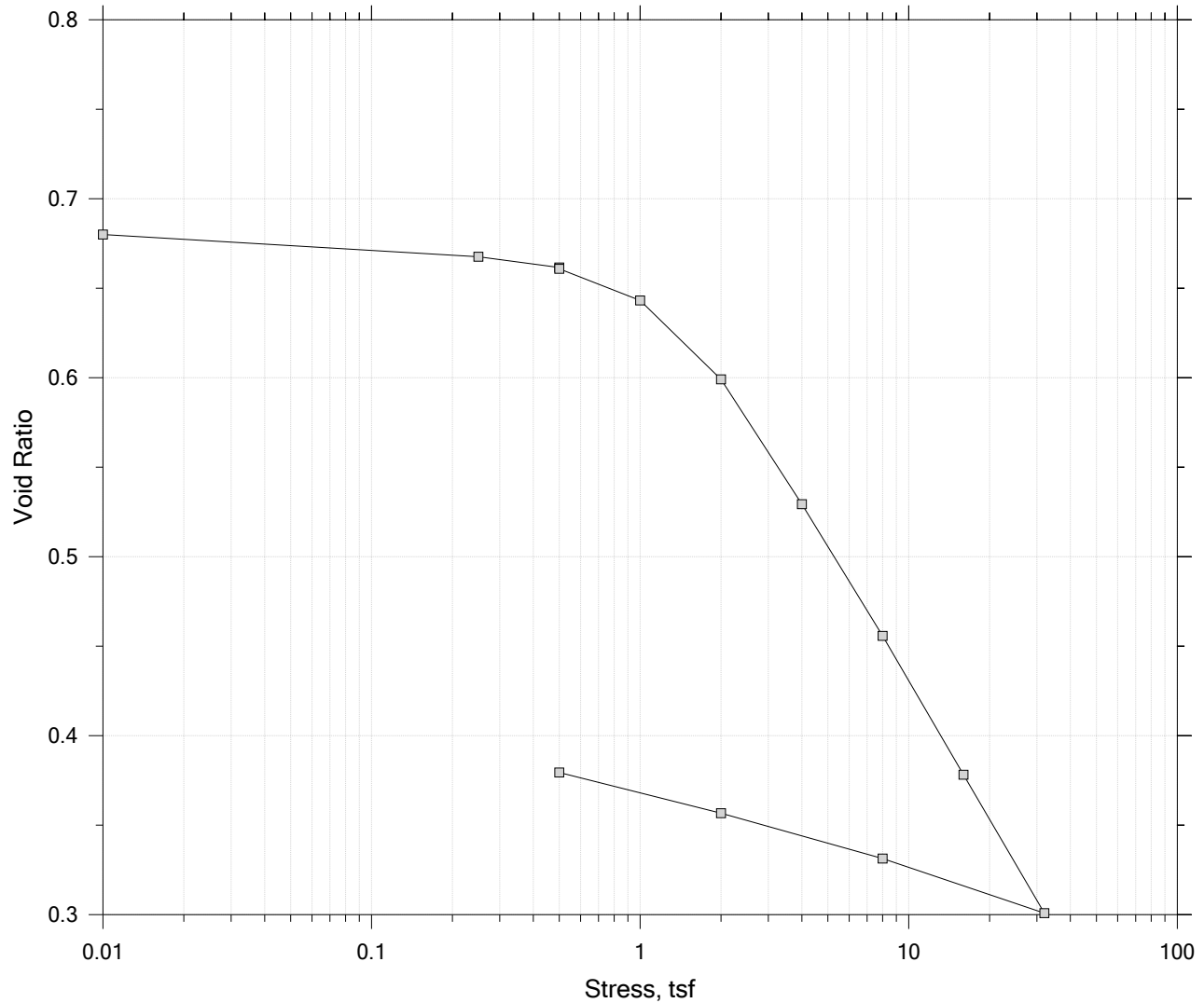


				Before Test	After Test	
Current Vertical Effective Stress, tsf: ---				Water Content, %	30.87	24.09
Preconsolidation Stress, tsf: ---				Dry Unit Weight, pcf	89.822	113.32
Compression Ratio: ---				Saturation, %	95.08	133.43
Specimen Diameter, in: 2.37		Specimen Height, in: 0.902		Void Ratio	0.88	0.49
LL: 31	PL: 19	PI: 12	GS: 2.70	Back Pressure, tsf	4.048	4.112

	Project Name: JVVCD		Location: See site plan		Project Number: 202301-40-23-01	
	Boring Number: 23-BH-2		Tester: LP		Checker:	
	Sample Number: 1		Test Date: 4-17-2024		Depth: 3-4.5'	
	Test Number: 1		Preparation: Shelby Tube		Elevation:	
	Description: Lean Clay CL					
	Remarks: Loadframe #69 Colapse Swell					
	Displacement at End of Increment					

One-Dimensional Consolidation by ASTM D2435 - Method A

Summary Report

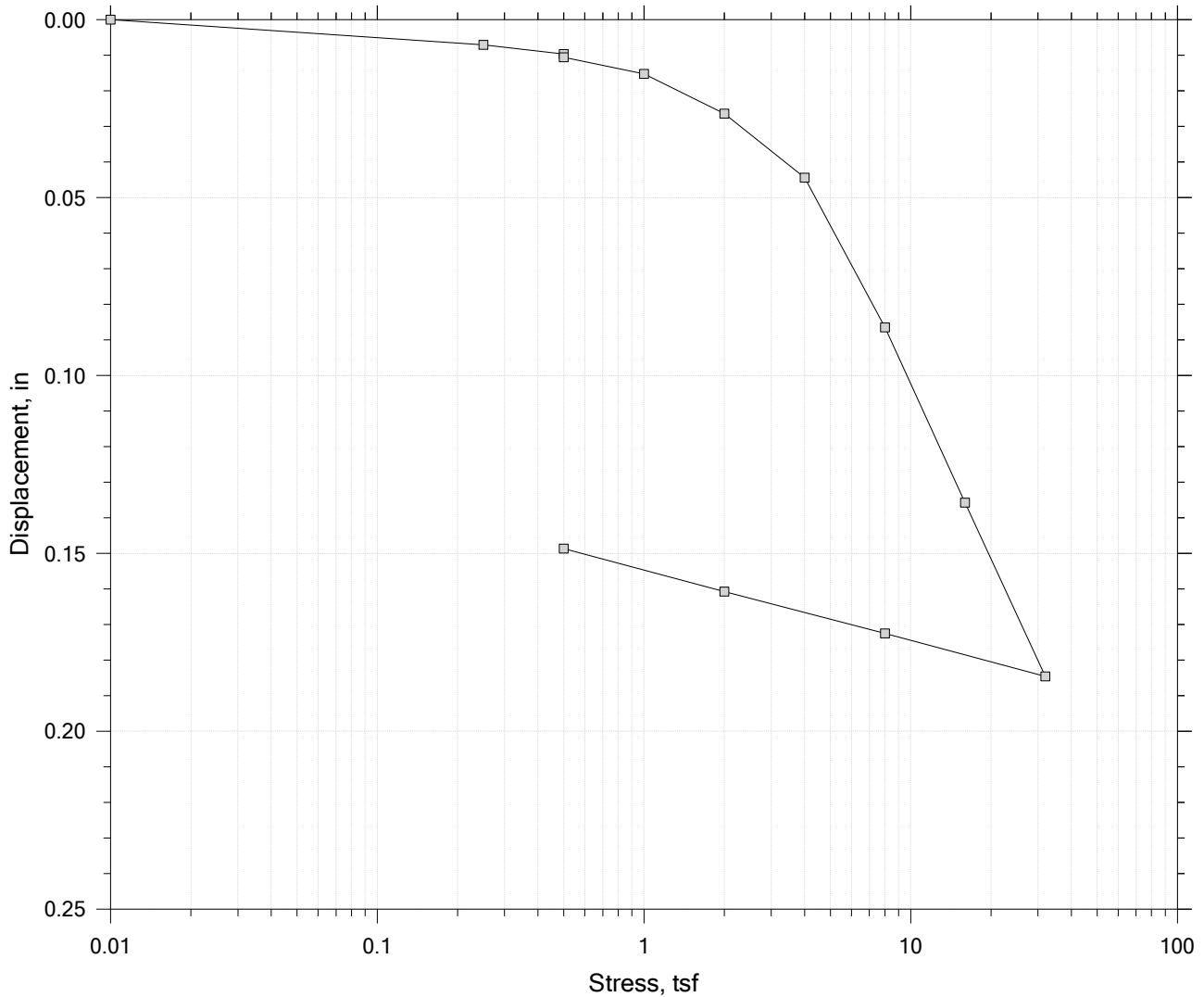


		Before Test	After Test	
Current Vertical Effective Stress, tsf: ---		Water Content, %	17.61	14.48
Preconsolidation Stress, tsf: ---		Dry Unit Weight, pcf	100.37	122.19
Compression Ratio: ---		Saturation, %	69.97	103.02
Specimen Diameter, in: 2.37	Specimen Height, in: 0.927	Void Ratio	0.68	0.38
LL: 29	PL: 15	PI: 14	GS: 2.70	

Project Name: JVWCD Aquaduct	Location: See site plan	Project Number: 202301-40-23-01
Boring Number: 23-BH-04	Tester: LP	Checker:
Sample Number: 1	Test Date: 4/17/2024	Depth: 12-13.5
Test Number: 1	Preparation: Shelby Tube	Elevation:
Description: Lean Clay CL		
Remarks: Load Frame #72. Collapse Swell		
Displacement at End of Increment		

Consolidation Test

Summary Report

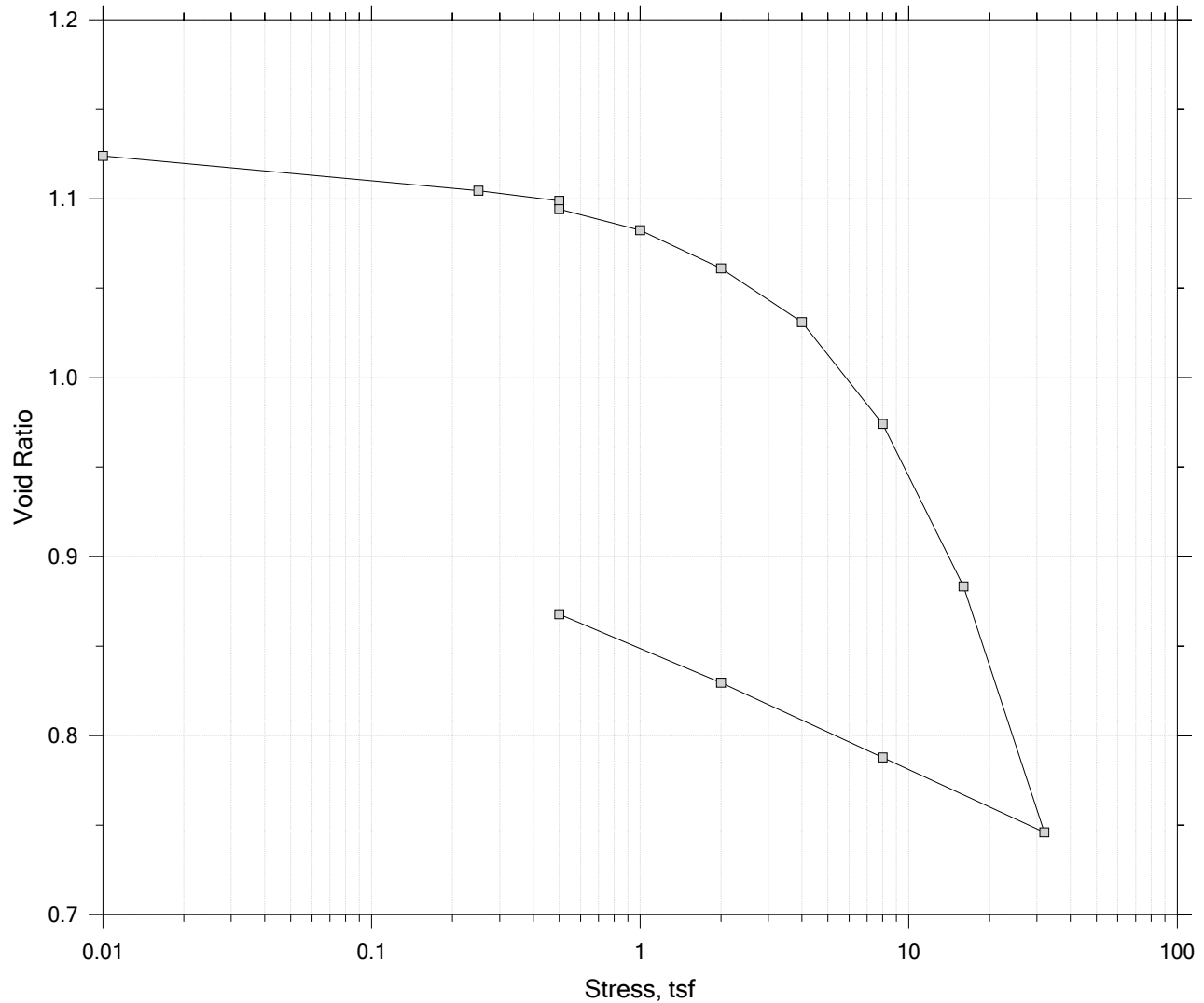


				Before Test	After Test	
Current Vertical Effective Stress, tsf: ---				Water Content, %	29.16	23.04
Preconsolidation Stress, tsf: ---				Dry Unit Weight, pcf	91.731	108.3
Compression Ratio: ---				Saturation, %	94.02	111.81
Specimen Diameter, in: 2.37		Specimen Height, in: 0.972		Void Ratio	0.84	0.56
LL: 45	PL: 20	PI: 25	GS: 2.70	Back Pressure, tsf	0.001152	0.001152

Project Name: JWCD Aquaduct	Location: See site plan	Project Number: 202301-40-23-01
Boring Number: 23-BH-06	Tester: JB	Checker:
Sample Number: 1	Test Date: 4-22-2024	Depth: 18-19.5'
Test Number: 1	Preparation: Shelby Tube	Elevation:
Client:	Classification:	Group Symbol:
Description: Lean Clay CL		
Remarks: Load frame #71. Collapse Swell		
Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method A

Summary Report

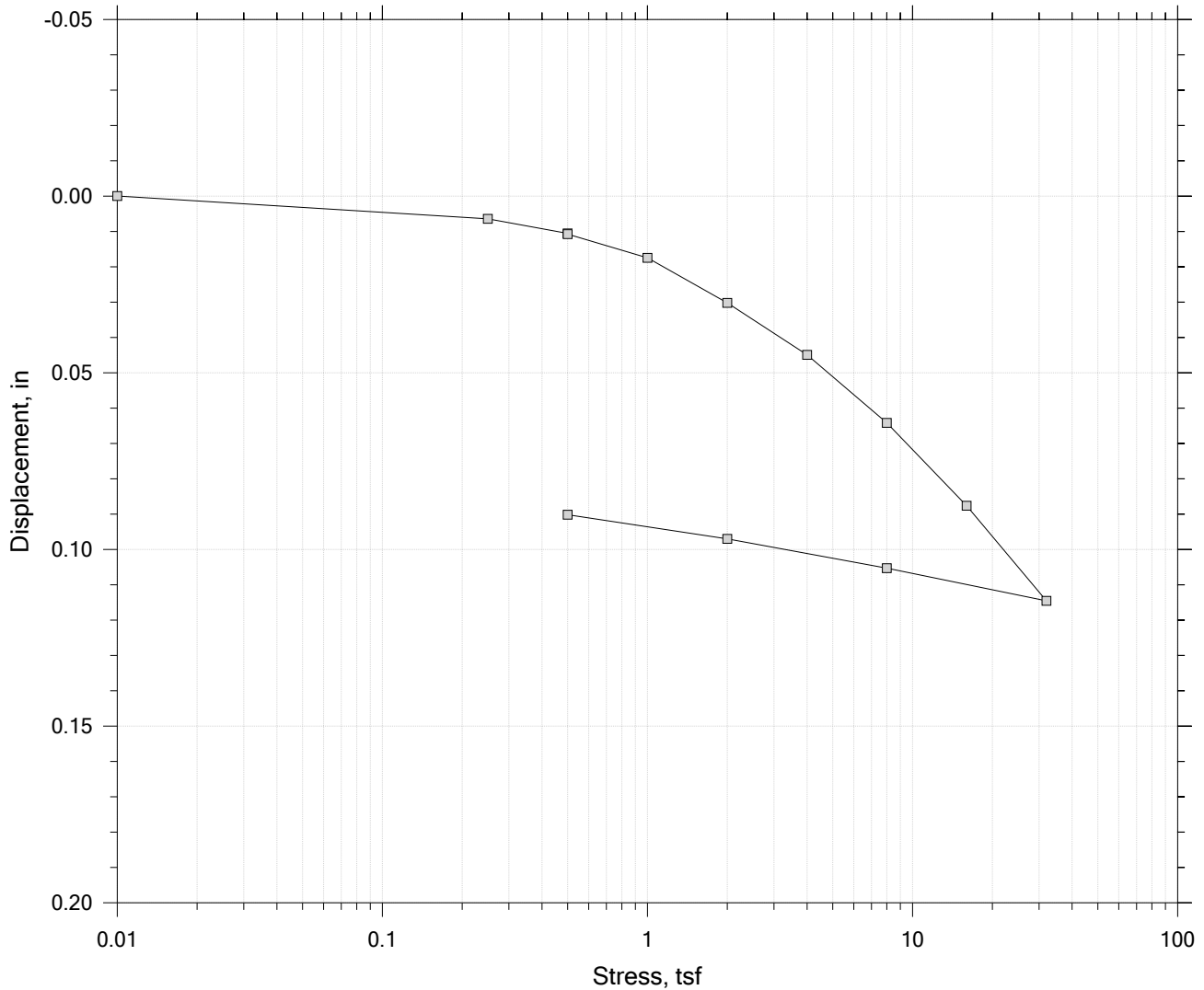


		Before Test	After Test	
Current Vertical Effective Stress, tsf: ---		Water Content, %	44.58	39.91
Preconsolidation Stress, tsf: ---		Dry Unit Weight, pcf	79.374	90.264
Compression Ratio: ---		Saturation, %	107.12	124.25
Specimen Diameter, in: 2.37	Specimen Height, in: 0.966	Void Ratio	1.12	0.87
LL: 44	PL: 16	PI: 28	GS: 2.70	

Project Name: JVWCD Aquaduct	Location: See site plan	Project Number: 202301-40-23-01
Boring Number: 23-BH-07	Tester: JB	Checker:
Sample Number: 1	Test Date: 4-22-2024	Depth: 3-4.5'
Test Number: 1	Preparation: Shelby Tube	Elevation:
Description: Silt (plastic) ML		
Remarks: Load Frame #72. Collapse Swell		
Displacement at End of Increment		

Consolidation Test

Summary Report

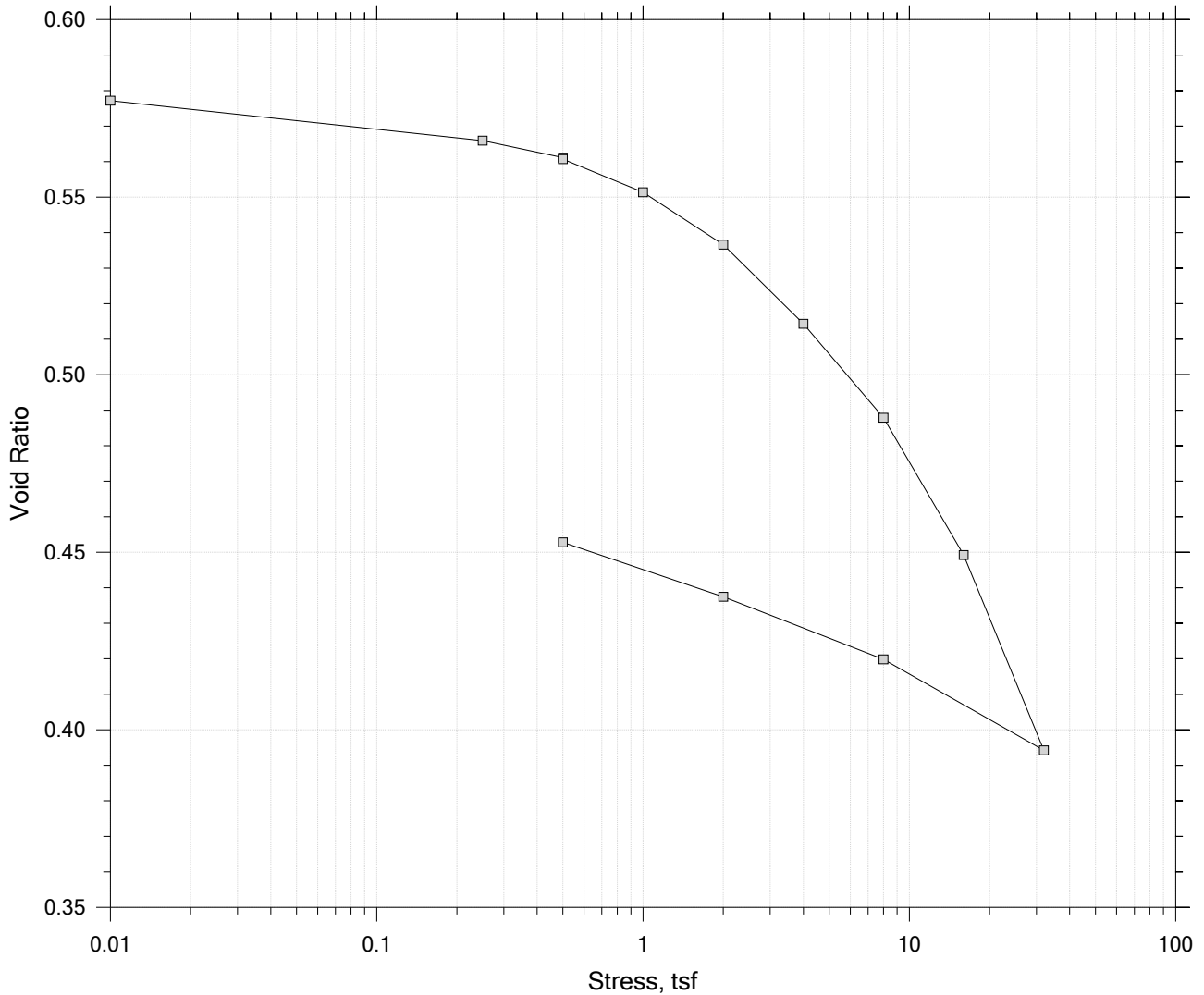


				Before Test	After Test	
Current Vertical Effective Stress, tsf: ---				Water Content, %	20.13	17.38
Preconsolidation Stress, tsf: ---				Dry Unit Weight, pcf	98.902	108.85
Compression Ratio: ---				Saturation, %	77.16	85.57
Specimen Diameter, in: 2.37		Specimen Height, in: 0.987		Void Ratio	0.70	0.55
LL: 30	PL: 18	PI: 12	GS: 2.70	Back Pressure, tsf	0.001152	0.001152

Project Name: JWCD Aquaduct	Location: See site plan	Project Number: 202301-40-23-01
Boring Number: 23-BH-09	Tester: LP	Checker:
Sample Number: 1	Test Date: 4/17/2024	Depth: 21-22.5'
Test Number: 1	Preparation: Shelby Tube	Elevation:
Client:	Classification:	Group Symbol:
Description: Lean Clay w/ Sand CL		
Remarks: Load frame #71. Collapse Swell		
Displacement at End of Increment		

Consolidation Test

Summary Report



				Before Test	After Test	
Current Vertical Effective Stress, tsf: ---				Water Content, %	21.04	18.52
Preconsolidation Stress, tsf: ---				Dry Unit Weight, pcf	106.89	116.02
Compression Ratio: ---				Saturation, %	98.46	110.47
Specimen Diameter, in: 2.37		Specimen Height, in: 0.97		Void Ratio	0.58	0.45
LL: 27	PL: 19	PI: 8	GS: 2.70	Back Pressure, tsf	4.08	4.112

Project Name: JVWCD	Location: See site plan	Project Number: 202301-40-23-01
Boring Number: 23-BH-15	Tester: JB	Checker:
Sample Number: 1	Test Date: 4-22-2024	Depth: 3-4.5'
Test Number: 1	Preparation: Shelby Tube	Elevation:
Description: Lean Clay CL		
Remarks: Loadframe #69 Colapse Swell		
Displacement at End of Increment		

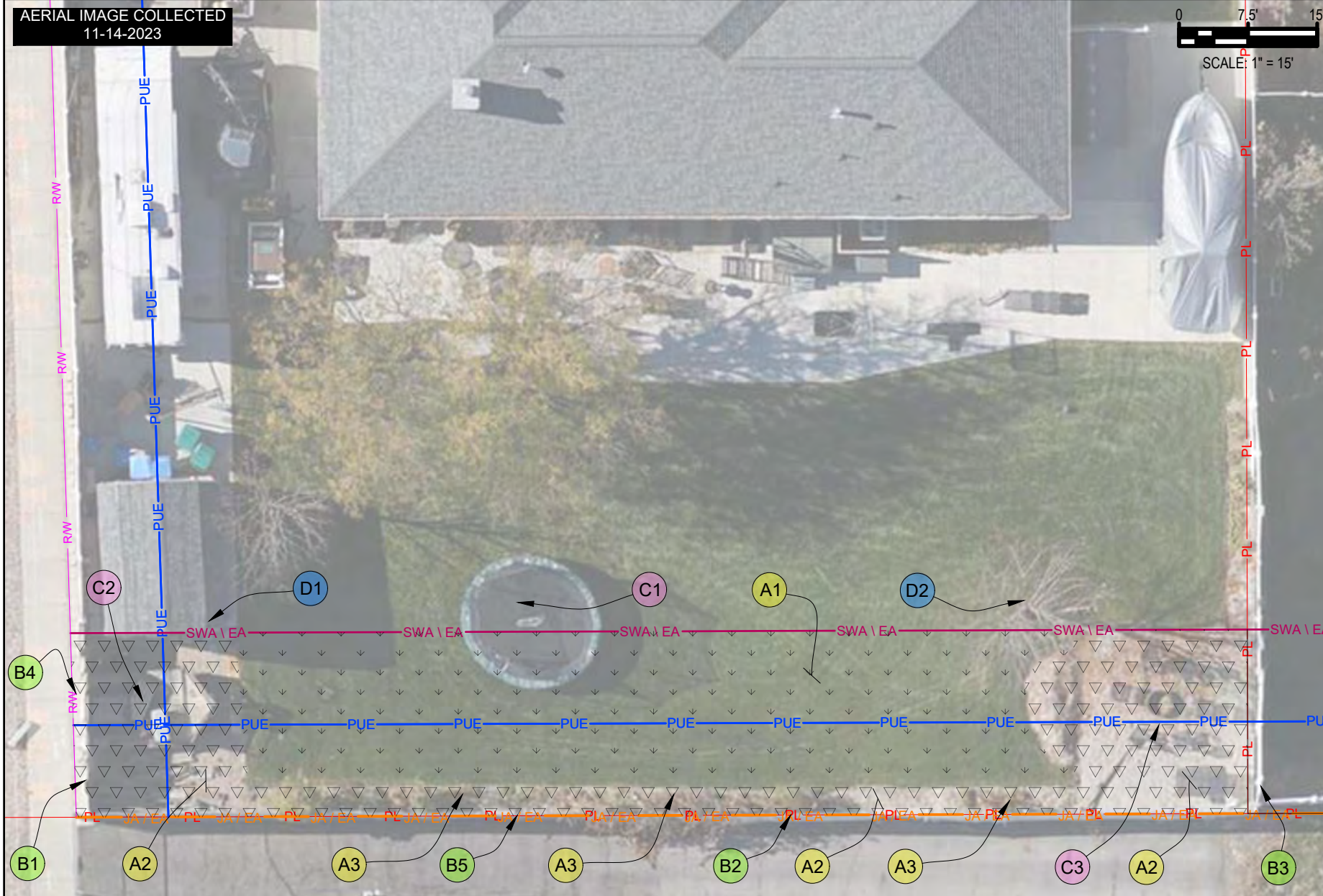
APPENDIX B

COST TO CURE EXHIBITS

OVERVIEW



PARCEL PLAN : 12585 SOUTH 3240 WEST (R03)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA | EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — EXISTING PROPERTY LINE
- JA / EA — EXISTING JORDAN AQUEDUCT EASEMENT
- OTHER LANDSCAPE MATERIALS
- CONCRETE FLAT WORK
- GRADE RESTORATION
- SOD

- A# ITEMS TO BE REMOVED BY JWVCD CONTRACTOR WITH COMPENSATION TO THE HOMEOWNER FOR REPLACEMENT
- B# ITEMS TO BE REMOVED AND REPLACED BY JWVCD CONTRACTOR UNLESS OTHERWISE NOTED
- C# HOMEOWNER TO REMOVE FROM EASEMENT PRIOR TO CONSTRUCTION
- D# PROTECT IN PLACE
- ARROW TERMINATOR TO POINT TO AN ITEM
- ARROW TERMINATOR TO POINT TO AREA

SUMMARY TABLE

ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWVCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	1460	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
A2	1100	SQ	GRAVEL / FABRIC
A3	3	LUMP	HEDGEROW (AT LEAST 3 BUSHES OR FLOWERING VEGETATION)
B1	20	FT	VINYL FENCE
B2	130	FT	CHAIN LINK FENCE (WITH PRIVACY) WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWVCD
B3	20	FT	VINYL FENCE (SHARED WITH 12555 SOUTH)
B4	20	FT	MODULAR BLOCK RETAINING WALL
B5	130	FT	RAILROAD TIE RETAINING
C1	-	-	OUTDOOR TRAMPOLINE (SEE NOTE 2)
C2	-	-	WOOD SCRAPS (SEE NOTE 2)
C3	-	-	FIRE PIT & PATIO FURNITURE (SEE NOTE 2)
D1	-	-	SHED
D2	-	-	TREE

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
- HOMEOWNERS SHALL REMOVE ALL NON-PERMANENT ITEMS FROM THE SOUTHWEST AQUEDUCT EASEMENT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES. THIS INCLUDES, BUT IS NOT LIMITED TO, SWING SETS, SHEDS, GARDEN BOXES AND SIMILAR NON-PERMANENT STRUCTURES THAT THE PROPERTY OWNER DESIRES TO PRESERVE.



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WARNING

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REVISIONS

DATE	REV #	DATE
01/08/2025		

DESIGNED: DANNY P.
DRAWN: DANNY P.
CHECKED: DALAN O.
PROJ#: UT-8262-23

SOUTHWEST AQUEDUCT REACH 2

COST TO CURE EXHIBIT

12585 SOUTH 3240 WEST (R03)

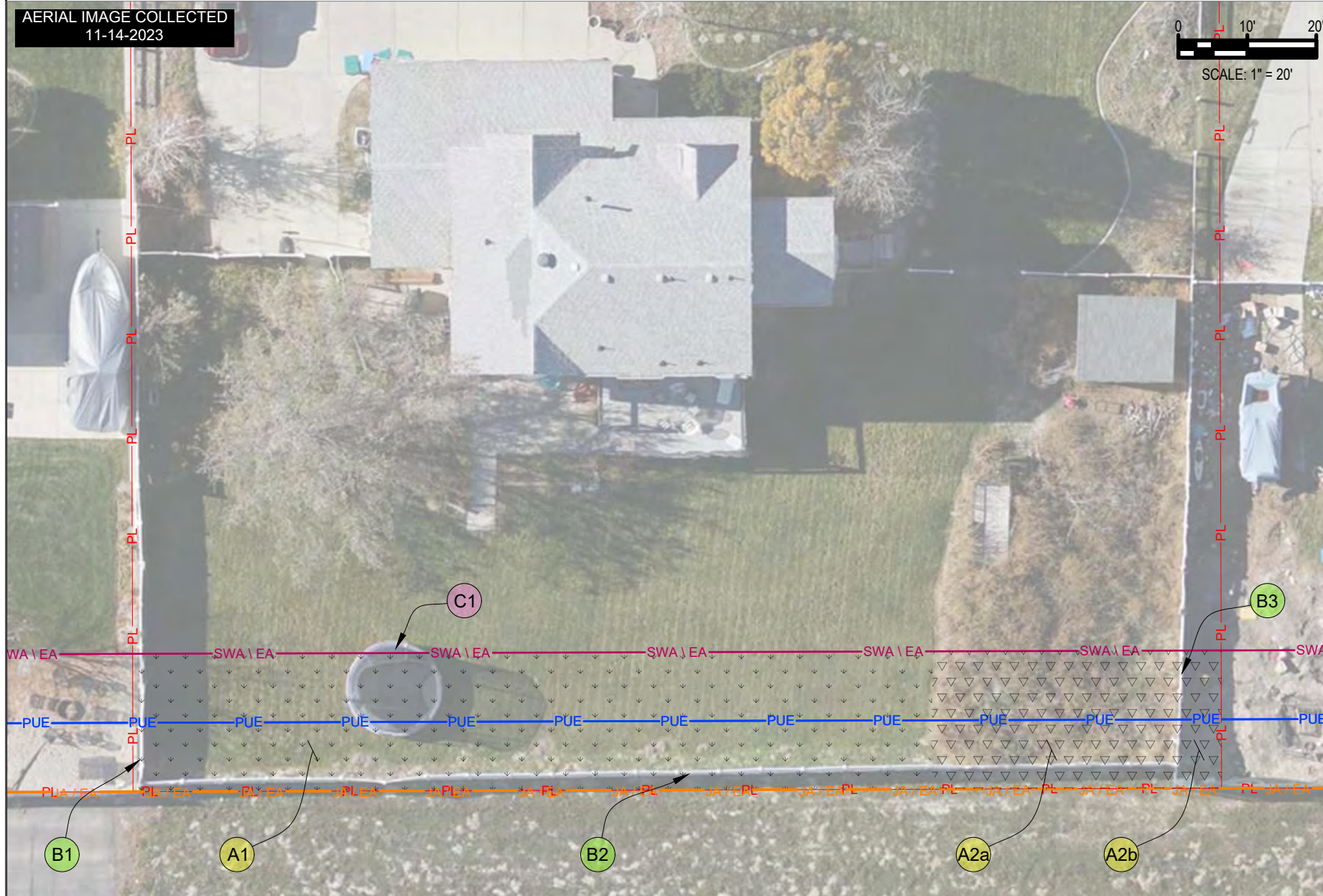


EXHIBIT: R03

OVERVIEW



PARCEL PLAN : 12555 SOUTH 3240 WEST (R04)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA \ EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
- JA / EA — JA / EA — EXISTING JORDAN AQUEDUCT EASEMENT
- OTHER LANDSCAPE MATERIALS
- CONCRETE FLAT WORK
- GRADE RESTORATION
- SOD
- A# ITEMS TO BE REMOVED BY JWVCD CONTRACTOR WITH COMPENSATION TO THE HOMEOWNER FOR REPLACEMENT
- B# ITEMS TO BE REMOVED AND REPLACED BY JWVCD CONTRACTOR UNLESS OTHERWISE NOTED
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- D# PROTECT IN PLACE
- ARROW TERMINATOR TO POINT TO AN ITEM
- ARROW TERMINATOR TO POINT TO AREA

SUMMARY TABLE			
ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWVCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	2320	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
A2a	715	SQ	TOP SOIL
A2b	125	SQ	TOP SOIL
B1	20	FT	VINYL FENCE (SHARED WITH 12585 SOUTH)
B2	150	FT	VINYL FENCE WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWVCD
B3	20	FT	VINYL FENCE (SHARED WITH 12535 SOUTH)
C1	-	-	OUTDOOR TRAMPOLINE (SEE NOTE 2)

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
- HOMEOWNERS SHALL REMOVE ALL NON-PERMANENT ITEMS FROM THE SOUTHWEST AQUEDUCT EASEMENT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES. THIS INCLUDES, BUT IS NOT LIMITED TO, SWING SETS, SHEDS, GARDEN BOXES AND SIMILAR NON-PERMANENT STRUCTURES THAT THE PROPERTY OWNER DESIRES TO PRESERVE.

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DRAWING INFO	REVISIONS
DATE: 01/08/2025	REV # / DATE
DESIGNED: DANNY P.	
CHECKED: DALAN O.	
PROJ#: UT-8262-23	

SOUTHWEST AQUEDUCT REACH 2
COST TO CURE EXHIBIT
12555 SOUTH 3240 WEST (R04)

EXHIBIT: R04

OVERVIEW



PARCEL PLAN : 12535 SOUTH 3240 WEST (R05)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA \ EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
- JA / EA — JA / EA — EXISTING JORDAN AQUEDUCT EASEMENT
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- GRADE RESTORATION
- SOD

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- ARROW TERMINATOR TO POINT TO AREA

SUMMARY TABLE

ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLE / IRRIGATION SYSTEM DURING CONSTRUCTION
A1a	125	SQ	TOP SOIL
A1b	570	SQ	TOP SOIL
A2	2045	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
A3	685	SQ	TOP SOIL
A4	20	FT	POST & RAIL FENCE FOR THE NORTH CORNER GARDEN
B1	20	FT	VINYL FENCE (SHARED WITH 12555 SOUTH)
B2	175	FT	CHAIN LINK FENCE WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWCD
B3	21	FT	VINYL FENCE (SHARED WITH 12515 SOUTH)
B4	3	EA	TREE (SEE NOTE 1)
C1	-	-	SURFACE STRUCTURE (SEE NOTE 2)
C2	-	-	GARDEN BOXES (SEE NOTE 2)
C3	-	-	FIRE PIT (SEE NOTE 2)

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
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DRAWING INFO	REVISIONS
DATE: 01/08/2025	REV # / DATE
DESIGNED: DANNY P.	
DRAWN: DANNY P.	
CHECKED: DALAN O.	
PROJ#: UT-8262-23	

SOUTHWEST AQUEDUCT REACH 2

COST TO CURE EXHIBIT

12535 SOUTH 3240 WEST (R05)

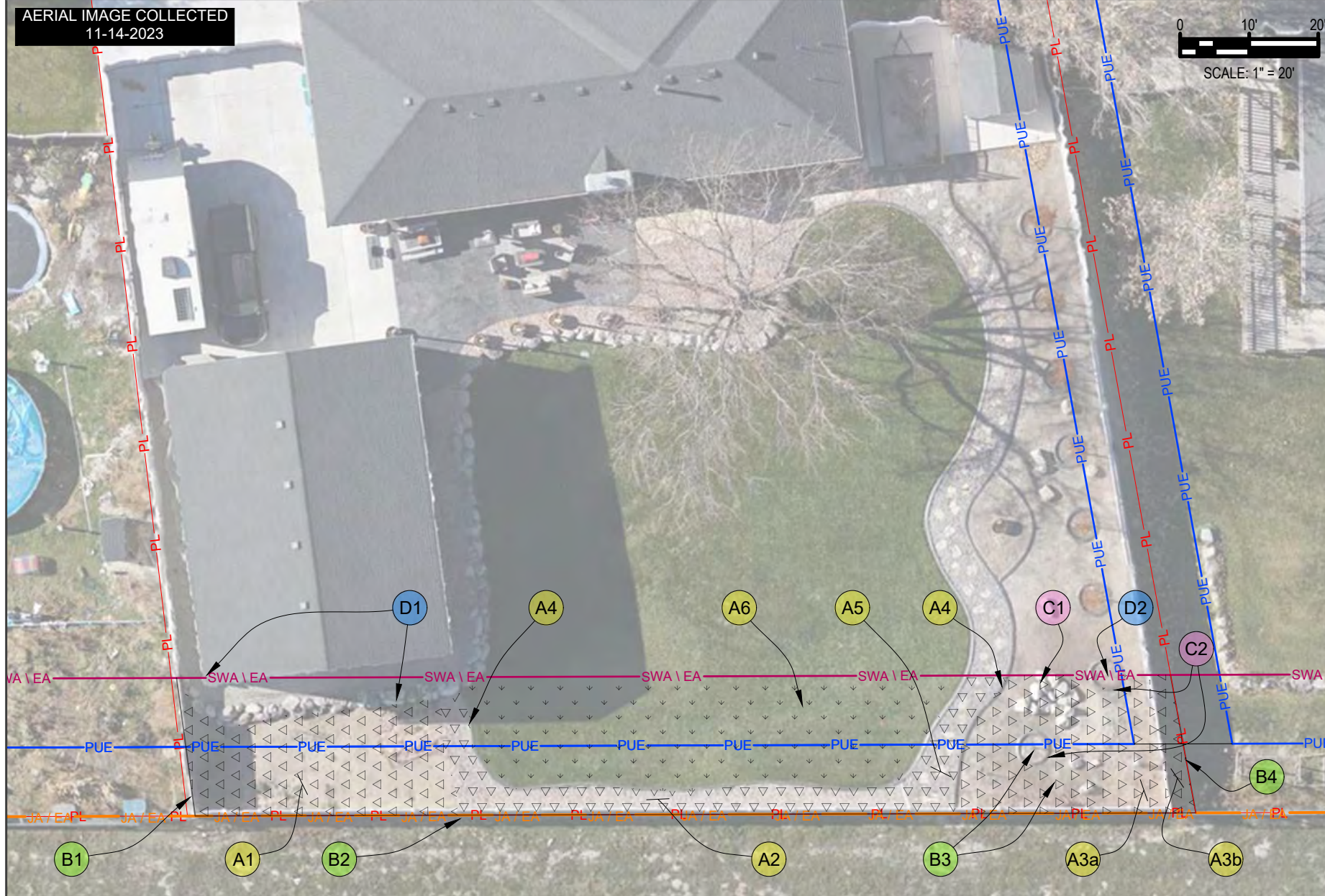


EXHIBIT:
R05

OVERVIEW



PARCEL PLAN : 12515 SOUTH 3240 WEST (R06)



- RW — EXISTING RIGHT OF WAY
- SWA | EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — EXISTING PROPERTY LINE
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SUMMARY TABLE

ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	570	SQ	TOP SOIL
A2	450	SQ	LANDSCAPE ROCK & FABRIC
A3a	543	SQ	TOP SOIL
A3b	67	SQ	TOP SOIL
A4	125	LF	CONCRETE CURBING
A5	7	EA	STEPPING STONES
A6	1065	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
B1	21	FT	VINYL FENCE (SHARED WITH 12535 SOUTH)
B2	147	FT	VINYL FENCE (INCLUDING SOLAR LIGHTING) WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWCD
B3	3	EA	TREES (SEE NOTE 1)
B4	22	FT	VINYL FENCE (SHARED WITH 12495 SOUTH)
C1	-	-	BOULDER PILE & SCATTERED BOULDERS (SEE NOTE 2)
C2	-	-	TREE COLLAR (SEE NOTE 2)
D1	-	-	STRUCTURE & ROCK WALL
D2	-	-	TREE

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
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REVISIONS

REV #	DATE

DRAWING INFO

DATE	01/08/2025
DESIGNED	
DRAWN	DANNY P.
CHECKED	DALAN O.
PROJ#	UT-8262-23

SOUTHWEST AQUEDUCT REACH 2

COST TO CURE EXHIBIT

12515 SOUTH 3240 WEST (R06)



EXHIBIT: R06

OVERVIEW



PARCEL PLAN : 12495 SOUTH 3240 WEST (R07)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA \ EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
- JA / EA — JA / EA — EXISTING JORDAN AQUEDUCT EASEMENT
- OTHER LANDSCAPE MATERIALS
- CONCRETE FLAT WORK
- GRADE RESTORATION
- SOD
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SUMMARY TABLE

ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1a	1115	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
A1b	33	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
B1	22	FT	VINYL FENCE (SHARED WITH 12515 SOUTH)
B2a	970	SQ	SITE RESTORATION
B2b	34	SQ	SITE RESTORATION
B3	100	FT	CHAIN LINK FENCE WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWCD
B4	20	FT	MASONRY BLOCK WALL (SHARED WITH 12475 SOUTH)
B5	1	LUMP	REMOVE & REPLACE EXISTING IRRIGATION SERVICE / STANDPIPE (LOCATION UNKNOWN)
C1	-	-	ROW OF GARDEN BOXES (SEE NOTE 2)
D1	-	-	ROCK WALL

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
- HOMEOWNERS SHALL REMOVE ALL NON-PERMANENT ITEMS FROM THE SOUTHWEST AQUEDUCT EASEMENT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES. THIS INCLUDES, BUT IS NOT LIMITED TO, SWING SETS, SHEDS, GARDEN BOXES AND SIMILAR NON-PERMANENT STRUCTURES THAT THE PROPERTY OWNER DESIRES TO PRESERVE.



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DRAWN: DANNY P.	
CHECKED: DALAN O.	
PROJ#: UT-8262-23	

SOUTHWEST AQUEDUCT REACH 2
 COST TO CURE EXHIBIT
 12495 SOUTH 3240 WEST (R07)

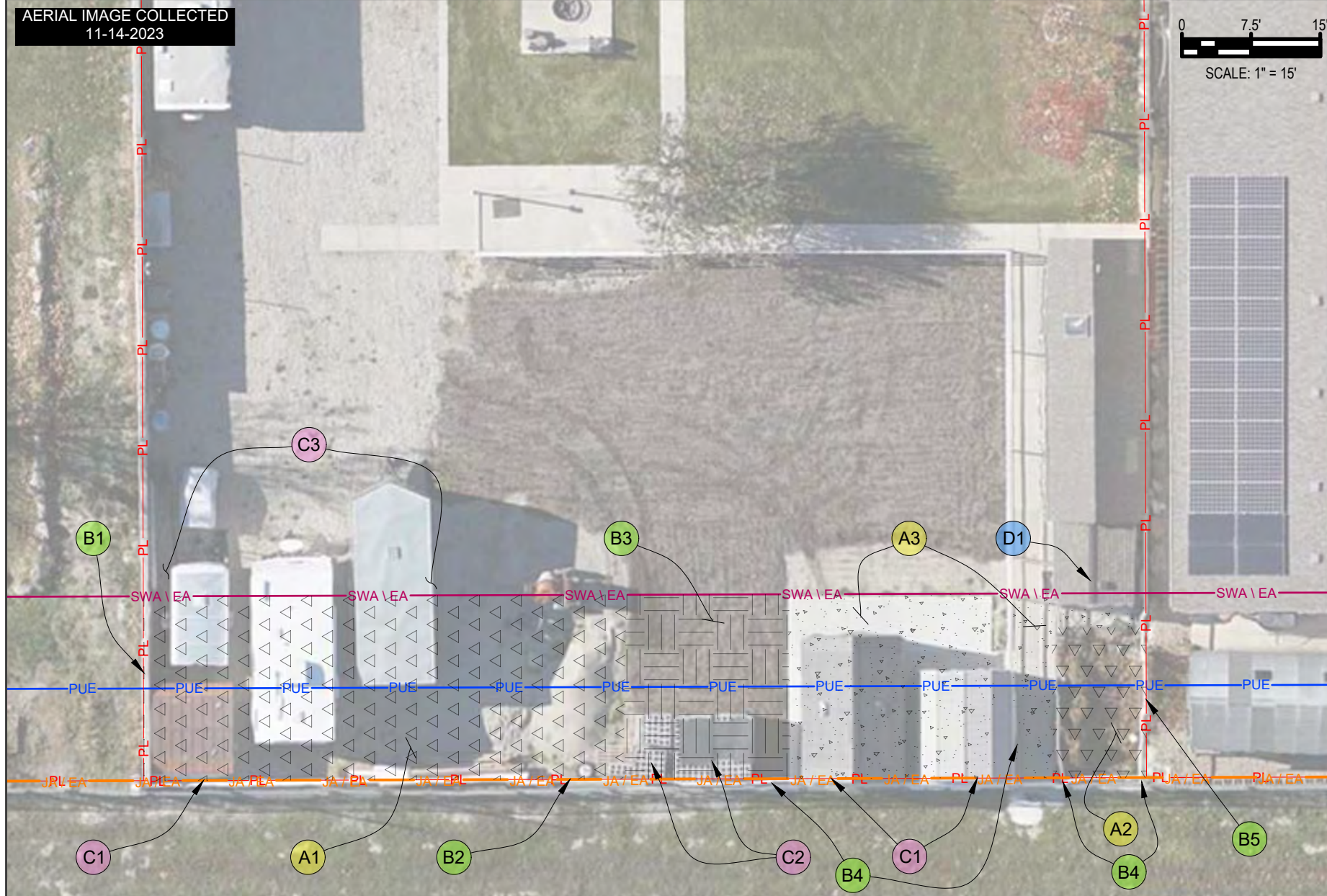


EXHIBIT:
R07

OVERVIEW



PARCEL PLAN : 12475 SOUTH 3240 WEST (R08)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA \ EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
- JA / EA — JA / EA — EXISTING JORDAN AQUEDUCT EASEMENT
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- CONCRETE FLAT WORK
- GRADE RESTORATION
- SOD
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- C# HOMEOWNER TO REMOVE FROM EASEMENT PRIOR TO CONSTRUCTION
- D# PROTECT IN PLACE
- ARROW TERMINATOR TO POINT TO AN ITEM
- ARROW TERMINATOR TO POINT TO AREA

SUMMARY TABLE			
ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	1401	SQ	GRAVEL / FABRIC
A2	165	SQ	TOP SOIL
A3	555	SQ	CONCRETE FLATWORK
B1	20	FT	MASONRY BLOCK WALL (SHARED WITH 12495 SOUTH)
B2	110	FT	CHAIN LINK FENCE WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWCD
B3	356	SQ	SITE RESTORATION
B4	155	FT	WELDED STEEL POLE FENCE
B5	20	FT	CHAIN LINK FENCE (SHARED WITH 12459 SOUTH)
C1	-	-	SHED (SEE NOTE 2)
C2	-	-	STACK OF MASONRY BLOCKS (SEE NOTE 2)
C3	-	-	TRAILERS / RESIDENTIAL GOODS & STORAGE (SEE NOTE 2)
D1	-	-	STRUCTURE

PROPERTY NOTES:

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SOUTHWEST AQUEDUCT REACH 2
COST TO CURE EXHIBIT
12475 SOUTH 3240 WEST (R08)

EXHIBIT: R08

PAGE 01

OVERVIEW



PARCEL PLAN : 12459 SOUTH 3240 WEST (R09)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA \ EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
- JA / EA — JA / EA — EXISTING JORDAN AQUEDUCT EASEMENT
- OTHER LANDSCAPE MATERIALS
- CONCRETE FLAT WORK
- GRADE RESTORATION
- SOD
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- ARROW TERMINATOR TO POINT TO AREA

SUMMARY TABLE

ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWVCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	810	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
A2	580	SQ	CONCRETE FLAT WORK
B1	20	FT	CHAIN LINK FENCE (SHARED WITH 12475 SOUTH)
B2	690	SQ	SITE RESTORATION
B3	110	FT	CHAIN LINK FENCE WITH 4-FT MAN GATE. GATE LOCATION TO BE DETERMINED BY JWVCD
B4	1	EA	TREE (SEE NOTE 1)
B5	20	FT	VINYL FENCE (SHARED WITH 12445 SOUTH)
B6	110	FT	RAILROAD TIE RETAINING
C1	-	-	SHED (SEE NOTE 2)
C2	-	-	SURFACE STRUCTURE (SEE NOTE 2)
C3	-	-	CHICKEN COOP (SEE NOTE 2)
C4	-	-	FIRE PIT (SEE NOTE 2)
D1	-	-	LARGE STRUCTURE

PROPERTY NOTES:

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SOUTHWEST AQUEDUCT REACH 2

COST TO CURE EXHIBIT

12459 SOUTH 3240 WEST (R09)



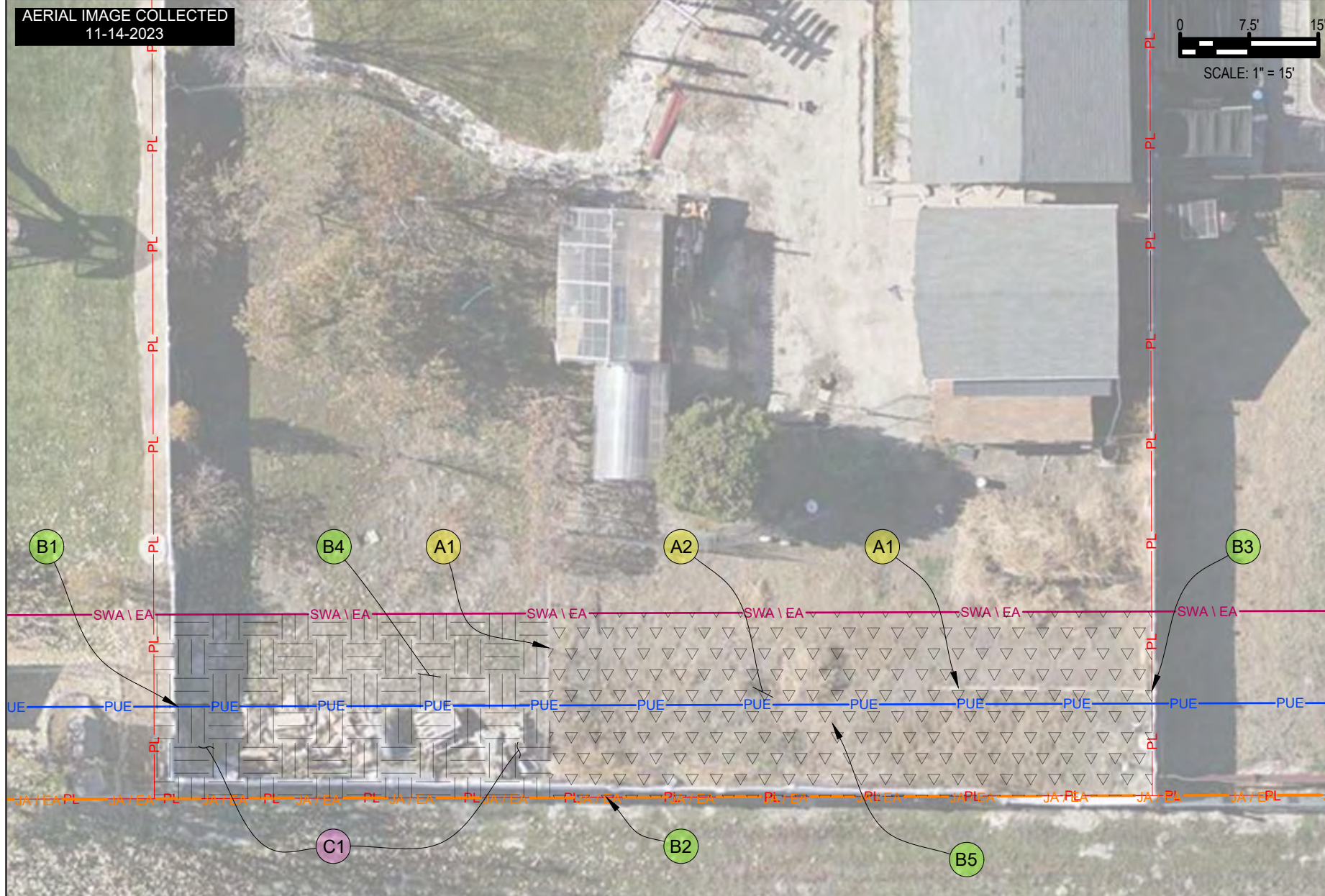
EXHIBIT:
R09

PAGE

OVERVIEW



PARCEL PLAN : 12445 SOUTH 3240 WEST (R10)



LEGEND

- RW — EXISTING RIGHT OF WAY
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SUMMARY TABLE

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	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	43	FT	CONCRETE CURBING
A2	1310	SQ	TOP SOIL PATCH FOR GARDEN REMOVAL & REMOVAL OF SPRINKLER / IRRIGATION SYSTEM
B1	20	FT	VINYL FENCE (SHARED WITH 12459 SOUTH)
B2	110	FT	VINYL FENCE WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWCD
B3	20	FT	VINYL FENCE (SHARED WITH 12405 SOUTH)
B4	860	SQ	SITE RESTORATION
B5	1	LUMP	REMOVE & REPLACE EXISTING IRRIGATION SERVICE / STANDPIPE (LOCATION UNKNOWN)
C1	-	-	WOOD & MISC. SCRAPS (SEE NOTE 2)

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
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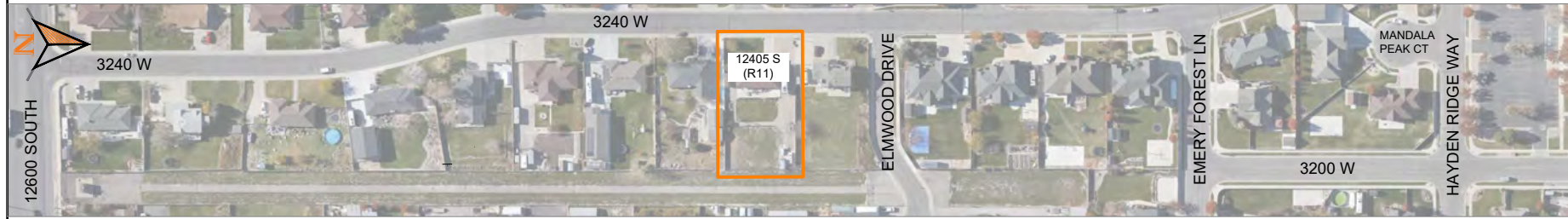
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PROJ.#		

SOUTHWEST AQUEDUCT REACH 2
 COST TO CURE EXHIBIT
 12445 SOUTH 3240 WEST (R10)



EXHIBIT:
R10

OVERVIEW



PARCEL PLAN : 12405 SOUTH 3240 WEST (R11)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA | EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — EXISTING PUBLIC UTILITY EASEMENT
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SUMMARY TABLE			
ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	521	SQ	CONCRETE FLATWORK
B1	20	FT	VINYL FENCE (SHARED WITH 12445 SOUTH)
B2	110	FT	CHAIN LINK FENCE WITH PRIVACY, WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWCD
B3	20	FT	CHAIN LINK FENCE WITH PRIVACY (SHARED WITH 12397 SOUTH)
B4	1650	SQ	SITE RESTORATION
B5	105	FT	WELDED STEEL POLE FENCE
C1	-	-	UNSECURED FENCE SECTION
C2	-	-	VEHICLES / RESIDENTIAL GOODS & STORAGE (SEE NOTE 2)

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
- HOMEOWNERS SHALL REMOVE ALL NON-PERMANENT ITEMS FROM THE SOUTHWEST AQUEDUCT EASEMENT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES. THIS INCLUDES, BUT IS NOT LIMITED TO, SWING SETS, SHEDS, GARDEN BOXES AND SIMILAR NON-PERMANENT STRUCTURES THAT THE PROPERTY OWNER DESIRES TO PRESERVE.

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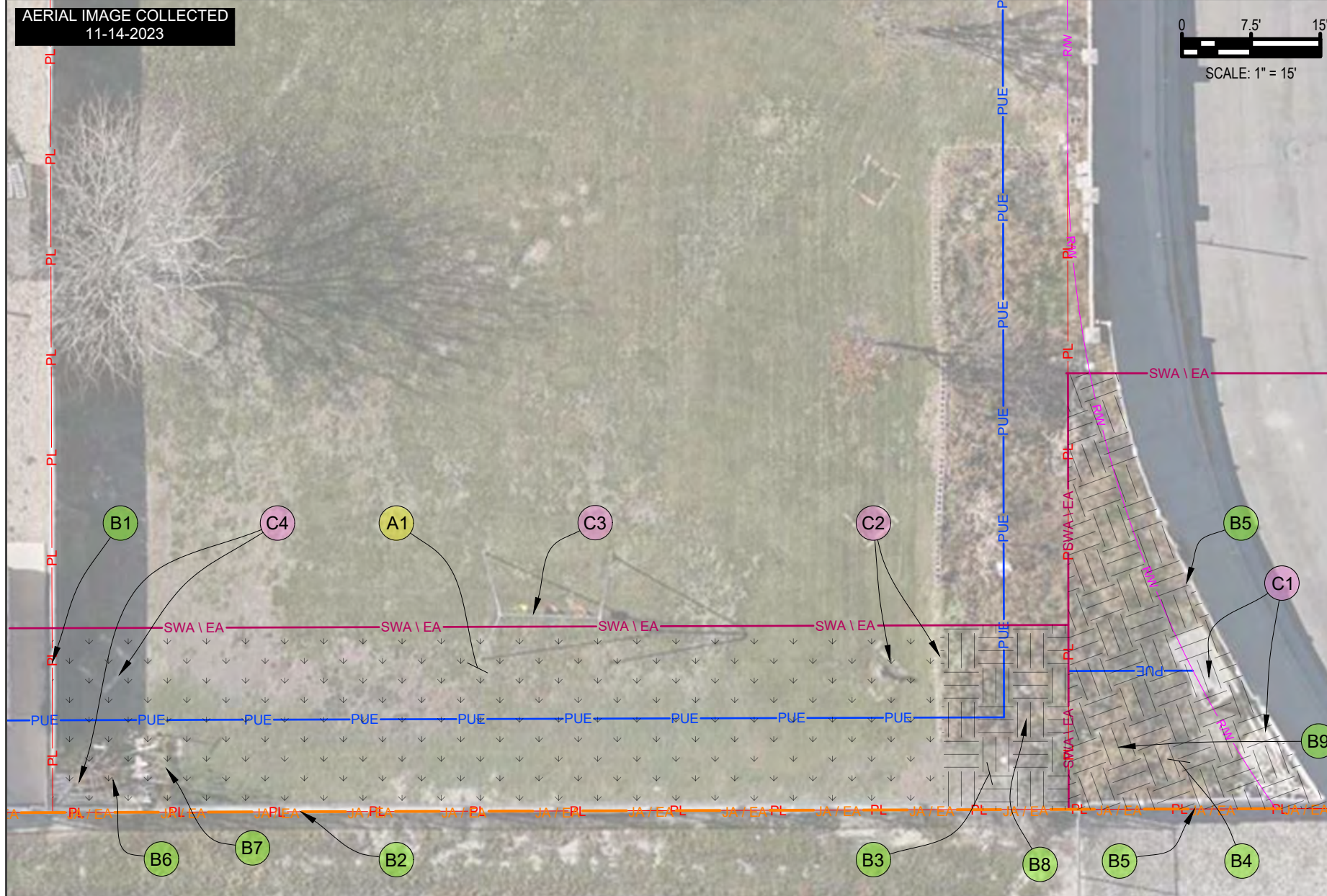
SOUTHWEST AQUEDUCT REACH 2
COST TO CURE EXHIBIT
12405 SOUTH 3240 WEST (R11)

EXHIBIT: R11
 PAGE 01

OVERVIEW



PARCEL PLAN : 12397 SOUTH 3240 WEST (R12)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA | EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
- JA | EA — JA | EA — EXISTING JORDAN AQUEDUCT EASEMENT
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SUMMARY TABLE

ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWVCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	1930	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
B1	20	FT	CHAIN LINK FENCE WITH PRIVACY (SHARED WITH 12405 SOUTH)
B2	110	FT	CHAIN LINK FENCE (WITH PRIVACY) WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWVCD
B3	275	SQ	SITE RESTORATION WITHIN PROPERTY LINE
B4	700	SQ	SITE RESTORATION ON TRIANGULAR STRIP
B5	80	FT	VINYL FENCE WITH 2 GATE PANELS
B6	1	LUMP	IRRIGATION SERVICE / STANDPIPE
B7	1	LUMP	IRRIGATION BUTTERFLY VALVE
B8	1	LUMP	STORM DRAIN BOX - REMOVE ONLY
B9	1	LUMP	IRRIGATION BOX
C1	-	-	WOOD AND MISC. SCRAPS (SEE NOTE 2)
C2	-	-	CINDER BLOCKS (SEE NOTE 2)
C3	-	-	SWING SET FRAME (SEE NOTE 2)
C4	-	-	WOOD AND MISC. SCRAPS (SEE NOTE 2)

PROPERTY NOTES:

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SOUTHWEST AQUEDUCT REACH 2
 COST TO CURE EXHIBIT
 12397 SOUTH 3240 WEST (R12)



EXHIBIT:
R12

OVERVIEW



PARCEL PLAN : 12383 SOUTH SAGE GLEN DR (R13)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA | EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
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SUMMARY TABLE			
ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	890	SQ	GRAVEL / FABRIC
A2	55	SQ	BARK MULCH BED
A3	2620	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
A4	630	SQ	CONCRETE FLATWORK
B1	140	FT	VINYL FENCE RUNS SOUTH TO CORNER BEND, CONTINUES TO PROPERTY LINE INCLUDES TWO-GATE PANEL SYSTEM WITH REMOVABLE POST (SOUTH SIDE) & MAN GATE (EAST SIDE) GATE LOCATION TO BE DETERMINED BY JWCD
B2	85	FT	CHAIN LINK FENCE RUNNING NORTH ALONG EXISTING JORDAN AQUEDUCT EASEMENT - REMOVE ONLY
B3	450	SQ	SITE RESTORATION
B4	50	FT	VINYL FENCE (SHARED WITH 12377 SOUTH)
B5	1	EA	TREE (SEE NOTE 1)
C1	-	-	TRAILER (SEE NOTE 2)
C2	-	-	METAL FRAMES AND MISC. SCRAPS (SEE NOTE 2)
C3	-	-	BASKETBALL HOOP (SEE NOTE 2)

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
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SOUTHWEST AQUEDUCT REACH 2
COST TO CURE EXHIBIT
12383 SOUTH SAGE GLEN DR (R13)

EXHIBIT:
R13
 PAGE 01

OVERVIEW



PARCEL PLAN : 12377 SOUTH SAGE GLEN DR (R14)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA | EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
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	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	1565	SQ	BARK / MULCH BED
A2	1	LUMP	HEDGEROW (AT LEAST 5 BUSHES OR FLOWERING VEGETATION)
A3	1	LUMP	HEDGEROW (AT LEAST 5 BUSHES OR FLOWERING VEGETATION)
A4	1	LUMP	HEDGEROW (AT LEAST 5 BUSHES OR FLOWERING VEGETATION)
A5	240	FT	CONCRETE CURBING
A6	72	FT	ROCK EDGING AROUND BUSHES & SOUTH MULCH BED
A7	2020	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
B1	3	EA	REMOVE TREES (SEE NOTE 1)
B2	50	FT	VINYL FENCE (SHARED WITH 12383 SOUTH)
B3	105	FT	CHAIN LINK FENCE WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWCD
B4	50	FT	VINYL FENCE (SHARED WITH 12353 SOUTH)
B5	1270	FT	SITE RESTORATION
C1	-	-	SWING SET FRAME (SEE NOTE 2)
C2	-	-	WOODEN RAIL FENCE (SEE NOTE 2)
C3	-	-	GARDEN BOXES (SEE NOTE 2)
C4	-	-	SHED & MISC. SCRAPS (SEE NOTE 2)

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
- HOMEOWNERS SHALL REMOVE ALL NON-PERMANENT ITEMS FROM THE SOUTHWEST AQUEDUCT EASEMENT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES. THIS INCLUDES, BUT IS NOT LIMITED TO, SWING SETS, SHEDS, GARDEN BOXES AND SIMILAR NON-PERMANENT STRUCTURES THAT THE PROPERTY OWNER DESIRES TO PRESERVE.



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REVISIONS

DATE	REV #	DATE
01/08/2025		

DESIGNED: DANNY P.
DRAWN: DANNY P.
CHECKED: DALAN O.
PROJ#: UT-8262-23

SOUTHWEST AQUEDUCT REACH 2

COST TO CURE EXHIBIT

12377 SOUTH SAGE GLEN DR (R14)



EXHIBIT: R14

OVERVIEW



PARCEL PLAN : 12353 SOUTH SAGE GLEN DR (R15)



SUMMARY TABLE

ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	1680	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
A2	1825	SQ	CONCRETE FLATWORK
A3	1	EA	CONCRETE STAIRS
B1	2	EA	REMOVE TREE (SEE NOTE 1)
B2	50	FT	VINYL FENCE (SHARED WITH 12377 SOUTH)
B3	105	FT	VINYL FENCE WITH 4-FT GATE. GATE LOCATION TO BE DETERMINED BY JWCD
B4	1360	SQ	SITE RESTORATION
B5	50	FT	VINYL FENCE (SHARED WITH 12337 SOUTH)
B6	65	FT	CHAIN LINK FENCE RUNNING ALONG EXISTING JORDAN AQUEDUCT EASEMENT - REMOVE ONLY
C1	-	-	WOOD AND MISC. SCRAPS (SEE NOTE 2)
C2	-	-	OUTDOOR TRAMPOLINE (SEE NOTE 2)
C3	-	-	BASKETBALL HOOP (SEE NOTE 2)

PROPERTY NOTES:

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- HOMEOWNERS SHALL REMOVE ALL NON-PERMANENT ITEMS FROM THE SOUTHWEST AQUEDUCT EASEMENT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES. THIS INCLUDES, BUT IS NOT LIMITED TO, SWING SETS, SHEDS, GARDEN BOXES AND SIMILAR NON-PERMANENT STRUCTURES THAT THE PROPERTY OWNER DESIRES TO PRESERVE.

LEGEND

R/W	EXISTING RIGHT OF WAY	A#	ITEMS TO BE REMOVED BY JWCD CONTRACTOR WITH COMPENSATION TO THE HOMEOWNER FOR REPLACEMENT
SWA \ EA	EXISTING SOUTHWEST AQUEDUCT EASEMENT	B#	ITEMS TO BE REMOVED AND REPLACED BY JWCD CONTRACTOR UNLESS OTHERWISE NOTED
PUE	EXISTING PUBLIC UTILITY EASEMENT	C#	HOMEOWNER TO REMOVE FROM EASEMENT PRIOR TO CONSTRUCTION
PL	EXISTING PROPERTY LINE	D#	PROTECT IN PLACE
JA / EA	EXISTING JORDAN AQUEDUCT EASEMENT	ARROW TERMINATOR TO POINT TO AN ITEM	
	OTHER LANDSCAPE MATERIALS	ARROW TERMINATOR TO POINT TO AREA	
	CONCRETE FLAT WORK		
	GRADE RESTORATION		
	SOD		

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REV #	DATE	DESCRIPTION

DRAWING INFO: DATE 01/08/2025, DESIGNED DANNY P., DRAWN DANNY P., CHECKED DALAN O., PROJ.# UT-8262-23

SOUTHWEST AQUEDUCT REACH 2
 COST TO CURE EXHIBIT
 12353 SOUTH SAGE GLEN DR (R15)

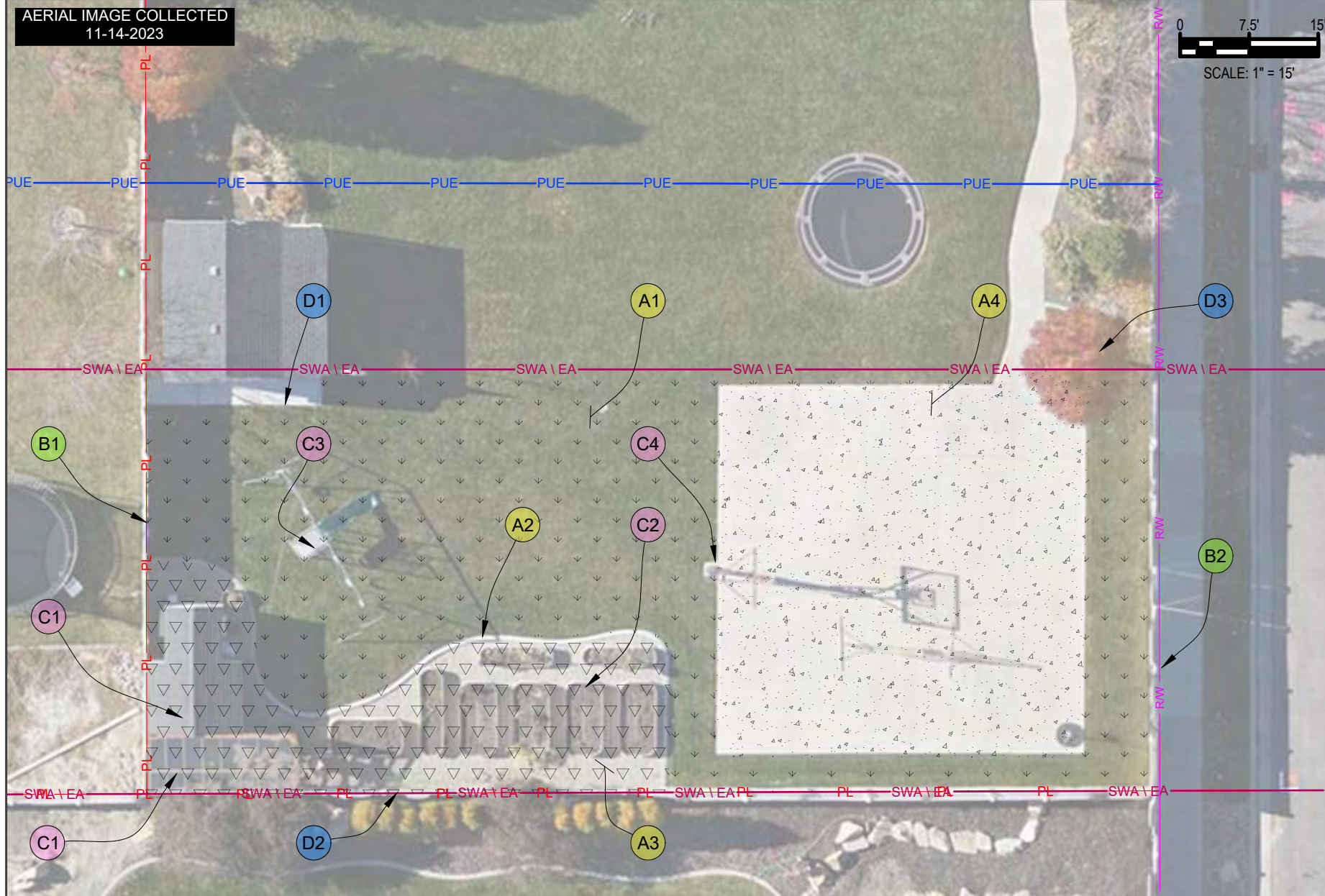
EXHIBIT: R15

PAGE 01

OVERVIEW



PARCEL PLAN : 12337 SOUTH SAGE GLEN DR (R16)



LEGEND

- RW — EXISTING RIGHT OF WAY
- SWA | EA — EXISTING SOUTHWEST AQUEDUCT EASEMENT
- PUE — PUE — EXISTING PUBLIC UTILITY EASEMENT
- PL — PL — EXISTING PROPERTY LINE
- JA | EA — JA | EA — EXISTING JORDAN AQUEDUCT EASEMENT
- OTHER LANDSCAPE MATERIALS
- CONCRETE FLAT WORK
- GRADE RESTORATION
- SOD

- A# ITEMS TO BE REMOVED BY JWCD CONTRACTOR WITH COMPENSATION TO THE HOMEOWNER FOR REPLACEMENT
- B# ITEMS TO BE REMOVED AND REPLACED BY JWCD CONTRACTOR UNLESS OTHERWISE NOTED
- C# HOMEOWNER TO REMOVE FROM EASEMENT PRIOR TO CONSTRUCTION
- D# PROTECT IN PLACE
- ARROW TERMINATOR TO POINT TO AN ITEM
- ARROW TERMINATOR TO POINT TO AREA

SUMMARY TABLE

ITEM #	QUANTITY	UNIT	DESCRIPTION
	1	LUMP	HOMEOWNER TO CAP EXISTING SPRINKLER SYSTEM PRIOR TO JWCD CONSTRUCTION ACTIVITIES
	1	LUMP	HOMEOWNER TO PROVIDE TEMPORARY SPRINKLER / IRRIGATION SYSTEM DURING CONSTRUCTION
A1	2410	SQ	SOD & REMOVAL OF SPRINKLER SYSTEM
A2	90	FT	CONCRETE CURBING
A3	940	SQ	GRAVEL / FABRIC
A4	1635	SQ	CONCRETE FLATWORK
B1	50	FT	VINYL FENCE (SHARED WITH 12353 SOUTH)
B2	50	FT	8-FT VINYL FENCE WITH 4-FT MAN GATE GATE LOCATION TO BE DETERMINED BY JWCD
C1	-	-	REMOVE SURFACE STRUCTURES (SEE NOTE 2)
C2	-	-	REMOVE GARDEN BOXES (SEE NOTE 2)
C3	-	-	SWING SET FRAME (SEE NOTE 2)
C4	-	-	BASKETBALL HOOP (SEE NOTE 2)
D1	-	-	SIDE WALK & LARGER SHED
D2	-	-	VINYL FENCE
D3	-	-	TREE & PLANTS

PROPERTY NOTES:

- ALL NON-APPROVED ENCROACHMENTS WITHIN THE SOUTHWEST AQUEDUCT EASEMENT, WILL BE REMOVED DURING CONSTRUCTION UNLESS OTHERWISE AGREED UPON AND DESCRIBED WITHIN AN EXECUTED ENCROACHMENT AGREEMENT WITH JORDAN VALLEY WATER CONSERVANCY DISTRICT. THIS INCLUDES, BUT IS NOT LIMITED TO, FOOTINGS, FOUNDATIONS, RETAINING WALLS, TREES, AND OTHER PERMANENT STRUCTURES THAT ARE NOT AUTHORIZED WITHIN THE SOUTHWEST AQUEDUCT EASEMENT.
- HOMEOWNERS SHALL REMOVE ALL NON-PERMANENT ITEMS FROM THE SOUTHWEST AQUEDUCT EASEMENT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES. THIS INCLUDES, BUT IS NOT LIMITED TO, SWING SETS, SHEDS, GARDEN BOXES AND SIMILAR NON-PERMANENT STRUCTURES THAT THE PROPERTY OWNER DESIRES TO PRESERVE.



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01/08/2025		DANNY P.	DANNY P.	DALAN O.	UT-8262-23

SOUTHWEST AQUEDUCT REACH 2

COST TO CURE EXHIBIT

12337 SOUTH SAGE GLEN DR (R16)



EXHIBIT:
R16

APPENDIX C

ATTACHMENTS FOR 01 71 51 AQUEDUCT PROTECTION AND MONITORING

01 71 51 – REFERENCE ATTACHMENT
SF299 – 11400S SWA-2
SF299 – SWA-2

01 71 51 – REFERENCE ATTACHMENT

EXHIBIT "A"

ENCROACHMENT GUIDELINES FOR JORDAN AQUEDUCT, REACH 1, 2, 3 & 4

PROTECTION CRITERIA

A. Surface structures that generally will be allowed to be constructed within United States rights-of-way include asphalt roadways, with no utilities within roadway, non reinforced parking lots, curbs, gutters and sidewalks, walkways, driveways. However, where United States system pipe has specific maximum and minimum cover designation the special requirements for roadways, parking lots and driveways crossing over the pipe shall be obtained from the United States for the maximum allowable external loading or minimum cover. **HOWEVER, IT IS UNDERSTOOD THAT ALL SURFACE STRUCTURES SHALL BE ANALYZED AND CONSIDERED ON AN INDIVIDUAL BASIS.**

B. Structures that may not be constructed in, on, or along United States rights-of-way include but are not limited to, permanent structures such as retaining walls, block walls, buildings, garages, decks, carports, mobile homes with permanent foundations, swimming pools, block, cement, fences, or rock fences and walls as designated by the United States.

C. No trees or vines will be allowed within the rights-of-way of the United States.

D. All temporary or permanent changes in ground surfaces within United States rights-of-way are to be considered to be encroaching structures and must be handled as such. Earthfills and cuts on adjacent property shall not encroach onto United States rights-of-way without prior approval by the United States.

E. Existing gravity drainage of the United States rights-of-way must be maintained. No new concentration of surface or subsurface drainage may be directed onto or under the United States rights-of-way without adequate provision for removal of drainage water or adequate protection of the United States rights-of-way.

F. Prior to construction of any structure that encroaches within United States rights-of-way, an excavation must be made to determine the location of existing United States facilities. The excavation must be made by or in the presence of water users or the United States.

G. Any contractor or individual constructing improvements in, on, or along United States rights-of-way must limit his construction to the encroaching structure previously approved and construct the improvements strictly in accordance with plans or specifications.

H. The ground surfaces within United States rights-of-way must be restored to a condition equal to that which existed before the encroachment work began or as shown on the approved plans or specifications.

I. The owner of newly constructed facilities that encroach on United States rights-of-way shall notify the United States and/or the District upon completion of construction and shall provide the

District with one copy and the United States with two copies of as-built drawings showing actual improvements in, on, or along the rights-of-way.

J. Except in case of ordinary maintenance and emergency repairs, an owner of encroaching facilities shall give the District at least 10 days notice in writing before entering upon United States rights-of-way for the purpose of reconstructing, repairing, or removing the encroaching structure or performing any work on or in connection with the operation of the encroaching structure.

K. If unusual conditions are proposed for the encroaching structure or unusual field conditions within United States rights-of-way are encountered, the United States reserves the right to impose more stringent criteria than those prescribed herein.

L. All backfill material within United States rights-of-way shall be compacted to 90 percent of maximum density unless otherwise shown. Mechanical compaction shall not be allowed within 6 inches of the projects works whenever possible. In no case will mechanical compaction using heavy equipment be allowed over the project works or within 18 inches horizontally of the projects works.

M. That the backfilling of any excavation or around any structure within the United States rights-of-way shall be compacted in layers not exceeding 6 inches thick to the following requirements: (1) cohesive soils to 90 percent maximum density specified by ASTM Part 19, D-698, method A; (2) noncohesive soils to 70 percent relative density specified by ANSI/ASTM Part 19, d-2049, par. 7.1.2, wet method.

N. Any nonmetallic encroaching structure below ground level shall be accompanied with a metallic strip within the United States rights-of-way.

O. Owners of encroaching facilities shall notify the United States at (801) 379-1000 and/or the District at (801) 565-4300 at least forty-eight (48) hours in advance of commencing construction to permit inspection by the United States and/or the District.

P. No use of United States lands or rights-of-way shall be permitted that involve the storage of hazardous material.

RECLAMATION

Managing Water in the West

Engineering and O&M Guidelines for Crossings

Bureau of Reclamation Water Conveyance Facilities
(Canals, Pipelines, and Similar Facilities)



U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

April 2008

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Engineering and O&M Guidelines for Crossings

**Bureau of Reclamation Water Conveyance Facilities
(Canals, Pipelines, and Similar Facilities)**

Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Official
AOE	authorized operating entity
AWWA	American Water Works Association
CFR	Code of Federal Regulations
CPS	cathodic protection system
DOT	Department of Transportation
HDD	horizontal directional drilling
kV	kilovolt(s)
MERL	Materials Engineering and Research Laboratory
O&M	operations and maintenance
Reclamation	Bureau of Reclamation
ROW	right-of-way
WB-67	67-foot wheelbase

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1.0 PURPOSE

These are general guidelines for Bureau of Reclamation (Reclamation) offices to follow when reviewing the engineering and operations and maintenance (O&M) factors in outside entity requests for authorization to cross (encroach upon) Reclamation lands that contain project features such as levees, canals, pipelines, or other water conveyance facilities owned or administered by Reclamation. These guidelines include a general overview of the permitting process administered by Reclamation Lands Groups for allowing a particular use on lands where Reclamation holds a fee or an easement right-of-way interest. These engineering and construction recommendations are minimum guidelines for engineers to use in reviewing and evaluating these portions of the applications.

2.0 GENERAL PERMIT INFORMATION

Applicants requesting to cross any Reclamation land, facility, or water body must obtain a written land use authorization from Reclamation. Requirements for obtaining a use authorization to cross Reclamation project land and water surfaces are in the Code of Federal Regulations (CFR) at 43 CFR 429 and Reclamation Manual LND 08-01. The applicant must complete the *Standard Form (SF) 299, "Application for Transportation and Utility Systems and Facilities on Federal Lands,"* or similar forms in use at the local Reclamation office. The form can be obtained by contacting the involved Reclamation office, or it can be accessed electronically at Reclamation's Web site at: <http://www.usbr.gov/pmts/lands>.

Applicants can contact their local Reclamation office to discuss their proposed use before filing an application for a use authorization.

3.0 ENGINEERING AND O&M REVIEW CONSIDERATIONS

3.1 Introduction

Technical review of the crossing evaluates impacts on any existing Reclamation facility and **does not determine the adequacy of the crossing design for the applicant's intended purpose.**

The use authorization or consent document specifies criteria which, if followed, would not be deemed unreasonable interference. These review guidelines are strictly limited to those criteria which:

Engineering and O&M Guidelines for Crossings

- Protect Reclamation's facility and/or appurtenant facility from damage
- Ensure unrestricted flow and quality of water in Reclamation's facility
- Do not diminish the ability to perform O&M of Reclamation's facility, including access
- Prevent any burden of liability

These guidelines are provided as recommendations that apply to most Reclamation facilities. Each Reclamation office and/or authorized operating entity (AOE) should apply these guidelines using **sound engineering judgment** that best applies to their facilities and existing conditions. Additional Reclamation guidelines for specific locations (e.g., Central Arizona Project Reach 11 Basin Guidelines) may also apply and may be provided to applicants when necessary. These guidelines are minimums, and local conditions may be more stringent depending on the direct impacts to facilities and lands. AOE's may have additional requirements.

Uses that may be deemed reasonable within Reclamation pipeline easements include greenbelts, asphalt roadways, flexible pavement parking lots, transverse curbs and gutters, and sidewalks. Canals and pipelines may have overhead power and telephone lines (but not their supporting poles), transverse fences with gated openings (no walls), and similar surface and overhead structures.

3.2 General

The following individual items should be addressed by the applicant and evaluated by Reclamation and/or AOE as they may affect the Reclamation facility's engineering and O&M aspects. If unusual conditions are proposed for the encroaching structure or unusual field conditions within a Reclamation facility right-of-way (ROW) are encountered, Reclamation reserves the right to impose more stringent criteria than prescribed in these guidelines.

1. Structures that should not be constructed on Reclamation pipeline or canal ROW (whether fee owned or easement) include foundations, buildings, garages, carports, trailers, street light standards, supports for large signs, walls, longitudinal fences (except security/safety fences), power or telephone poles, and similar surface structures.
2. Prior to construction, a joint inspection should be conducted and the condition of existing facilities documented. Reclamation's ROW should be restored to pre-existing conditions following completion of work.

3. When applications are requesting public use of trails and maintenance roads adjacent to or crossing Reclamation canals, these facilities should be fenced for safety to separate them from open canal water, except when Reclamation's ROW is used as a greenbelt and the applicant accepts legal hazard responsibility. Trails and maintenance roads should be fenced on an as-needed basis whenever such fencing is warranted for public safety, restricted access, security, etc. If a fence is allowed within Reclamation's ROW, Reclamation should approve the fence materials. Any gates allowed within Reclamation's ROW should be at least 16 feet wide. Reclamation will be provided with full access through any fences or gates.
4. Prior to construction of any structure that encroaches within a Reclamation pipeline or canal ROW, a "pothole excavation" should be made to determine the locations of any existing Reclamation and non-Reclamation facilities and their appurtenant features that may be affected. Potholing is the practice of digging test holes to expose underground utilities to determine the horizontal and vertical location of the utility.

All work within 18 inches of the facility should be done using hand-held tools only. The excavation should be made by or in the presence of Reclamation and/or AOE personnel. The presence of a Reclamation and/or AOE inspector may be required throughout the excavation process, but this presence in no way relieves the applicant or their contractor of responsibility.

The resultant elevation information should be delineated on the profile view and labeled as:

POTHOLED ELEVATION XX.X
Surface Elevation XX.X

The pothole excavation should be filled in, or a safety fence installed, prior to departing the site each day.

5. If Reclamation facilities need to be modified to avoid adverse impacts from the applicant's crossing facility, the applicant should be responsible for the cost of such modifications.

Engineering and O&M Guidelines for Crossings

6. A temporary permit may be required for visual inspections, ground and aerial surveys,¹ or potholing that requires physical entrance onto a Reclamation facility. **A use authorization or consent document issued by Reclamation and/or AOE should be obtained prior to entering or crossing Reclamation's ROW for any activity.**
7. Applications should include a project description, calculations, specifications, and detailed construction plans showing plan views, profiles and sections, and grading plans of proposed work within or adjacent to Reclamation's ROW. Plans should show an easily recognizable boundary (tied to a known corner) and Reclamation's ROW and Reclamation stationing or mile post designation.

All Reclamation facilities should be shown and labeled (e.g., "Centerline of xx-inch Reclamation Pipeline," "Reclamation Communication and Control Cable," etc.) The type and weight of the construction equipment crossing Reclamation pipelines, roads, and bridges as well as the crossing locations should be included. Additional information, as identified in following individual specific feature sections of these guidelines, should also be included with the application for review.

Any engineering or land survey drawing should contain the appropriate registered engineer's or land surveyor's stamp and signature. A construction schedule outlining the anticipated duration of the construction should be submitted. A minimum of two² copies of the application (including calculations, specifications, and plans) should be submitted to Reclamation and/or AOE for review and approval.

8. For crossings of all Reclamation facilities, Reclamation and/or AOE personnel familiar with the facilities (including cathodic protection systems) will obtain and provide copies of existing files showing information about existing buried facilities (center of pipeline, depth of cover, size of pipe, class of pipe, etc.) to the applicant.
9. Existing Reclamation facilities (e.g., canal lining, canal check structure, turnout structure, etc.) and appurtenances (e.g., existing blow-offs, air valves, vents, manholes, and/or cathodic protection test stations) and existing non-Reclamation facilities on Reclamation's ROW (e.g., petroleum pipelines, natural gas pipelines, communications lines, powerlines, water lines, sewer lines, storm drain lines, etc.) **should be protected** in place prior to and during construction.

¹ Aerial surveys require placing on-the-ground survey control markers.

² Revise per local Reclamation office and/or AOE practice.

The applicant and/or their contractor may be liable for all damages to Reclamation facilities and appurtenances as a result of construction and for any other damages or losses suffered by Reclamation or its water contractors, including power, irrigation, municipal and industrial water supply, and communication losses.

10. Trench excavation should comply with the most current Occupational Safety and Health Administration standards or Reclamation Health and Safety Standards, whichever are more stringent. Trench backfill should be placed in 4- to 6-inch lifts if hand compacted or no more than 8-inch lifts if power compacted. Trench backfill within Reclamation's ROW should be compacted to 95 percent relative compaction (ASTM D 698, Standard Proctor) (or 90 percent of ASTM D 1557). Mechanical compaction using heavy equipment (greater than 2,000 pounds) should not be used within 18 inches of the Reclamation pipeline. Flowable fill (or controlled low strength material) should be substituted for compacted pipe embedment under canals and may be used when crossing pipelines.
11. Erosion control measures, including re-vegetation, should be implemented after completing construction.
12. If existing drainage features are to be modified during construction, detailed drawings showing the proposed drainage replacement/restoration should be submitted with the application for review and approval. The applicant is responsible for the care and handling of storm water runoff both during and after construction.
13. The applicant should not divert surface runoff³ toward Reclamation canal or canal embankments. The 100-year storm⁴ surface runoff should use detention basins outside of Reclamation's ROW. Lined drainage channels should be designed to transfer flow from the detention basins to the existing cross drainage facilities that drained the original area. Also refer to "4.4 Storm Water Cross Drainage."
14. Proposed temporary or permanent modifications to the existing cover over Reclamation pipelines should be subject to review and approval by Reclamation and/or AOE. Design parameters for roadway, parking lot, and driveway crossings over the pipe should also be subject to review and approval by Reclamation and/or AOE.

³ Subdivision or commercial development on the uphill side of canals that pave large areas and have large roof areas will greatly increase peak storm runoff—most city development requires retention basins. Applicants should provide the same retention basins that are required for similar development projects.

⁴ Revise per Reclamation field office for specific canal if a higher storm frequency is required.

Engineering and O&M Guidelines for Crossings

15. When a Reclamation pipeline system being crossed has pipe with an “A” cover pipe designation (less than 5 feet of earth), the applicant is to analyze the crossing to show “A” pipe load carrying capability exists to meet their carrying requirements or replace the “A” pipe with pipe of sufficient load carrying capability.
16. Reclamation’s ongoing O&M activities should not be disrupted during construction. The primary or secondary operating road should be kept available for Reclamation and/or AOE use at all times.
17. Detectable warning tape may be required over below-ground utilities. Refer to “3.3 Detectable Warning Tape.”
18. The points where the proposed utilities enter and exit Reclamation’s ROW should be plainly and permanently marked by sign posts extending 5 feet above grade. Applicants should provide sign posts directly above their utilities and at all angle points within Reclamation’s ROW. The distance between adjacent sign posts should not exceed 500 feet. Sign posts should contain the name of owner/operator, contents of the pipeline, utility identification, and emergency contact telephone number. Sign posts for angle points that lie within roads or canals should be offset and have a reference noted. The locations of the sign posts should be shown on the plans.
19. Following completion of work, applicants should provide as-built drawings of their facilities on Reclamation’s ROW. Reclamation as-built drawings are to be updated by the appropriate Reclamation office and/or AOE to reflect the crossing. As-built drawings may be maintained by the AOE, but should remain accessible to Reclamation upon request.

3.3 Detectable Warning Tape

Detectable warning tape may be required over below-ground utilities situated within Reclamation’s ROW and should be a minimum of 18 inches above the utility and between 18 and 30 inches below the ground surface. Warning tapes should conform to the following specifications:

- a. For potable water lines, the warning tape should be a 3-inch-wide blue detectable tape imprinted with “**CAUTION BURIED POTABLE WATER LINE.**”
- b. For nonpotable water lines, the warning tape should be a 3-inch-wide purple detectable tape imprinted with “**CAUTION BURIED NONPOTABLE WATER LINE.**”

- c. For sewer and storm drain lines, the warning tape should be a 3-inch-wide green detectable tape imprinted with “**CAUTION BURIED (type) LINE.**”
- d. For gas, oil, and steam chemical lines, the warning tape should be a 3-inch-wide yellow detectable tape imprinted with “**CAUTION BURIED (type) LINE.**”
- e. For telecommunications, telephone, and television conduit(s), the warning tape should be a 3-inch-wide orange detectable tape imprinted with “**CAUTION BURIED (type) CONDUIT.**”
- f. For electrical, street lighting, and traffic signal conduit(s), the warning tape should be a 3-inch-wide red detectable tape imprinted with “**CAUTION BURIED (type) CONDUIT.**”

4.0 SPECIFIC FEATURE REVIEW GUIDELINES

4.1 Bridges

- 1. New bridge crossings (vehicular, pedestrian, and utility) should be perpendicular (between 70 and 90 degrees) to the centerline of the water conveyance facility and at locations approved by Reclamation and/or the AOE. Exceptions to the policy may be considered on an individual basis.
- 2. Public use bridges in urban areas should be spaced no closer together than 1/3 mile (about 4 blocks or 1,700 feet) apart. This is to ensure O&M operations are not overly restricted.
- 3. Bridge crossings should be of free span design. Consideration of any anticipated (known or ongoing) canal subsidence issues, anticipated raising of the canal lining, or anticipated increases in the canal’s high water level should be made. The minimum vertical clearance between the bottom of the superstructure and the top of the canal lining should be 3 feet. For unlined canals, the vertical clearance may be measured to the high water level. If this minimum clearance is reduced by subsidence or by future Reclamation modifications to the canal lining, the minimum clearance should be re-established at the applicant’s expense. The minimum horizontal clearance from the face of the abutment to the top of the canal lining should be 5 feet. For unlined canals, the horizontal clearance may be measured to the high water level.

Engineering and O&M Guidelines for Crossings

These clearances are suggested to minimize impact on the canal section during construction and future inspections and O&M. Applicants may request to re-construct a canal section if Reclamation's operations are impacted by close construction during periods when the canal is normally unwatered. If so, vertical clearances may be reduced to 1 foot and horizontal clearance to 3 feet.

4. Canal O&M roads should intersect public roads at bridges at right angles for proper visibility. This may require the applicant to acquire additional ROW for use if the existing canal ROW is not sufficient. American Association of State Highway and Transportation Official (AASHTO) criteria for sight distances at the intersection of O&M roads and roadways at new bridges should be met to allow O&M vehicles to cross them safely.
5. Driving piles at concrete-lined canals should not be permitted. Any abutment foundation support piles, at concrete-lined canals, should be drilled and cast-in-place.

At a minimum, the applicant's drilling and piling plan should include:

- Drilling methods and equipment
- Methods for preserving existing foundation material
- Methods and equipment to determine the presence of quick soil conditions or scouring and caving
- The proposed method for casing installation and removal if casings are used
- Methods and equipment for accurately determining the depth of concrete and actual or theoretical volume placed

At a minimum, the applicant's contingency plan should include:

- Means to repair in a certain time
- Minimum flows after event
- Review of geotechnical conditions surrounding the pile locations
- Assessment of how the proposed mitigations will address geotechnical conditions
- Methods for restoring foundation material

- A list of material, equipment, and personnel with qualifications to be used during mitigation work
 - A seal from a Professional Engineer on all relevant plans and drawings
6. The submitted plan drawings for the bridge should contain the following information:
 - a. Superstructure, abutments, railings, embankments, and drainage, including details and sections
 - b. Type of materials (concrete, steel, timber, etc.) used for different members
 - c. Details of cast-in-place foundation piles, if any, on both sides of the canal
 - d. The elevation of the bottom of the superstructure and the clearance between the top of the canal lining (or high water level if unlined canal) to the superstructure or bottom of deck slab, whichever is lowest
 - e. Design loadings
 - f. Design standards on which the bridge is based (AASHTO, etc.)
 7. The calculations and specifications for the bridge should be submitted to Reclamation and/or AOE for review.
 8. The right lane turn radius from the new road onto a Reclamation operating road should comply with the provisions of a 67-foot wheelbase⁵ (WB-67) truck turning template in the AASHTO manual on Geometric Design of Highway and Streets.
 9. Details of any proposed utilities to be attached to an existing bridge include:
 - a. Anchor bolt locations should not intercept the critical reinforcing steel of the bridge.

⁵ The field office should adjust these provisions according to anticipated needs.

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- b. Utilities should be placed and anchored under bridge decks and through utility openings, if they are present. The utility should be placed off center in the utility opening, if possible, to allow for future utility additions.
 - c. If an expansion joint is used in the pipeline, the joint should be placed near the bridge deck expansion joint.
 - d. Holes through bridge concrete or abutment and retaining walls for passage of utilities should be allowed by core drilling. The annular space between the utility and core hole surface should be completely filled with an elastomeric sealant to prevent loss of material or water piping from behind the wingwalls and abutments.
 - e. Submit calculations showing the effects of the weights of the proposed utilities on the load carrying capacity of the bridge for Reclamation review.
 - f. Intermediate supports for the utility should withstand the same seismic load considerations as the bridge.
 - g. Load limit signs should be placed adjacent to the bridge, as required under AASHTO criteria.
 - h. Beam guardrails should be installed at bridges and bridge approaches, as required under AASHTO criteria.
10. The applicant will be responsible for changes to Reclamation existing ROW; bridge O&M approach roads; existing fencing, gates, and signs; and the addition of new fencing, O&M gates, cattle guards, signs, etc.

4.2 Landscaping

- 1. No landscaping or other changes in ground surfaces within Reclamation pipeline and canal/lateral ROW should be made without advance written permission of Reclamation through the application process. Landscaping changes may (1) limit, prevent, or hamper O&M access; (2) increase the costs of operations and maintenance of the facility; (3) impact facility reliability; or (4) create a public nuisance or liability issue.
- 2. Open space with natural hiking trails and walkways may be permitted if vehicle access to Reclamation pipeline and appurtenant facilities for patrol and maintenance is provided.

3. The following may apply within Reclamation's ROW:
 - a. The easement may be used as a greenbelt upon Reclamation approval.
 - b. Ground cover and shrubs are permitted upon Reclamation approval.
 - c. Trees and vines should not be allowed. See Appendix B of *Review of Operation and Maintenance Program Field Examination Guidelines* (reproduced as appendix B at the end of these guidelines).
4. All temporary or permanent changes in ground surfaces within Reclamation pipeline and canal ROW are considered encroaching structures and are handled as such. Earthfills and cuts on adjacent property should not encroach onto Reclamation pipeline and canal ROW. Excavations of adjacent property (even property not within Reclamation's purview) within the projection of the Reclamation embankment line may impact embankment stability and should be evaluated.
5. Permanent landscaping structures should not be allowed within the exterior limits of a Reclamation linear facility ROW (fee owned or easement).
6. Pressurized lawn and park sprinkler irrigation lines (3-inch maximum size) and isolation valves within Reclamation easements that run parallel to a Reclamation pipeline should be installed at least 15 feet from the edge of the Reclamation pipeline.

Irrigating lawns and flower beds along canal embankments should not overwater the area or threaten the embankment stability.

4.3 Roadway Crossing

Note: This type of encroachment also includes parking areas and recreational trails.

1. The applicant should submit a grading plan as part of the application.
2. If the roadway crosses a Reclamation pipeline system that has a cover pipe designation of "A," refer to "3.2 General."

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3. If the applicant intends to modify existing drainage features during construction, detailed drawings showing the proposed drainage replacement/restoration should be submitted with the application for review and approval. (Refer to “3.2 General.”)
4. If the proposed roadway includes a bridge crossing over a Reclamation canal or pipeline, Reclamation and/or AOE should review and approve the vertical clearance and location of the abutments. (Refer to “4.1 Bridges.”)
5. Streets, roads, or parking areas crossing Reclamation pipeline easements are permissible. All streets, roads, and parking surfaces are to be asphalt or other flexible pavement. Depressed curbs or driveways should be provided for Reclamation vehicular access when new roads cross Reclamation pipelines or canals.
6. Roadway ditch drainage should not be allowed to flow into the canal. Drainage should be retained and released in a controlled way to maintain peak discharges that are less than any peak historical runoff rate before these modifications. Applicants should direct drainage to an original sub-basin cross drainage culvert or overchute. (Refer to “3.2 General” and “4.4 Storm Water Cross Drainage.”)
7. If existing roadway embankments are to be widened, the work should be conducted in accordance with the provisions of construction in the applicable State Department of Transportation (DOT) Standard Specifications.

4.4 Storm Water Cross Drainage

1. Upslope development impacts historic natural drainage volumes and peak flow rates. Development re-grades and revises drainage sub-basins. Revised ground cover from constructing roads, parking areas, and buildings may result in the need to change the cross drainage features (culverts and/or overchutes) along Reclamation canals.
2. A hydrologic study should accompany all plans that modify the existing drainage across and/or along Reclamation facilities. The study or report should show the proposed flows of the canal and the associated crossings. The drainage study or report should show that the downstream system can accept the flows without creating any flooding to properties adjacent to or downstream of the canal.
3. All drainage crossings, whether existing or proposed, should carry the peak runoff of a 100-year event while preventing any storm water from entering the canal and/or ponding against the canal embankment.

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4. Urban runoff should not be allowed to enter into, or drain onto, Reclamation's land. All flows generated outside Reclamation's ROW should enter the storm drain system prior to entering Reclamation's ROW. Piped connections are preferred, but concrete-lined channels may be acceptable upon Reclamation's review.
5. The new crossing under a canal should be designed with 3 feet vertical clearance from the top of the cross drainage structure to the bottom of the canal (or liner). The structure should extend completely across Reclamation's ROW.
6. New overcrossings of the canal should have 2 feet of vertical clearance from the top of the liner and 2 feet of horizontal clearance from the support abutments to the outside edge of the canal lining. The O&M road crossing of the cross drainage structure should be structurally capable of withstanding highway-legal vehicle loadings and provide at least 1 foot of cover in the roadway.
7. Pipe crossing barriers should be installed on all pipe overcrossings.
8. All drainage flow should be discharged to a downstream storm drainage system owned, operated, and maintained by a public agency (such as a city or county) or into areas such as channels, roadways, parks, wetland basins, or other non-private lands that can accept the concentrated flows from the drainage crossing.
9. All drainage from upland property should be collected by the applicant's installed system of curbs and inlets within their property and discharged into a non-Reclamation public agency's drainage system.
10. New drainage system designs will not use ponding against the existing canal embankment for temporary detention of storm runoff that will not immediately pass through existing or new crossings.

Proposed permanent detention facilities adjacent to Reclamation's property should include engineered fill beyond the canal ROW to provide, at a minimum, a fill-width maintenance access roadway between the canal property and the basin. The applicant shall submit a geotechnical report verifying that the canal embankments can perform as detention basin embankments. The design should provide for sufficient freeboard to contain the 100-year event within the proposed basin adjacent to Reclamation's property and shall have adequate protection from seepage and erosion.

The ownership and related O&M of the embankments shall be the responsibility of the applicant requesting the crossing.

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11. When grading operations upstream of existing canal drainage crossings are scheduled to take longer than a normal construction season to complete, temporary basins shall be installed. These temporary basins should be designed to detain the 100-year event, capture silt from the disturbed area, and meter the flows across the existing drain crossings without spilling flows into the canal.
12. Unless Reclamation specifies otherwise, the applicant should remove or plug and abandon existing drainage crossings that are not used by the development unless they are shown to provide an additional measure of safety for the canal by reducing the likelihood of spill into the canal caused by extreme runoff flows. Otherwise, these crossings should remain in place for Reclamation's benefit and will not require ownership transfer to a public agency.

These crossings must discharge into the non-Reclamation public agency's storm drainage systems or into areas such as channels, roadways, parks, wetland basins, or other nonprivate lands that can accept the concentrated flows from the drainage crossing in the case of an extreme runoff event.

Grading in Reclamation property should be preserved or revised to direct extreme runoff flows into these unused drainage crossings without allowing said flows to enter into the canal until the crossings reach their capacity.

4.5 Subdivision

Urban developments are reaching Reclamation's lands and ROWs. These are general guidelines for accommodating development in subdivisions (refer to "3.2 General" and "4.4 Storm Water Cross Drainage").

1. Permanent structures should not be permitted within Reclamation fee-owned linear ROWs.
2. Open space with natural hiking trails and vegetation may be allowable.
3. Where subdivision development is adjacent to a canal, fencing should include these characteristics:
 - a. Temporary chain link fences must be installed prior to removing any portion of existing fences.

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- b. Upon completion of grading for drainage and other work, fencing should be installed along the subdivision's boundary length of the adjacent ROW plus 150 feet beyond the development's property boundary. The fence should be per project standards and at the applicant's expense.
 - c. The new fence should be located 1 foot outside of Reclamation's ROW. The fence location should be shown on the improvement plans.
4. Use of Reclamation pipeline easements as part of residential subdivision lots should not be allowed. Pipeline easements may be included within the subdivision greenbelt or similar use areas.
5. Drawings should include all proposed improvements (i.e., streets, utilities, landscaping, etc.) within, and adjacent to, Reclamation's ROW.
6. Trees or vines should not be allowed within a Reclamation pipeline or canal ROW. See Appendix B of *Review and Operation and Maintenance Program Field Examination Guidelines* (reproduced as appendix B at the end of these guidelines).
7. Streets, roads, or parking areas using Reclamation easements may be permissible. All streets, roads, and parking surfaces should be asphalt or other flexible pavement. Depressed curbs or driveways should be provided for Reclamation vehicular access when new roads cross Reclamation pipelines or canals.
8. Where fencing is proposed within Reclamation easements, a minimum 16-foot-wide gate should be provided for Reclamation access.
9. Pipelines containing sewage, oil, gasoline, natural gas, or hazardous materials should only cross perpendicular (between 70 and 90 degrees) to the Reclamation pipeline or canal and be installed with the necessary safety measures and separation clearance as required in "4.6 Utility Crossing."
10. Electroliers, posts, etc., should be installed at the maximum distance possible from the edge of the pipeline or canal.
11. If crossing a Reclamation pipeline system that has "A" cover pipe designation, refer to recommendations in "3.2 General."

4.6 Utility Crossing

Note: All pipelines, electrical, and communication lines and conduits are referred to as “utilities” in these guidelines.

4.6.1 Casings

The Reclamation Materials Engineering and Research Laboratory’s (MERL) position is to avoid using casing pipes around metallic carrier pipelines (steel, ductile iron, cast iron, reinforced concrete, pretensioned concrete cylinder, etc.) whenever possible. The experience of the corrosion community in general is that these casings often cause corrosion-control problems. Furthermore, dielectric (plastic, fiberglass, etc.) casings, or even dielectrically coated casings, should not be used. They can shield the carrier pipe from receiving cathodic protection current.

Cathodic protection to a buried metallic pipeline is more trouble free and more certain without a casing pipe. MERL recommends relying on effective corrosion control measures on the carrier pipeline rather than relying on a casing pipe (which may shield cathodic protection current) to direct a leak away from Reclamation property.

4.6.2 Overhead Line Crossing

1. Overhead wires across Reclamation pipeline and canal ROWs should be at least 32 feet above all ground levels in the Reclamation ROW. For electrical powerlines of 69 kilovolts (kV) or higher voltage, the minimum clearance should be 40 feet plus 0.25 inch per kV of line-to-line voltage above 450 kV. In any case, the minimum clearance is to be that determined to be needed with an ambient temperature of 120 degrees Fahrenheit.
2. Reclamation has the following requirements for overhead crossings:
 - a. Poles or towers should not be allowed within Reclamation’s ROW.
 - b. Overhead electrical and communication lines should cross perpendicular (between 70 and 90 degrees) to the centerline of the Reclamation facility.
 - c. If necessary, fence grounding is to be provided for existing fence lines, especially under power transmission lines.

3. A marker warning sign should be provided that shows the clearance and electrical line voltage. The warning sign should face oncoming traffic and state, “**DANGER, HIGH VOLTAGE OVERHEAD.**”

4.6.3 Utility Crossing Reclamation’s Canal

Utility crossings include open ditch laterals, subsurface and surface drains, levees, and similar facilities.

General Requirements:

1. Utilities crossing Reclamation canals should be designed to cross perpendicular (between 70 and 90 degrees).
2. Pier construction in the canal for new utility crossing(s) should not be allowed. New utility crossings should be free span design.
3. Open cut crossings of Reclamation canals and ditches, when allowed, should require replacing linings to re-establish the original construction style and materials (i.e., disturbed concrete lining panels should be removed in their entirety and replaced, membrane lining and earth or concrete protective cover should be re-constructed, gravel and canal under-drainage systems should be re-established to full working order, etc.) Proposals should be submitted for approval with the crossing permit application.
4. For trench excavation and backfill requirements, refer to “3.2 General.”
5. Boring and jacking of a utility through canal embankments or protective levees should not be permitted. Boring and jacking of a utility should be constructed through the embankment foundation materials. Applicants should make special design and construction considerations with bored crossings under canals containing water during construction. Among these should be using proper bentonite slurry to seal the annulus space between the utility conduit and the boring cavity from canal seepage. Refer to appendix A for more details to be considered.

The applicant’s drilling plan should cover:

- a. Drilling methods and equipment
- b. Methods for preserving existing foundation material
- c. Methods and equipment to determine the presence of quick soil conditions or scouring and caving

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- d. Proposed method for casing installation and removal if casings are used
- e. Methods and equipment for accurately determining the depth of concrete and actual or theoretical volume placed

The applicant's contingency plan should cover:

- a. Means to repair in a certain time
 - b. Minimum flows after event
 - c. Review of geotechnical conditions surrounding the pile locations
 - d. Assessment of how the proposed mitigations will address geotechnical conditions
 - e. Methods for restoring foundation material
 - f. List of material, equipment, and personnel with qualifications to be used during mitigation work
 - g. A seal from a Professional Engineer on all relevant plans and drawings
6. When horizontal directional drilling (HDD) or other trenchless methods are used, canal seepage conditions may be aggravated by the collapse of the canal foundation material into the annular void between the bore and pipe. Penetration through the top stratum of fine-grained materials may concentrate seepage at those locations. Pipe installed with trenchless methods should proceed only after completion of a comprehensive evaluation of the following:
- (a) Comprehensive understanding of the subsurface soil and groundwater conditions to a minimum depth of 20 feet below the lowest pipe elevation
 - (b) Locations of the HDD pipe penetration entry and exit
 - (c) Construction procedure
 - (d) Allowable uplift pressures
 - (e) Onsite quality control and quality assurance monitoring during construction operation

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- (f) Grouting of the pipe annulus
- (g) Backfilling of any excavated areas
- (h) Repair and reinstatement of the construction staging areas

A geotechnical report should be submitted with the application for review prior to approval of the proposed utility crossing.

Directional drilling under a canal may be considered if a minimum clearance of 25 feet to the bottom of the canal lining is maintained for utilities with less than a 24-inch outside diameter. Larger utility crossings should be considered on an individual basis and may require additional clearance from the bottom of the canal lining.

7. Cut and cover constructed utilities under Reclamation canals should have a minimum cover of 36 inches when within Reclamation's ROWs. Bored construction utilities should have a minimum of 3 diameters cover.
8. Reclamation's ongoing O&M activities should not be disrupted during crossing construction. The primary or secondary operating road should be kept available for Reclamation use at all times.
9. Canal embankments should be re-built or repaired with materials and standards equal to or better than the existing embankments.
10. Drawings should be stamped and signed by a Professional Engineer and contain the following information:
 - a. Canal milepost or station at each proposed crossing, utility size and location, and type of utility or material transported
 - b. Maximum utility operating pressure, type of pipe, joints, wall thickness, maximum test pressure, and description of test procedures
 - c. Type of sleeve/casing (when allowed) including diameter, joints, and wall thickness
 - d. For utilities attached to a bridge or an overchute, details showing the structure name, superstructure, abutments, embankments, protective dikes, method of attachment, spacing of utility supports on the structure, location of other attached utilities, and structural calculations

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- e. Protective coatings and corrosion control measures
- f. Method of handling pipeline expansion and contraction
- g. Location of nearest shutoff valve on each side of the crossing
- h. Location and details of thrust restraint
- i. Design code(s) used for the utility crossing
- j. Location, including depth, of the buried pipeline communication and control cables
- k. Other existing utility easements in the immediate vicinity

Hazardous Material Carrier Requirements:

1. Pipelines carrying hazardous material or pollutants (e.g., oils, gasoline, sewage, contaminated waters, and nonpotable waters) should be designed for a reduced risk of failure in the portion within Reclamation's ROW. The design should require either:
 - a. Designing the crossing pipeline with an additional 50 percent working pressure factor
 - or*
 - b. Using secondary containment (casing pipe) for all hazardous material pipelines
2. To minimize the amount of any hazardous material entering the canal, Reclamation may require the installation of a block (gate) valve and or a check valve on each side of the canal between the ROW boundary and the embankment. When selecting the type of the valves, take into the account the flow direction and the terrain.
3. A final hazardous material spill contingency plan and an emergency response plan should be approved by Reclamation prior to start of construction.
4. A monitoring program and/or Supervisory Control and Data Acquisition System alarm may be required depending on the hazardous material transported. This applies to all "overcrossings" and "undercrossings" when the hydraulic grade line is within 60 inches of the canal liner or when local geology would promote this requirement.

Attaching Utilities to Bridges and Overchutes:

Note: Reclamation does not guarantee the long-term availability of bridges or overchutes as support devices for utility crossings because they may require structural modifications or alterations to accommodate widening, repairs, subsidence offsets, etc., to such an extent that service may be interrupted or stopped. Reclamation may determine the bridge is no longer required and may remove it. In that event, the owner/operator of each utility attached to a bridge or an overchute may be required to re-locate or permanently remove their utility at their own expense.

Specific details for attaching utilities to bridges are:

- a. Utilities should not be placed on the bridge deck.
- b. Anchor bolt locations should not intercept the critical reinforcing steel of the bridge.
- c. Utilities should be placed and anchored under bridge decks between girders and through utility openings, if they are present. The utility should be placed off center in the utility opening, if possible, to allow for future utility additions.
- d. If an expansion joint is used in the pipeline, it should be placed near the bridge deck expansion joint.
- e. Holes through bridge concrete or abutment and retaining walls for passage of utilities may be allowed and should be core drilled. The annular space between the utility and core hole surface should be completely filled with an elastomeric sealant to prevent loss of material or water piping from behind the wingwalls and abutments.
- f. Calculations showing the effects of the weights of the proposed utilities on the load carrying capacity of the bridge should be submitted for Reclamation review.
- g. Intermediate supports for the utility should withstand the seismic conditions of the bridge.

4.6.4 Utility Crossing Reclamation's Underground Pipelines

1. The applicant should submit the procedures, excavation plans, schedules, as well as type and weight of the construction equipment to be used for crossing the Reclamation pipeline.

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2. High voltage, direct current powerlines should not be permitted to encroach on the Reclamation pipeline ROW, except in unusual circumstances and with proper cathodic protection considerations.
3. For proposed metallic pipelines, refer to “5.0 Cathodic Protection Requirements.”
4. For utilities crossing above or under the Reclamation pipeline, the vertical clearance between the utility and Reclamation pipeline should be a minimum of 12 inches.
5. The location of the Reclamation pipeline and the communication and control cables throughout the area of the proposed construction should be shown on the plans. Prior to Reclamation and/or AOE issuing a use authorization or consent document, the pipeline and the cable(s) should be located and exposed by potholing. The pothole locations should be shown on the drawings. The pothole elevations should be referenced to Reclamation stationing or milepost. (Refer to “3.2 General.”)
6. Drawings should contain the following information:
 - a. Reclamation milepost or station at each proposed crossing, pipeline size and location, and type of utility or material transported.
 - b. Maximum utility operating pressure, type of pipe and joints, maximum test pressure and description of test procedures, wall thickness, and utility pipe classification.
 - c. Type of sleeve/casing pipe (when allowed) including diameter, joints, and wall thickness.
 - d. Protective coatings and corrosion control measures.
 - e. Location of nearest shutoff valve on each side of the crossing.
 - f. Location and details of thrust restraint.
 - g. Design code(s) used for utility crossing.
 - h. Location, including depth of the Reclamation pipeline and the communication and control cables.
 - i. Other existing utility easements in the immediate vicinity.

7. Detectable warning tape may be required over trenched utilities. (Refer to “3.3 Detectable Warning Tape.”)
8. For trench excavation and backfill requirements, refer to “3.2 General.”
9. Embankments should not be permitted within Reclamation’s ROW where underground pipeline exists.

4.6.5 Utility Crossing Under Reclamation’s Roadways

1. The applicant should supply typical cross sections that show existing ground surface elevations, utility trench invert elevations, and utility details.
2. For trench excavation and backfill requirements, refer to “3.2 General.”
3. Conduits with diameters up to 24 inches should be bored and jacked underneath pavements. Larger conduits may be considered on an individual basis. Pavement or road surfaces should not be cut unless an acceptable detour, if required, is approved. The cover over the conduit(s) when within Reclamation’s ROWs should be a minimum of 36 inches. (Refer to “3.2 General.”)
4. Unless otherwise approved, the applicant should replace existing Reclamation roads and parking surfaces that are removed or damaged by the applicant’s construction activities in accordance with provisions in the latest edition of the applicable State DOT Standard Specifications.
5. If existing road embankments are to be widened, the work should be conducted in accordance with the provisions of embankment construction in the applicable State DOT Standard Specifications.
6. Detectable warning tape may be required over buried utilities. (Refer to “3.3 Detectable Warning Tape.”)

5.0 CATHODIC PROTECTION REQUIREMENTS

5.1 Cathodically Protected Metallic Pipelines

Unless approved in writing by Reclamation, metallic pipelines or those containing metallic reinforcement (e.g., reinforced concrete) installed within Reclamation’s ROW should have a suitable bonded dielectric coating (see “5.2 Protective Coatings for Corrosion Control”) and be cathodically protected. Impressed current cathodic protection rectifiers and deep-well anode systems should not be

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permitted within Reclamation facilities without prior approval from MERL's Corrosion Technology Group. All submittals should include details of the cathodic protection system (CPS) and its appurtenances.

1. All existing Reclamation cathodic protection test stations, cables running to these stations, rectifiers, anode beds, and any other appurtenances should be located prior to any grading or excavation. The test stations should be staked and flagged. The test stations, cables running to these stations, any anode beds, etc., should be suitably enclosed or protected during construction to prevent damage. No re-location or modification of the test stations, cables, anode beds, etc., is allowed without prior approval from MERL's Corrosion Technology Group.
2. Generally, the CPS to the proposed pipeline should be the sacrificial anode type unless the proposed installation continues an existing pipeline that uses impressed current type of cathodic protection.
3. A means of monitoring the effectiveness of the CPS on the proposed pipeline should be provided within Reclamation's ROWs. The number of anodes and test stations will differ with each project. Test stations should be located at every anode bed connection and should not be more than 1,000 feet apart. A test station should also be located where any metallic pipeline crosses over or under a metallic Reclamation pipeline, metallic fence, other metallic structure embedded in the ground, or comes within 20 feet of a Reclamation structure on or embedded in the ground. Both the proposed cathodically protected pipeline and the Reclamation pipeline should be monitored regularly using these test stations. Monitoring results should be reported to MERL's Corrosion Technology Group. In addition, the owner of the proposed crossing pipeline should investigate and mitigate any adverse potential shift caused by the proposed pipeline on the Reclamation pipeline. Owners of proposed crossing pipelines should return Reclamation pipelines to their original electrochemical potentials or to more benign potentials. Mitigation measures should be approved by MERL's Corrosion Technology Group. The effectiveness of mitigation measures should be confirmed in the presence of a Reclamation representative following installation.

For those pipelines under DOT regulation, the application and monitoring of the CPS should conform to Title 49 CFR, Part 195, any special provisions of this guideline, and the provisions of NACE International RP 0169, in that order. For other pipelines, any special provisions of this guideline should take precedence, followed by the provisions of NACE RP 0169.

5.2 Protective Coatings for Corrosion Control

1. *Atmospheric Exposed Pipe*

The coating should be a high build modified aluminum epoxy mastic primer and top coated with a high build aliphatic urethane. The type of coating should be listed in the submitted plans and specifications. Information should include the surface preparation and the thickness of the coating to be applied.

2. *Buried Pipe*

The type of coating may vary from project to project due to geology and soil corrosivity and should be considered on an individual basis. The type of coating should be listed in the submitted plans and specifications. Information should include the surface preparation and the thickness of the coating to be applied.

REFERENCES

- Application for Transportation and Utility Systems and Facilities on Federal Lands, <http://www.ntia.doc.gov/FROWsite/SF-299_2006.pdf>.
- Application for Use of Reclamation Project Land and Water Surfaces, <<http://www.usbr.gov/pmts/lands/>>.
- Bureau of Reclamation Right-of-Use Application, <<http://www.usbr.gov/pmts/lands/FINAL7-2540-5-06ExpDate03312009.pdf>>.
- California Department of Water Resources - Encroachment Permit Guidelines.
- Central Arizona Project, Reach 11 Guidelines.
- GP Region Billings MT – Standard Crossing & Clearance Requirements, Utility Lines and Cables, drawing 40-600-51. The office also uses a Preliminary Project Description Form and a Special Use Permit.
- NACE, International RP 0169, “Standard Recommended Practice – Control of External Corrosion on Underground or Submerged Metallic Piping Systems.”
- PN Region Burley ID – Overhead and underground crossing clearances.
- Policy on Geometric Design of Highway and Streets, American Association of State Highway and Transportation Officials (AASHTO), Fifth Edition, 2004.
- Reclamation, 2005. Preliminary drawing 103-D-1700 that provides general requirements for installation of crossings, June 2005.
- Reclamation Manual, Directive and Standards LND 08-01, Land Use Authorizations, <<http://www.usbr.gov/recman/lnd/lnd08-01.pdf>>.
- Title 29 CFR, Part 195.
- U.S. Army Corps of Engineers – Engineering and Design, Design and Construction of Levees EM 1110-2-1913, 30 Apr 2000, CECW-EG Washington, DC 20314-1000.

GLOSSARY

Bored and jacked – This terminology is a general way of referring to a family of trenchless methods.

Bridge, class A – Vehicular bridge used by the public. May or may not be owned by the Bureau of Reclamation.

Consent Document Permit – Permit required across fee-owned lands.

Detention basin – An artificial flow control structure used to contain flood water for a limited period of a time, thereby providing protection for areas downstream. Detention basins provide a way to reduce storm peak flows, while retention basins hold water for an extended period of time. These basins are generally a part of a larger engineered flood water management system.

Electroliers – A branching frame, often of ornamental design, used to support electric illuminating lamps.

Pothole excavation – See potholing.

Potholing – The practice of digging test holes to expose underground utilities (e.g., cables) to determine the horizontal and vertical location of these utilities.

Trenchless methods – Procedures for installing pipe without using traditional trench cut and cover methods. These trenchless methods may be referred to as bore and jack, tunneling, horizontal directional drilling, and microtunneling, among others.

Water conveyance facility – Canal, ditch, pipeline, drain, levee, open or closed laterals, and similar facilities and their associated appurtenant features.

Appendix A

General Requirements for Installing Bored and Jacked Pipe Undercrossings

Bored and Jacked Under the Canal – This terminology is a general way of referring to a family of trenchless technologies. Similar guidance to the requirements listed below should be followed no matter what method is used for installation.

1. Installing a lone carrier pipe (without casing) is encouraged. Refer to “4.6 Utility Crossing,” and “4.6.1 Casings” for information on cautions of using casings around metallic carrier pipe.
2. Plans must show carrier/casing pipe type, diameter, and thickness. Casing pipes should be steel pipe (American Water Works Association [AWWA] C-200) and have 1/4-inch minimum wall thickness. Applicants should provide the type of carrier pipe and appropriate bell dimensions for said carrier pipe to verify annular clearances.
3. When installing pipe while the canal is unwatered, a minimum of 3 pipe diameters or 60 inches of clearance (whichever is greater) between the top of the pipe and the bottom of the canal must be maintained. However, 72 inches or more clearance is recommended.
4. Provide a minimum of 3 inches of clearance between the carrier and casing pipes at all points (including bells).
5. A bulkhead or effective sealing device should be provided at both ends of each casing pipe to seal the annular space between the two pipes. Vent pipe should be included to allow ventilation and reduce the risk of condensation buildup and flooding.
6. As a result of the installation process, an annular void is usually created around the outside of the casing pipe. Provisions should be made to pressure grout or effectively seal (e.g., bentonite slurry) this void space.
7. Requirements below are provided to establish minimums for determination of the length of pipe to be installed. It is strongly recommended that pipes be installed perpendicular (between 70 and 90 degrees) to the canal alignment. Regardless, the pipe must extend completely through the Bureau of Reclamation’s (Reclamation) right-of-way (ROW). These minimums do not relieve the applicant’s engineer from performing an onsite investigation or other work to determine local conditions that may require additional pipe length.

Jacking pit configuration, location, and length of pipe to be installed should be based on the following parameters:

- a. One operating road shall remain open to vehicular traffic at all times.

- b. The minimum operating road embankment top width to be maintained during construction should be either 14 feet wide, the width of the existing embankment, or as required by Reclamation.
 - c. As a minimum, jacking pit excavations should not be within:
 - (1) A line drawn from the outside edge of the operating road embankment extended downward and away from the canal at a slope of 3/4 horizontal to 1 vertical.
 - (2) A line drawn from the outside edge of the top of the concrete lining extended downward and away from the canal at a slope of 1 horizontal to 1 vertical.
 - d. To contain the slurry during installation, jacking pits should be constructed so that natural ground or a compacted dike is entirely around the pit to an elevation at least 1 foot above the top of the canal lining.
 - e. All excavations should be in compliance with Occupation Safety and Health Administration regulations and Reclamation's Health and Safety Standards.
 - f. If the contractor elects to install shoring in the jacking pits, all shoring designs should be prepared by a Professional Engineer knowledgeable in said type of work. A copy of the shoring designs should be submitted to Reclamation.
8. Jacking pits should be backfilled with native material and mechanically compacted to 95 percent of the maximum dry density per ASTM D-698.
 9. The contractors should be responsible for any damage to the canal section during the construction of a crossing, and the contractor shall repair the damage at their own expense.
 10. If an emergency situation develops during construction, the contractor should immediately notify appropriate contacts with Reclamation. Reclamation must approve further work at that point.
 11. The minimum distance between two jacked pipes should be 10 feet.
 12. Any pressure lines installed within Reclamation's ROW must have adequate thrust restraint at bends and valves. Specified design pressures and thrust restraint calculations shall be provided to Reclamation to confirm the design configuration.

Appendix B

Guidelines – Removal of Trees and Other Vegetative Growth from Earth Dams, Dikes, and Conveyance Features

**Excerpted from: Review of Operation and Maintenance
Program Field Examination Guidelines**

**GUIDELINES
REMOVAL OF TREES AND OTHER VEGETATIVE GROWTH
FROM EARTH DAMS, DIKES, AND CONVEYANCE FEATURES***

Growth of trees and other significant vegetation on or adjacent to earth dams, dikes, and conveyance features, should be prevented from becoming established for the following reasons:

1. To allow proper surveillance and inspection of the structures and adjacent areas for seepage, cracking, sinkholes, settlement, deflection, and other signs of distress.
2. To allow adequate access for normal and emergency Operation and Maintenance (O&M) activities.
3. To prevent damage to the structures due to root growth, such as shortened seepage paths through embankments; voids in embankments from decayed roots or toppled trees; expansion of cracks or joints of concrete walls, canal lining, or pipes; and plugging of perforated or open-jointed drainage pipes.
4. To discourage animal/rodent activity (by eliminating their food source and habitat), thereby preventing voids within embankments and possible shortened seepage paths.
5. To allow adequate flow-carrying capability of water conveyance channels (e.g., spillway inlet and outlet channels; open canals, laterals, and drains).

The growth of trees and potentially detrimental vegetation should be prevented during its early stages as part of the operating office or entity's normal O&M program. Early control is generally the most cost effective means of avoiding potential adverse effects on these structures from their continued growth. Control efforts may consist of applying herbicides, spraying, cutting, and/or removing the trees or undesirable vegetation.

Suggested clearance zones (areas of control) adjacent to these structures are provided within these guidelines. Concerted efforts should be made to maintain these clearance zones. However, site-specific conditions, such as landscaping, accessibility, erosion susceptibility of material in the area, type of abutment material, original construction clearance zone, right-of-way easement, etc., may influence the necessity or success of these control efforts.

Should trees and/or other significant vegetation become established, proper O&M of earth embankment dams, dikes, and conveyance features, may require their discriminate removal. During the Review of Operation and Maintenance examination for the facility or system, the examiners should use these guidelines, along with their experience and professional judgment, to evaluate the need for removal of such established growth.

If trees and other significant growth are identified by the examination team in locations delineated by these guidelines, a determination should be made regarding their need for removal. If the identified vegetation is deemed to be in location such that its existence is not considered to be detrimental and therefore does not require removal, sufficient justification should be provided during the examination and included within the associated report to support that determination.

* Enclosure to memorandum dated April 26, 1989, from Manager, Project Operation Services Staff, to all Regional Directors, Subject: Revised Guidelines — *Removal of Trees and Other Vegetative Growth From Earth Dams, Dikes, and Conveyance Features.*

When, in the opinion of an Review of Operation and Maintenance examination team, such established growth requires removal, specific followup procedures should be addressed as part of the examination. Such procedures may include the need for right-of-way easement determination; the need for an assessment for potential environmental impacts (any impact assessments should be coordinated with designated regional or project office environmental staff); whether removal of the root system is necessary and to what extent; the method of removal and recompaction of material within the void created; and the need for any erosion stabilization measures.

National Environmental Policy Act compliance is required relative to such tree and vegetation removal. Additionally, the application of herbicides should comply with applicable provisions of the Endangered Species Act. The determination of appropriate procedures to be followed in assessing potential environmental impacts and mitigation (including those to wildlife and its habitat) will be the responsibility of each regional and/or project office. This will include the preparation of an appropriate National Environmental Policy Act document and an assessment of the need for mitigation prior to the onset of removal activities. Appropriate National Environmental Policy Act compliance may include a Categorical Exclusion Checklist, an environmental assessment followed by a Finding of No Significant Impact, or an Environmental Impact Statement.

The following guidelines and associated clearance zones should be used for all Reclamation earth dams, dikes, and conveyance features. They are not considered "policy;" rather, they are guides which should be used with reasonable judgment and practicality.

1. Trees and detrimental vegetative growth should be prevented from becoming established on the surface of all earth dam, dike, and conveyance feature embankments. A small amount of shallow-rooted vegetation may be acceptable to aid in erosion protection and slope stabilization. Mowing of grass and other small vegetation is desirable and may be necessary to allow proper surveillance of the surfaces and observation of animal/rodent activity.
2. A clearance zone of 25 feet beyond each contact (groins and toe) of earth dam embankments and dikes should be maintained of all trees and detrimental vegetation. Similarly, a clearance zone of 15 feet should be maintained beyond the outside toe of all fill sections/embankments for open canals and laterals. These clearance zones may need to be extended for seepage areas or other conditions where proper surveillance or access may be warranted.
3. Earth dam, dike, and conveyance feature (open canal and lateral) embankments have large tree growth or stumps from previously cut trees on or near them should be evaluated, usually in conjunction with an Review of Operation and Maintenance examination, for any necessary future action, (i.e., monitor, excavation and backfill, rebuild, etc.). Generally, sizable old root systems of large trees should be grubbed out and the embankment replaced and compacted to prevent the development of piping action or erosion. Likewise, any sizable voids resulting from animal/rodent burrowing activity should be filled and compacted. Seeding may be necessary for protection from surface erosion.
4. Spillway inlet and outlet channels, outlet works discharge channels, and other open conveyance channels (open canals, laterals, and drains) should be free of vegetative growth that could significantly impede water flow or reduce design capacity.
5. A clearance zone of 25 feet adjacent to all concrete structures associated with such facilities should be maintained of all trees and detrimental vegetative growth to prevent damage from root growth, to allow proper surveillance, and to allow adequate O&M access.

6. Associated cut slopes adjacent to open canals and laterals should be kept clear of vegetation which, if toppled and/or uprooted, could affect operations or O&M access.

7. For pipe conveyance systems (such as siphons, aqueducts, discharge lines, perforated or open-jointed drains, etc.), to provide O&M access and to prevent root encroachment, a clearance zone should be maintained 15 feet from each side of the pipeline. However, in some cases, farming of annual crops over pipelines may be permissible.

* * * * *

SF299 – 11400 S SWA-2

**APPLICATION FOR TRANSPORTATION, UTILITY SYSTEMS, TELECOMMUNICATIONS AND FACILITIES
ON FEDERAL LANDS AND PROPERTY**

FORM APPROVED
OMB Control Number: 0596-0249
Expiration Date: 1/31/2027

FOR AGENCY USE ONLY

NOTE: Before completing and filing the application for an authorization (easement, right-of-way, lease, license or permit), the applicant should completely review this package, including instructions, and schedule a pre-application meeting with representatives of the agency responsible for processing the application. Each agency may have specific and unique requirements to be met in preparing and processing the application. Many times, with the help of the agency representative, the application can be completed at the pre-application meeting.

Application Number

Date Filed

1. Name and address of applicant

Jordan Valley Water Conservancy District
(JVWCD)

8215 South 1300 West
West Jordan, UT 84088

2. Name and address of authorized agent if different from item 1

Bowen Collins & Associates (BC&A)

154 East 14075 South
Draper, UT 84020

3. Applicant telephone number and email:

801-565-4300
KevinR@jvwcd.org

Authorized agent telephone number and email:

801-495-2224
jluettinger@bowencollins.com

4. As applicant are you? (check one)

- a. Individual
- b. Corporation*
- c. Partnership/Association*
- d. State Government/State Agency
- e. Local Government
- f. Federal Agency

* If checked, complete supplemental page

5. Specify what application is for: (check one)

- a. New authorization
- b. Renewing existing authorization number
- c. Amend existing authorization number
- d. Assign existing authorization number
- e. Existing use for which no authorization has been received *
- f. Other*

* If checked, provide details under item 7

6. If an individual, or partnership, are you a citizen(s) of the United States? Yes No

7. Project description (describe in detail): (a) Type of use or occupancy, (e.g., canal, pipeline, road, telecommunications); (b) related structures and facilities; (c) physical specifications (Length, width, grading, etc.); (d) term of days/years needed; (e) time of year of use or operation; (f) Volume or amount of product to be transported; (g) duration and timing of construction; and (h) temporary work areas needed for activity/construction (Attach additional sheets, if additional space is needed.)

See attached.

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8. Attach a map covering area and show location of project proposal.

9. State or Local government approval: Attached Applied for Not Required

10. Nonrefundable application fee: Attached Not required To be determined by agency

11. Does project cross international boundary or affect international waterways? Yes No (if "yes," indicate on map)

12. Give statement of your technical and financial capability to construct, operate, maintain, and terminate system for which authorization is being requested.

Jordan Valley Water Conservancy District is funding this Project internally. They have contracted with Bowen Collins & Associates for design. Operation and maintenance to be performed by JVWCD. This project has been planned and budgeted for over many years and approved to proceed by JVWCD's board.

13a. Describe other alternative locations considered.

No other locations were considered.

b. Why were these alternatives not selected?

The JA-2 11400 South Mainline Valve Vault will be constructed entirely within BOR easements. The vault will house a JA-2 mainline isolation valve and also provide an interconnection with SWA-2. This location provides significant operational flexibility between the two aqueducts and other JWCD transmission lines.

c. Give explanation as to why it is necessary to use or occupy Federal assets (lands or buildings).

It is necessary to occupy Federal BOR easements for the effective operation of both the Southwest Aqueduct and Jordan Aqueduct in tandem. The two aqueducts will work together to supply Salt Lake County with drinking water.

14. List authorizations and pending applications filed for similar projects which may provide information to the authorizing agency. (Specify number, date, code, or name)

A separate application is also being submitted for SWA-2 Project work between 11800 South and 13400 South.

15. Provide statement of need for project, including the economic feasibility and items such as: (a) cost of proposal (construction, operation, and maintenance); (b) estimated cost of next best alternative; and (c) expected public benefits.

(a) BC&A estimates the construction cost of the Project to be between 35 and 45 million dollars. (Includes 11400 S Vault)

(b) No alternatives considered.

(c) This Project benefits the public by ensuring adequate water supply for Salt Lake County in the coming decades. +

16. Describe probable effects on the population in the area, including the social and economic aspects, and the rural lifestyles.

The 11400 South JA-2 Mainline Valve Vault will provide redundancy for existing water transmission systems, and ensure constant availability of water for the people of JWCD's Service area in Salt Lake County via improved operational flexibility for JWCD.

17. Describe likely environmental effects that the proposed project will have on: (a) air quality; (b) visual impact; (c) surface and ground water quality and quantity; (d) the control or structural change on any stream or other body of water; (e) existing noise levels; and (f) the surface of the land, including vegetation, permafrost, soil, and soil stability; and, (g) historic or archaeological resources or properties.

(a) None. (b) No new visual impacts. (c) None. (d) N/A. (e) None. (f) All disturbed areas will be restored to original or better condition. (g) No historic or archaeological resources or properties are within Project area.

18. Describe the probable effects that the proposed project will have on (a) populations of fish, plant life, wildlife, and marine life, including threatened and endangered species; and (b) marine mammals, including hunting, capturing, collecting, or killing these animals.

(a) No effects. Project is in a developed area.

(b) N/A.

19. State whether any hazardous material, as defined in this paragraph, would be used, produced, transported or stored on or in a federal building or federal lands or would be used in connection with the proposed use or occupancy. "Hazardous material" shall mean (a) any hazardous substance under section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9601(14); (b) any pollutant or contaminant under section 101(33) of CERCLA, 42 U.S.C. § 9601(33); (c) any petroleum product or its derivative, including fuel oil, and waste oils; and (d) any hazardous substance, extremely hazardous substance, toxic substance, hazardous waste, ignitable, reactive or corrosive materials, pollutant, contaminant, element, compound, mixture, solution or substance that may pose a present or potential hazard to human health or the environment under any applicable environmental laws. The holder shall not store any hazardous materials at the site without prior written approval from the authorized officer. This approval shall not be unreasonably withheld. If the authorized officer provides approval, this permit shall include (or in the case of approval provided after this permit is issued, shall be amended to include) specific terms addressing the storage of hazardous materials, including the specific type of materials to be stored, the volume, the type of storage, and a spill plan. Such terms shall be proposed by the holder and are subject to approval by the authorized officer.

No hazardous materials will be produced, stored, or transported within federal lands. The only petroleum products used within federal lands will be confined to construction equipment.

20. Name all the Federal Department(s)/Agency(ies) where this application is being filed.

Bureau of Reclamation

I HEREBY CERTIFY, That I am of legal age and authorized to do business in the State and that I have personally examined the information contained in the application and believe that the information submitted is correct to the best of my knowledge.

Signature of Applicant

Date

Title 18, U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

GENERAL INFORMATION
ALASKA NATIONAL INTEREST LANDS

This application will be used when applying for a right-of-way, permit, license, lease, or certificate for the use of Federal lands which lie within conservation system units and National Recreation or Conservation Areas as defined in the Alaska National Interest lands Conservation Act. Conservation system units include the National Park System, National Wildlife Refuge System, National Wild and Scenic Rivers System, National Trails System, National Wilderness Preservation System, and National Forest Monuments.

Transportation utility systems telecommunication installations facility uses for which the application may be used are:

1. Canals, ditches, flumes, laterals, pipes, pipelines, tunnels, and other systems for the transportation of water.
2. Pipelines and other systems for the transportation of liquids other than water, including oil, natural gas, synthetic liquid and gaseous fuels, and any refined product produced therefrom.
3. Pipelines, slurry and emulsion systems, and conveyor belts for transportation of solid materials.
4. Systems for the transmission and distribution of electric energy.
5. Wired and wireless systems for transmission or reception of radio, television, telephone, telegraph, and other electronic signals, and other means of communications.
6. Improved right-of-way for snow machines, air cushion vehicles, and all-terrain vehicles.
7. Roads, highways, railroads, tunnels, tramways, airports, landing strips, docks, and other systems of general transportation.

This application must be filed simultaneously with each Federal department or agency requiring authorization to establish and operate your proposal.

In Alaska, the following agencies will help the applicant file an application and identify the other agencies the applicant should contact and possibly file with:

Department of Agriculture
Regional Forester, Forest Service (USFS)
P.O. Box 21628
Juneau, Alaska 99802-1628
Telephone: (907) 586-7847
(or a local Forest Service Office)

Department of the Interior
Bureau of Indian Affairs (BIA)
Alaska Regional Office
709 West 9th Street
Juneau, Alaska 99802
Telephone: (907) 586-7177

Department of the Interior
Alaska State Office
Bureau of Land Management
222 West 7th Avenue #13
Anchorage, Alaska 99513
Public Room: 907-271-5960
FAX: 907-271-3684
(or a local BLM Office)

U.S. Fish & Wildlife Service (FWS)
Office of the Regional Director
1011 East Tudor Road
Anchorage, Alaska 99503
Telephone: (907) 786-3440

National Park Service (NPS)
Alaska Regional Office
240 West 5th Avenue
Anchorage, Alaska 99501
Telephone: (907) 644-3510

Note - Filings with any Interior agency may be filed with any office noted above or with the Office of the Secretary of the Interior, Regional Environmental Officer, P.O. Box 120, 1675 C Street, Anchorage, Alaska 99513.

Department of Transportation
Federal Aviation Administration
Alaska Region AAL-4, 222 West 7th Ave., Box 14
Anchorage, Alaska 99513-7587
Telephone: (907) 271-5285

NOTE - The Department of Transportation has established the above central filing point for agencies within that Department. Affected agencies are: Federal Aviation Administration (FAA), Coast Guard (USCG), Federal Highway Administration (FHWA), Federal Railroad Administration (FRA).

OTHER THAN ALASKA NATIONAL INTEREST LANDS

Use of this form is not limited to National Interest Conservation Lands of Alaska.

Individual department/agencies may authorize the use of this form by applicants for transportation, utility systems, telecommunication installations and facilities on other Federal lands outside those areas described above.

For proposals located outside of Alaska, applications will be filed at the local agency office or at a location specified by the responsible Federal agency.

SPECIFIC INSTRUCTIONS
(Items not listed are self-explanatory)

- 7 Attach preliminary site and facility construction plans. The responsible agency will provide instructions whenever specific plans are required.
- 8 Generally, the map must show the section(s), township(s), and range(s) within which the project is to be located. Show the proposed location of the project on the map as accurately as possible. Some agencies require detailed survey maps. The responsible agency will provide additional instructions.
- 9, 10, and 12 The responsible agency will provide additional instructions.
- 13 Providing information on alternate locations in as much detail as possible, discussing why certain locations were rejected and why it is necessary to use Federal assets will assist the agency(ies) in processing your application and reaching a final decision. Include only reasonable alternate locations as related to current technology and economics.
- 14 The responsible agency will provide instructions.
- 15 Generally, a simple statement of the purpose of the proposal will be sufficient. However, major proposals located in critical or sensitive areas may require a full analysis with additional specific information. The responsible agency will provide additional instructions.
- 16 through 19 Providing this information with as much detail as possible will assist the Federal agency(ies) in processing the application and reaching a decision. When completing these items, you should use a sound judgment in furnishing relevant information. For example, if the project is not near a stream or other body of water, do not address this subject. The responsible agency will provide additional instructions.

Application must be signed by the applicant or applicant's authorized representative.

PUBLIC BURDEN STATEMENT

The Federal agencies collect this information from proponents and applicants requesting a right-of-way, permit, license, lease, or certification for use of Federal assets. The Federal agencies use this information to evaluate a proponent's or applicant's proposal to use Federal assets. A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995 unless the information collection has a currently valid Office of Management and Budget (OMB) Control Number. The approved OMB Control Number for this information collection is 0596-0249. Without this approval, we could not conduct this information collection. Public reporting for this information collection is estimated to be approximately 8 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. All responses to this information collection are voluntary. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden, to the USDA Forest Service email address SM.FS.InfoCollect@usda.gov and include the OMB Control Number in the subject line. Disclosure of the information is voluntary. If all the information is not provided, the proposal or application may be rejected. Concerns about this form can be sent to Director, Lands, Minerals, and Geology Management Staff, 1st Floor Southeast, 201 14th Street, SW, Washington, DC 20250-1124

USDA NONDISCRIMINATION STATEMENT

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident. Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English. To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at [How to File a Program Discrimination Complaint and at any USDA office](#) or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov. The Privacy Act of 1974 (5 U.S.C. 552a) and the Freedom of Information Act (5 U.S.C. 552) govern the confidentiality to be provided for information received by the Forest Service.

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SUPPLEMENTAL

NOTE: The responsible agency(ies) will provide instructions	CHECK APPROPRIATE BLOCK	
I - PRIVATE CORPORATIONS	ATTACHED	FILED *
a. Articles of Incorporation	<input type="checkbox"/>	<input type="checkbox"/>
b. Corporation Bylaws	<input type="checkbox"/>	<input type="checkbox"/>
c. A certification from the State showing the corporation is in good standing and is entitled to operate within the State	<input type="checkbox"/>	<input type="checkbox"/>
d. Copy of resolution authorizing filing	<input type="checkbox"/>	<input type="checkbox"/>
e. The name and address of each shareholder owning 3 percent or more of the shares, together with the number and percentage of any class of voting shares of the entity which such shareholder is authorized to vote and the name and address of each affiliate of the entity together with, in the case of an affiliate controlled by the entity, the number of shares and the percentage of any class of voting stock of that affiliate owned, directly or indirectly, by that entity, and in the case of an affiliate which controls that entity, the number of shares and the percentage of any class of voting stock of that entity owned, directly or indirectly, by the affiliate.	<input type="checkbox"/>	<input type="checkbox"/>
f. If application is for an oil or gas pipeline, describe any related right-of-way or temporary use permit applications, and identify previous applications.	<input type="checkbox"/>	<input type="checkbox"/>
g. If application is for an oil and gas pipeline, identify all Federal lands by agency impacted by proposal.	<input type="checkbox"/>	<input type="checkbox"/>
II - PUBLIC CORPORATIONS		
a. Copy of law forming corporation	<input type="checkbox"/>	<input type="checkbox"/>
b. Proof of organization	<input type="checkbox"/>	<input type="checkbox"/>
c. Copy of Bylaws	<input type="checkbox"/>	<input type="checkbox"/>
d. Copy of resolution authorizing filing	<input type="checkbox"/>	<input type="checkbox"/>
e. If application is for an oil or gas pipeline, provide information required by item "I - f" and "I - g" above.	<input type="checkbox"/>	<input type="checkbox"/>
III - PARTNERSHIP OR OTHER UNINCORPORATED ENTITY		
a. Articles of association, if any	<input type="checkbox"/>	<input type="checkbox"/>
b. If one partner is authorized to sign, resolution authorizing action is	<input type="checkbox"/>	<input type="checkbox"/>
c. Name and address of each participant, partner, association, or other	<input type="checkbox"/>	<input type="checkbox"/>
d. If application is for an oil or gas pipeline, provide information required by item "I - f" and "I - g" above.	<input type="checkbox"/>	<input type="checkbox"/>

* If the required information is already filed with the agency processing this application and is current, check block entitled "Filed." Provide the file identification information (e.g., number, date, code, name). If not on file or current, attach the requested information.

SF 299 Item No. 7 – Project Description

Jordan Valley Water Conservancy District's (JVWCD) Southwest Aqueduct, Reach 2 (SWA-2) Project – 11400 South Jordan Aqueduct, Reach 2 (JA-2) Mainline Valve Vault

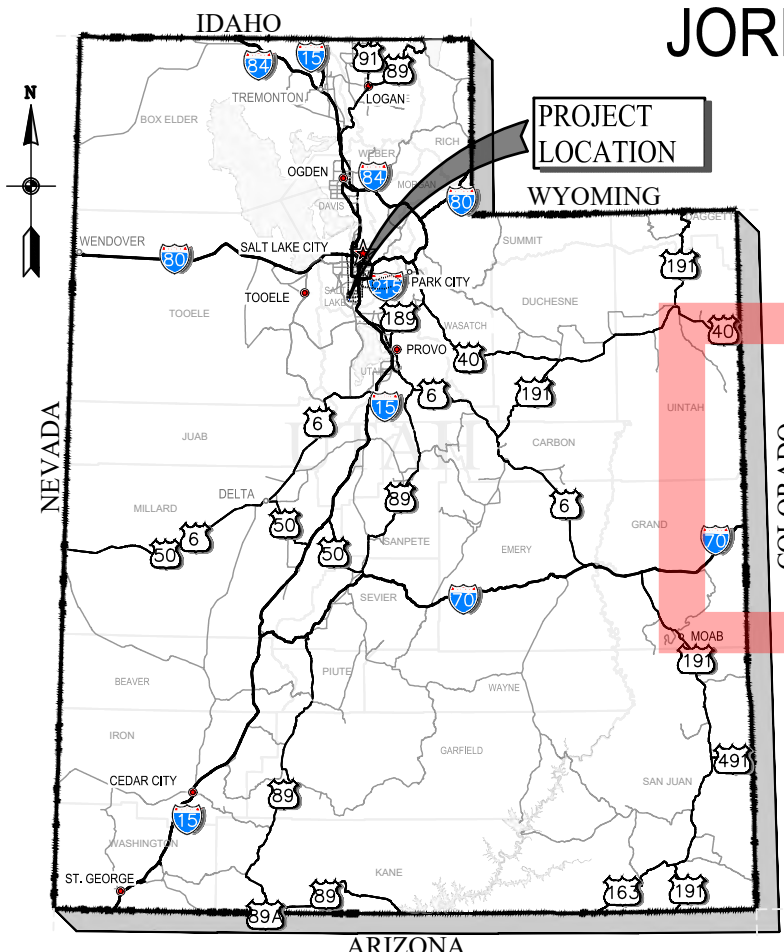
JVWCD is constructing a new JA-2 Mainline Valve Vault at 11400 South in Riverton, Utah with a connection to existing SWA-2 interconnect piping. The vault will be constructed entirely within existing JVWCD and BOR easements and adjacent to existing JA-2 structures. The Project Includes:

- (a) Replacement of 78-inch welded steel JA-2 pipeline for potable water.
- (b) Aqueduct Appurtenances – Mainline Valve Vault, butterfly valves and actuators, cathodic protection, manway access, air valves, vent piping, concrete vent pads and vent caps, minor drain, and associated buried drain piping, and 36-inch SWA-2 interconnection buried piping and reducer.
- (c) Items are numbered C1 through C9 below. This numbering is used in attached drawings for reference.
 - (C1) 11400 South JA-2 Mainline Valve Vault with Drain – See Sheets C-12 and M-11
 - o Buried structure, isolation valves, dismantling joints, air valve, DC blocker, isolation flanges, JA-2 manway access, and approximately 15 LF replaced 78-inch JA-2 welded steel water pipe
 - (C2) Buried Vent Piping with Concrete Vent Pad and Mushroom Vent Caps – See Sheets C-12 and C-14
 - (C3) New Asphalted Area and Curb and Gutter – See Sheet C-12
 - (C4) 30 LF of 12-inch diameter buried welded steel drain piping, 2-inch diameter buried sump drain piping, and Minor Drain / Pumpout – See Sheet C-12
 - (C5) 14 LF of 36-inch diameter buried welded steel SWA-2 interconnection piping – See Sheet C-12
 - (C6) Existing 11400 South JA-2 Double Turnout Structure Modifications – See Sheets S-03 and S-04
 - o Structural modifications to the existing structure to incorporate Item C1 (11400 South JA-2 Mainline Valve Vault)
 - (C7) Existing 11400 South Electrical Site Modifications – See Sheets E-09 through E12
- (d) Permanent.
- (e) SWA-2 and JA-2 will operate continuously, year-round except when taken offline for maintenance or inspection.
- (f) Flows range from approximately 14 MGD (winter months) to 102 MGD (summer months, only one aqueduct online)
- (g) It is anticipated that construction of the SWA-2 Project, and 11400 South Mainline Valve Vault will take place between April/May of 2025 and April/May of 2027 over approximately 24 months.

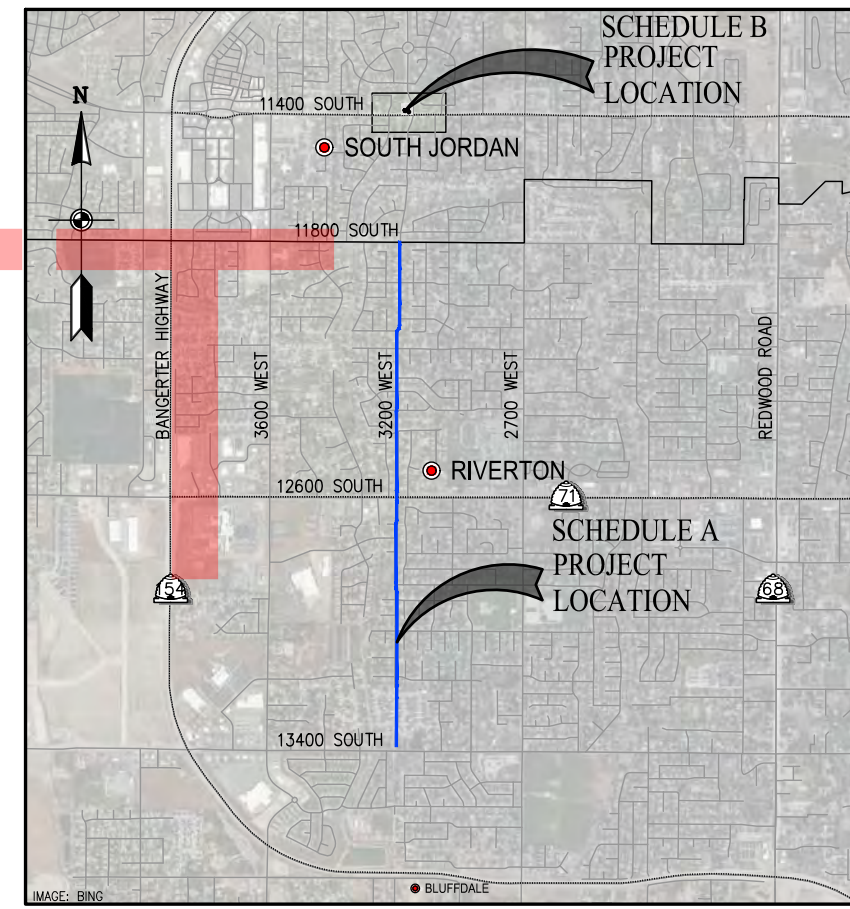
(h) Contractor will comply with Specification Section 015110 - Aqueduct Protection and Monitoring (see attached). No storage or staging permitted within the BOR easement. Contractor will delineate existing JA-2 and its load protection area and abide by BOR aqueduct protection and monitoring criteria.

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DRAWINGS FOR CONSTRUCTION OF THE SOUTHWEST AQUEDUCT REACH 2 13400 SOUTH TO 11800 SOUTH AND 11400 SOUTH JA-2 MAINLINE VAULT JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT



PROJECT LOCATION MAP

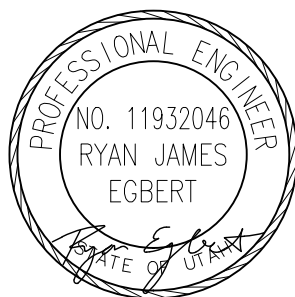


PROJECT VICINITY MAP

DRAFT



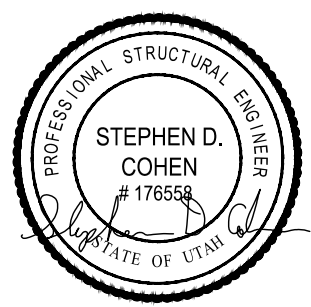
SCHEDULE A
CIVIL/MECHANICAL



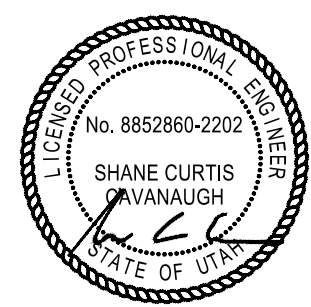
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CIVIL/MECHANICAL



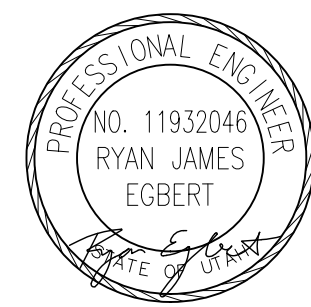
TRAFFIC CONTROL



STRUCTURAL



ELECTRICAL/INSTRUMENTATION



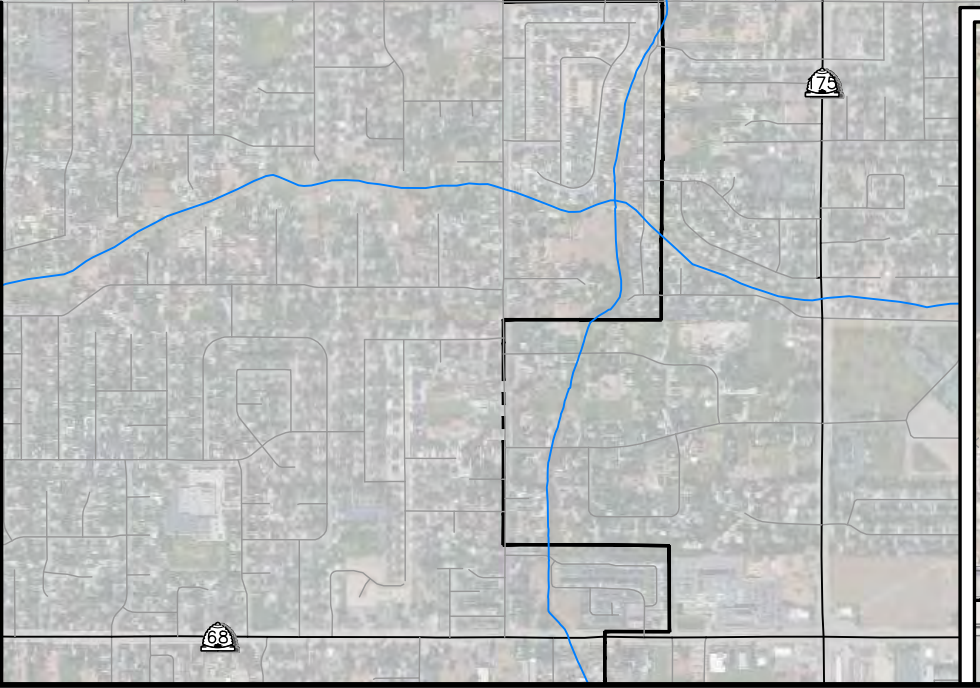
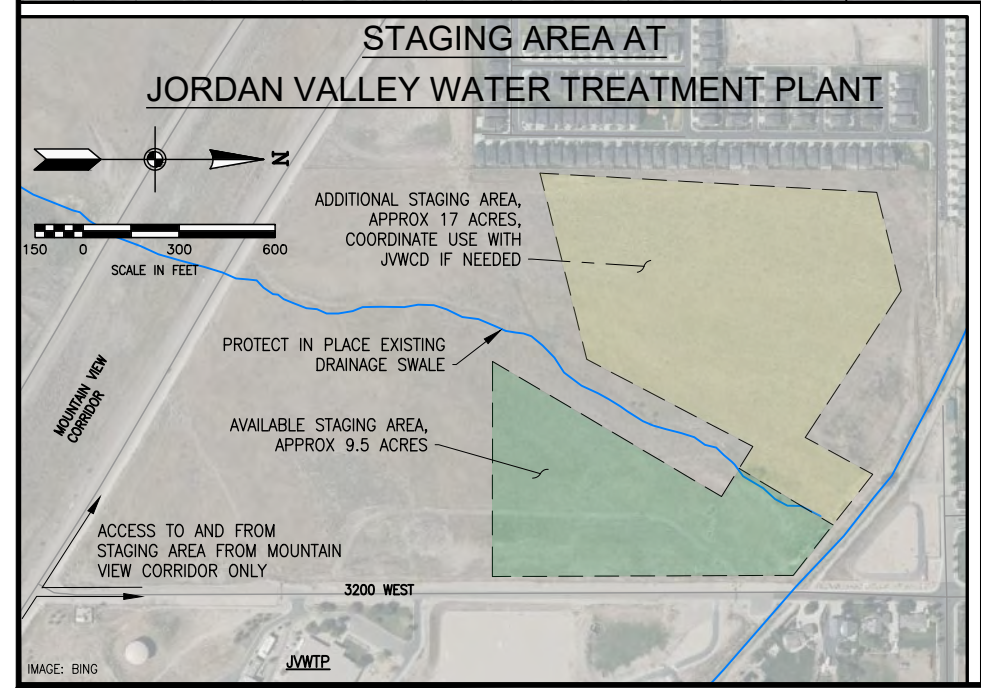
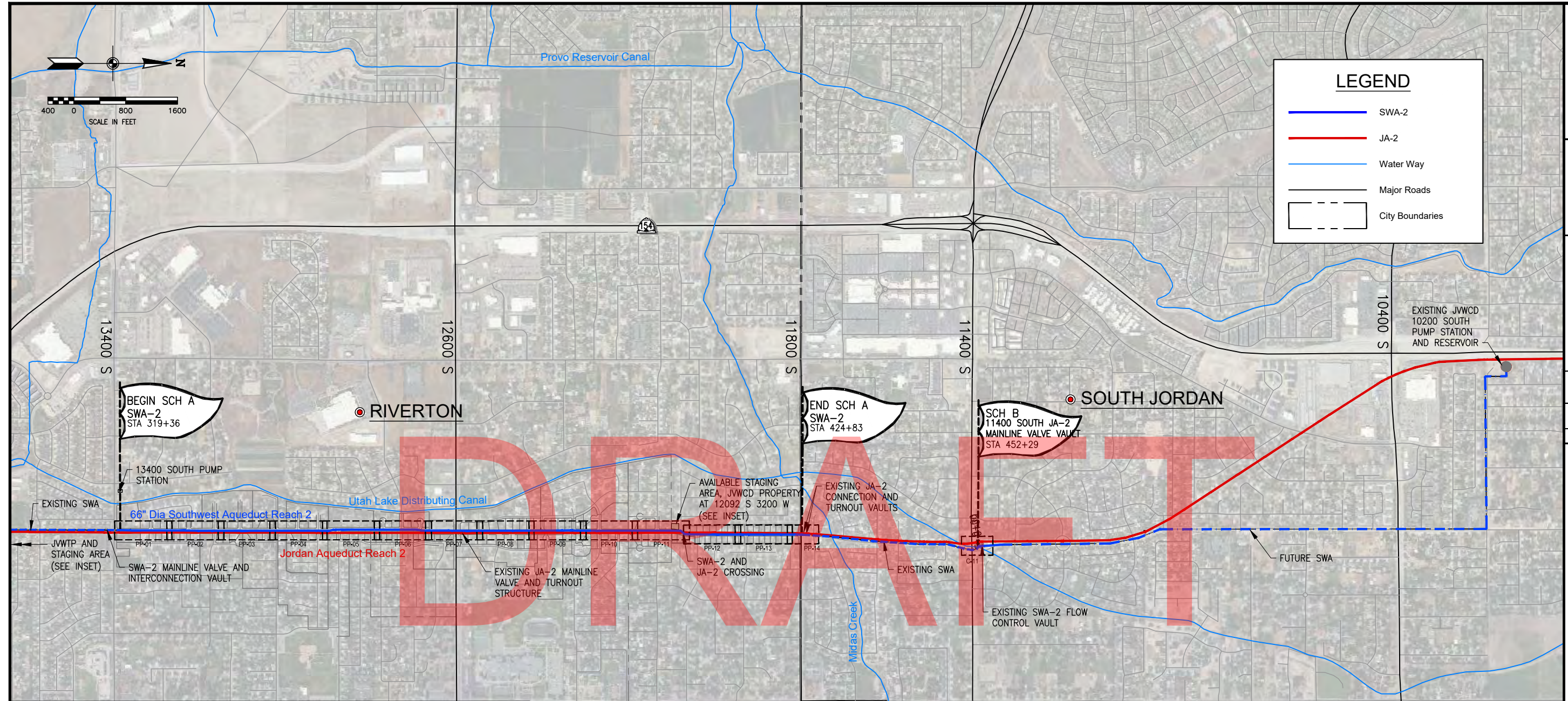
CATHODIC PROTECTION

NO.	DATE	REV. BY	DESCRIPTION

DESIGN L. MINCK		CHECKED T. OLSEN		REVIEW J. L. OLSEN		VERIFY SCALE 1" = 100'	
DRAWN J. BLACK		APPROVED J. LUETTINGER		JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT		BAR IS ONE INCH ON ORIGINAL DRAWING	

GENERAL		TITLE PAGE PROJECT LOCATION MAP AND VICINITY MAP	
DATE:	JANUARY 2025	PROJECT NUMBER	010-23-02

DRAWING NO.	G-01
SHEET	01 OF 99



NO.	DATE	REV. BY	DESCRIPTION

VERIFY SCALE
 BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
 CHECKED: T. OLSEN
 APPROVED: J. LUETTINGER

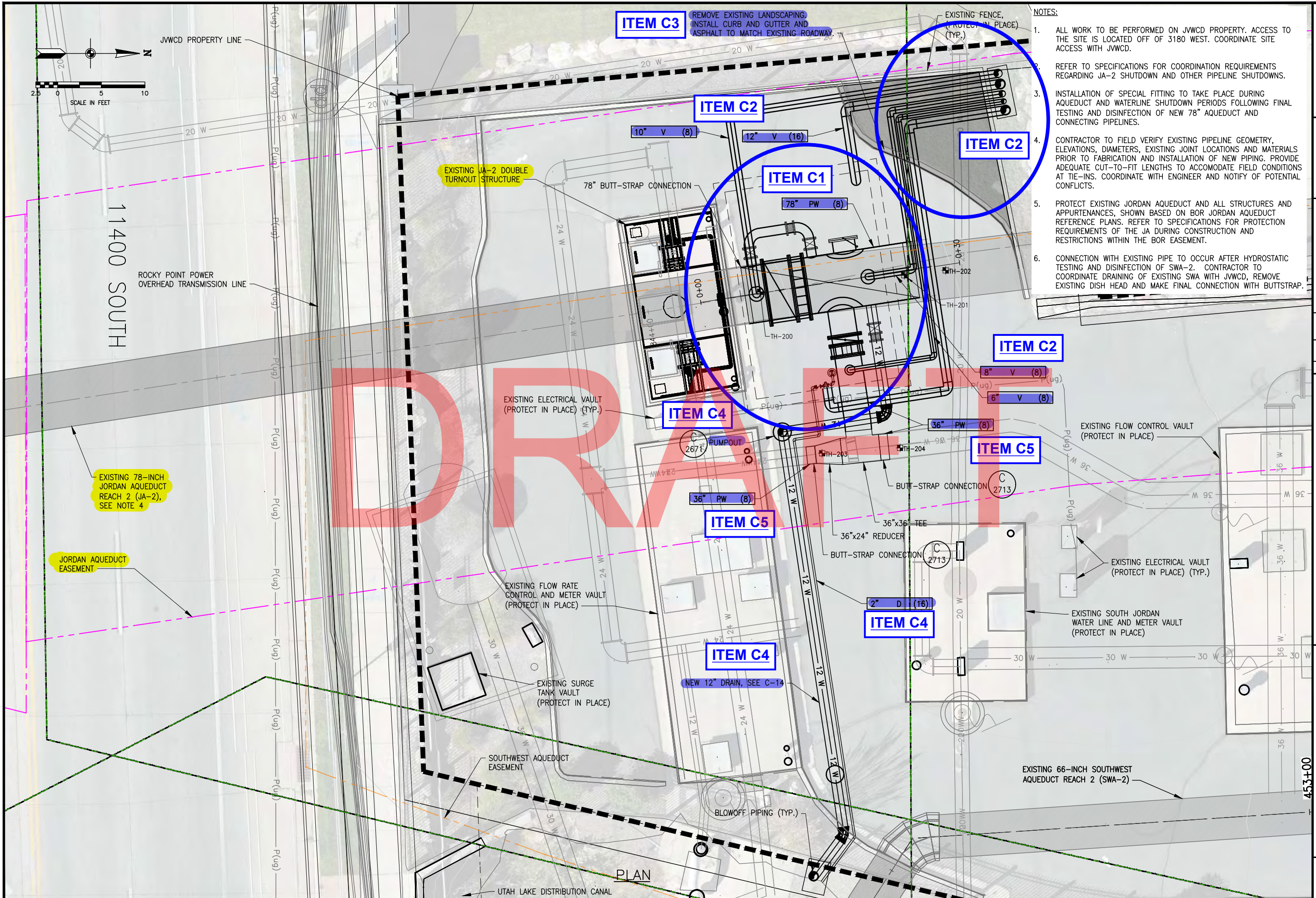
DESIGN
 DESIGN: L. MINCK
 DRAWN: J. BLACK

GENERAL

SWA OVERALL SYSTEM LAYOUT

DATE: JANUARY 2025
 PROJECT NUMBER: 010-23-02

P:\JORDAN VALLEY WCD\010-23-02 SOUTHWEST AQUEDUCT REACH 2 - 13400 S TO 11800 S\2.0 DESIGN PHASE\2.9 DRAWINGS\SH1\0102302_G-06.dwg Plotted: 1/10/2025 2:13 PM By: Jeremy Black



ITEM C3

REMOVE EXISTING LANDSCAPING, INSTALL CURB AND GUTTER AND ASPHALT TO MATCH EXISTING ROADWAY.

ITEM C2

10" V (8)
12" V (16)

ITEM C1

78" PW (8)

ITEM C2

ITEM C4

ITEM C5

ITEM C4

ITEM C5

ITEM C4

NOTES:

1. ALL WORK TO BE PERFORMED ON JWCD PROPERTY. ACCESS TO THE SITE IS LOCATED OFF OF 3180 WEST. COORDINATE SITE ACCESS WITH JWCD.
2. REFER TO SPECIFICATIONS FOR COORDINATION REQUIREMENTS REGARDING JA-2 SHUTDOWN AND OTHER PIPELINE SHUTDOWNS.
3. INSTALLATION OF SPECIAL FITTING TO TAKE PLACE DURING AQUEDUCT AND WATERLINE SHUTDOWN PERIODS FOLLOWING FINAL TESTING AND DISINFECTION OF NEW 78" AQUEDUCT AND CONNECTING PIPELINES.
4. CONTRACTOR TO FIELD VERIFY EXISTING PIPELINE GEOMETRY, ELEVATIONS, DIAMETERS, EXISTING JOINT LOCATIONS AND MATERIALS PRIOR TO FABRICATION AND INSTALLATION OF NEW PIPING. PROVIDE ADEQUATE CUT-TO-FIT LENGTHS TO ACCOMMODATE FIELD CONDITIONS AT TIE-INS. COORDINATE WITH ENGINEER AND NOTIFY OF POTENTIAL CONFLICTS.
5. PROTECT EXISTING JORDAN AQUEDUCT AND ALL STRUCTURES AND APPURTENANCES, SHOWN BASED ON BOR JORDAN AQUEDUCT REFERENCE PLANS. REFER TO SPECIFICATIONS FOR PROTECTION REQUIREMENTS OF THE JA DURING CONSTRUCTION AND RESTRICTIONS WITHIN THE BOR EASEMENT.
6. CONNECTION WITH EXISTING PIPE TO OCCUR AFTER HYDROSTATIC TESTING AND DISINFECTION OF SWA-2. CONTRACTOR TO COORDINATE DRAINING OF EXISTING SWA WITH JWCD, REMOVE EXISTING DISH HEAD AND MAKE FINAL CONNECTION WITH BUTTSTRAP.

BOWEN COLLINS ASSOCIATES

NO.	DATE	REV. BY	DESCRIPTION

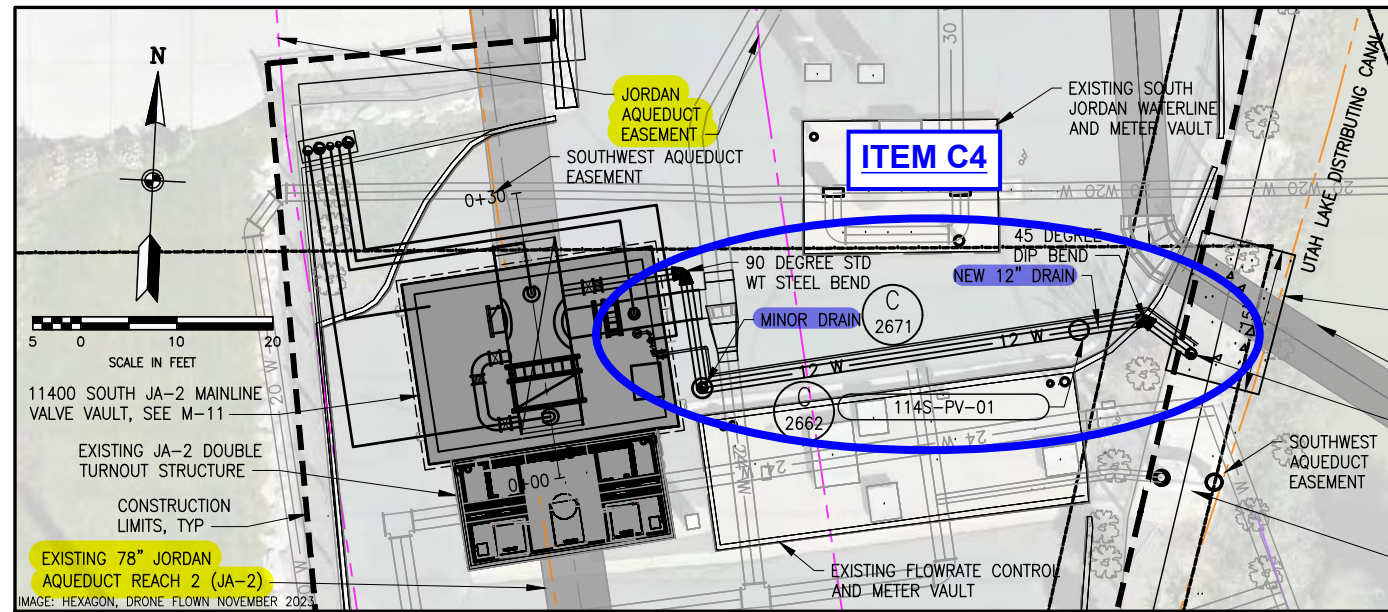
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN DESIGNER: R. EGBERT DRAWN: J. BLACK	REVIEW CHECKED: T. OLSEN APPROVED: J. LUETTINGER	SOUTHWEST AQUEDUCT REACH 2 JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT
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11400 SOUTH JA-2 MAINLINE VALVE VAULT PIPING SITE PLAN CIVIL	PROJECT NUMBER: 010-23-02 DATE: JANUARY 2025
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DRAWING NO. **C-12**

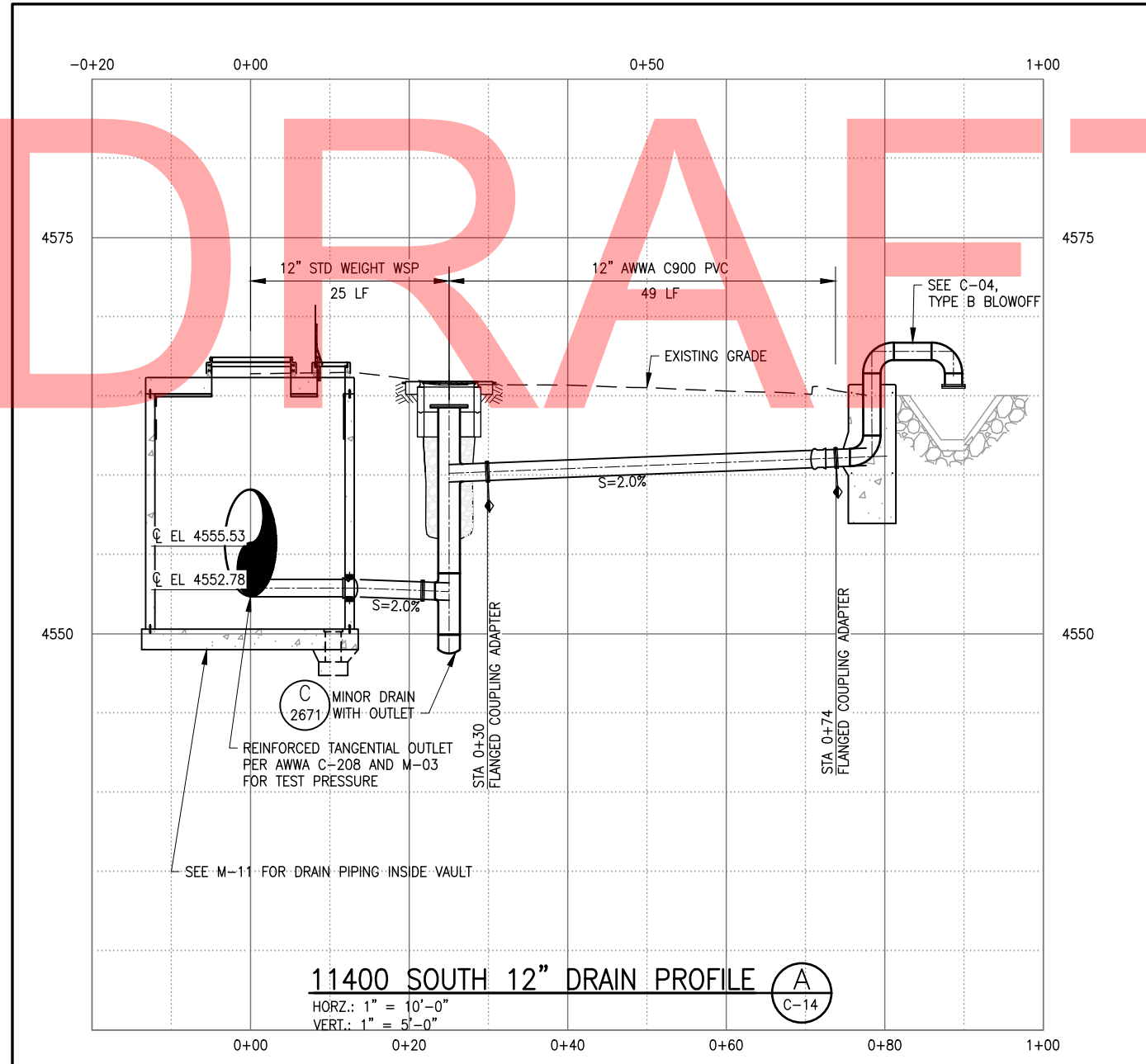
SHEET 41 OF 99



NOTES:

1. PROTECT EXISTING JORDAN AQUEDUCT PER BOR REQUIREMENTS AND SPECIFICATIONS.
2. DRAIN TO BE TESTED AND DISINFECTED WITH WATERLINE.
3. COORDINATE WITH UTAH LAKE DISTRIBUTION CANAL (ULDC) WATER MASTER FOR ALL WORK TO BE PERFORMED WITHIN CANAL ROW. WORK TO BE PERFORMED DURING CANAL OFF SEASON FROM OCTOBER 15TH TO APRIL 1ST. WORK IN ULDC REQUIRES CANAL PERMIT AND SALT LAKE COUNTY FLOOD CONTROL PERMIT, SEE SPECIFICATIONS.

- CANAL BLOWOFF PAD, TIE TO EXISTING PAD (C 2988)
- EXISTING 66" SOUTHWEST AQUEDUCT, REACH 2 (SWA-2)
- BLOWOFF TO CANAL, SEE C-04
- EXISTING BLOWOFF TO CANAL AND CONCRETE PAD, PROTECT IN PLACE



11400 SOUTH 12" DRAIN PROFILE (A)
 HORZ.: 1" = 10'-0"
 VERT.: 1" = 5'-0"
 C-14

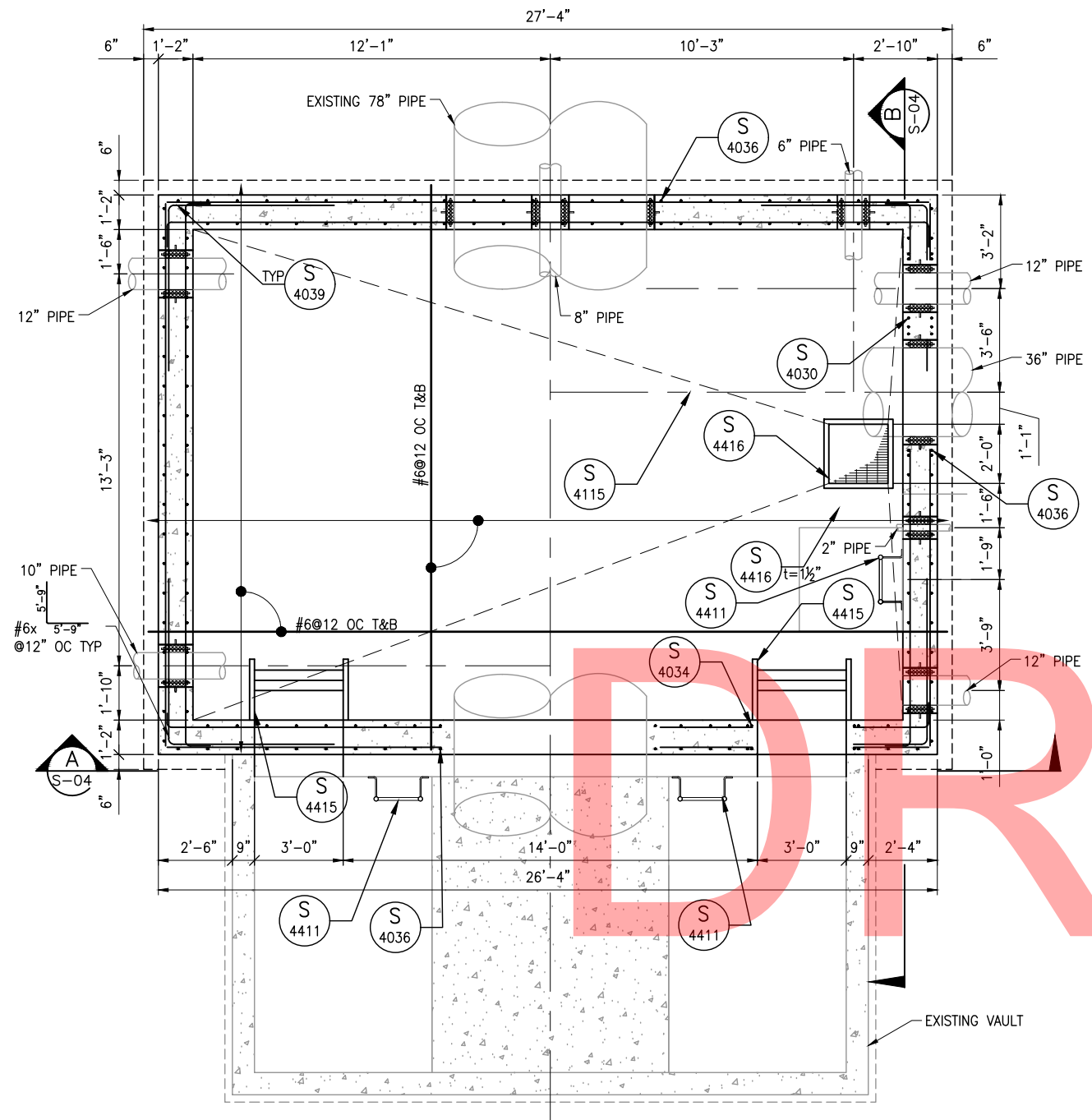


NO.	DATE	REV. BY	DESCRIPTION

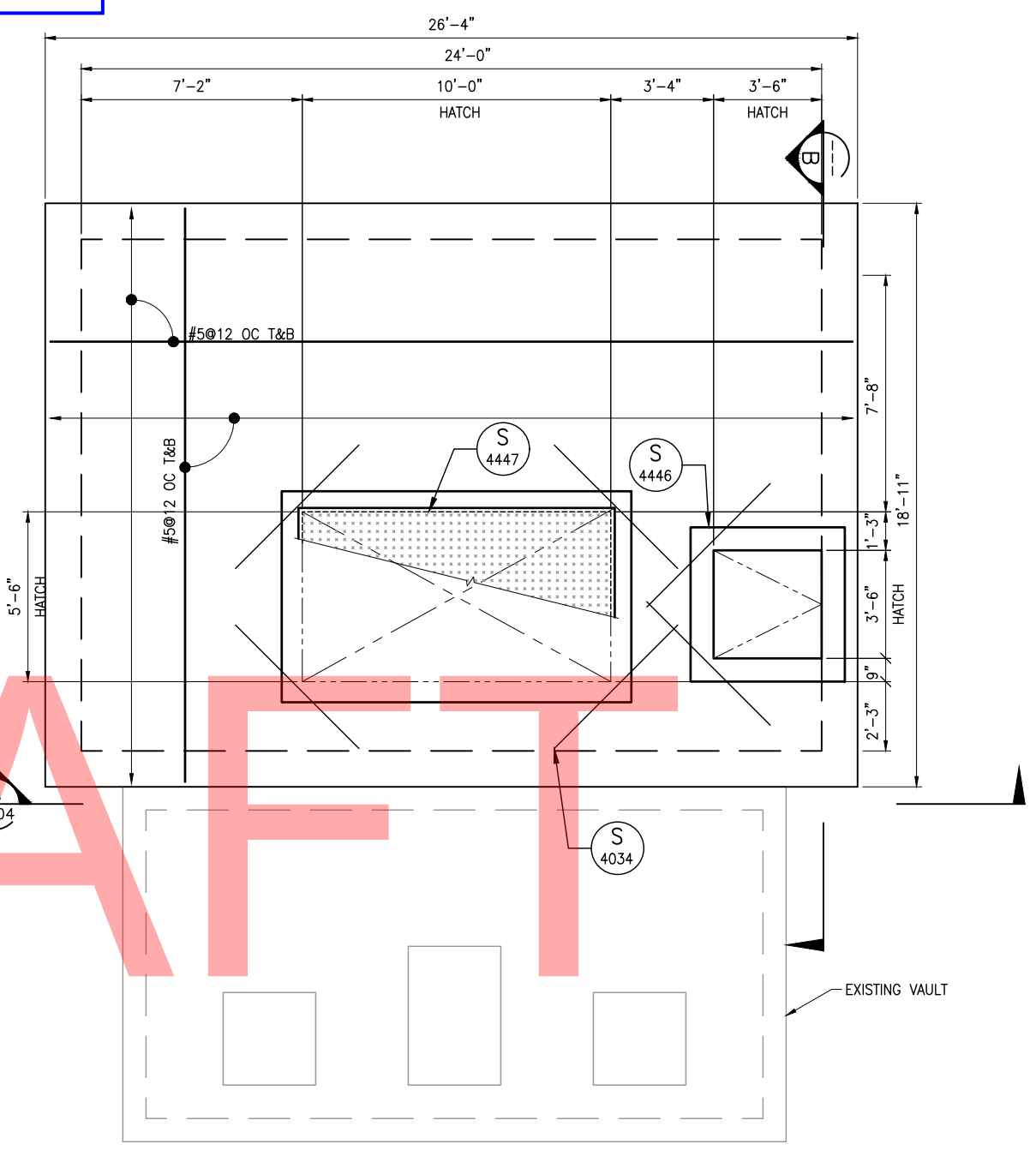
JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT	
SOUTHWEST AQUEDUCT REACH 2	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN R. EGBERT	CHECKED C. NELSON
DRAWN J. BLACK	APPROVED J. LUETTINGER

CIVIL	PROJECT NUMBER 010-23-02
STA 844+25 JA-2 DRAIN PLAN AND PROFILE	DATE JANUARY 2025

P:\JORDAN VALLEY WCD\010-23-02 SOUTHWEST AQUEDUCT REACH 2 - 13400 S TO 11800 S\2.0 DESIGN PHASE\2.9 DRAWINGS\SH1C-14.dwg Plotted: 1/10/2025 3:26 PM By: Jeremy Black



BASE PLAN
SCALE: 3/8"=1'-0"



ROOF PLAN
SCALE: 3/8"=1'-0"

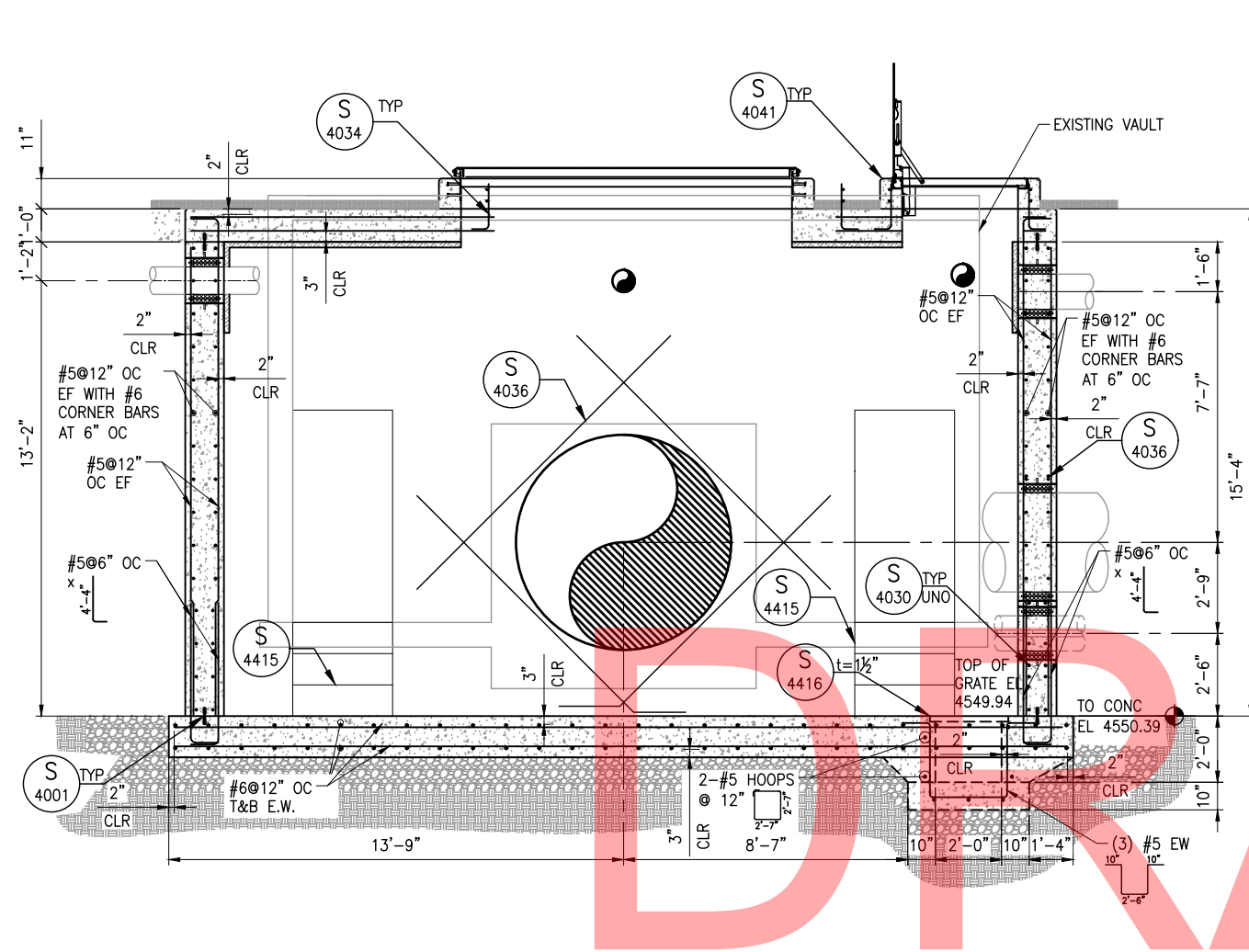
DRAWING NOTES

- FOR GENERAL STRUCTURAL NOTES, REFER TO DRAWING GS-01.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE THE STRUCTURAL DRAWINGS WITH ALL OTHER CONTRACT DOCUMENTS. STRUCTURAL DRAWINGS DO NOT ATTEMPT TO SHOW ALL MECHANICAL AND ELECTRICAL PENETRATIONS AND ROUTINGS.
- OVER EXCAVATE BENEATH BASE SLAB AND PLACE 1'-0" MINIMUM COMPACTED THICKNESS OF GRANULAR STRUCTURAL FILL. EXTEND A MINIMUM OF 2' BEYOND THE EDGE OF THE BASE SLAB.
- THE EXPOSED INTERIOR FACES OF THE CONCRETE WALLS AND TOP SLAB SHALL BE GIVEN A RUBBED FINISH. TOP SURFACE OF BOTH SLABS SHALL BE GIVEN A FLOATED SURFACE FINISH CONSISTENT WITH REQUIREMENTS FOR A PAINTED COATING.
- APPLY FLUID-APPLIED WATERPROOFING TO ALL EXTERIOR BURIED CONCRETE SURFACES OF THE VAULT.
- UNLESS SPECIFICALLY NOTED OTHERWISE, MISCELLANEOUS METAL ITEMS WITHIN THIS STRUCTURE ARE TO BE STAINLESS STEEL.
- UNO, HATCH SHALL HAVE A CONCEALED RECESSED PADLOCK HASP AND SHALL BE INSULATED WITH RIGID FOAM BOARD.
- WALLS AND ROOF SLAB SHALL BE INSULATED WITH RIGID FOAM BOARD.

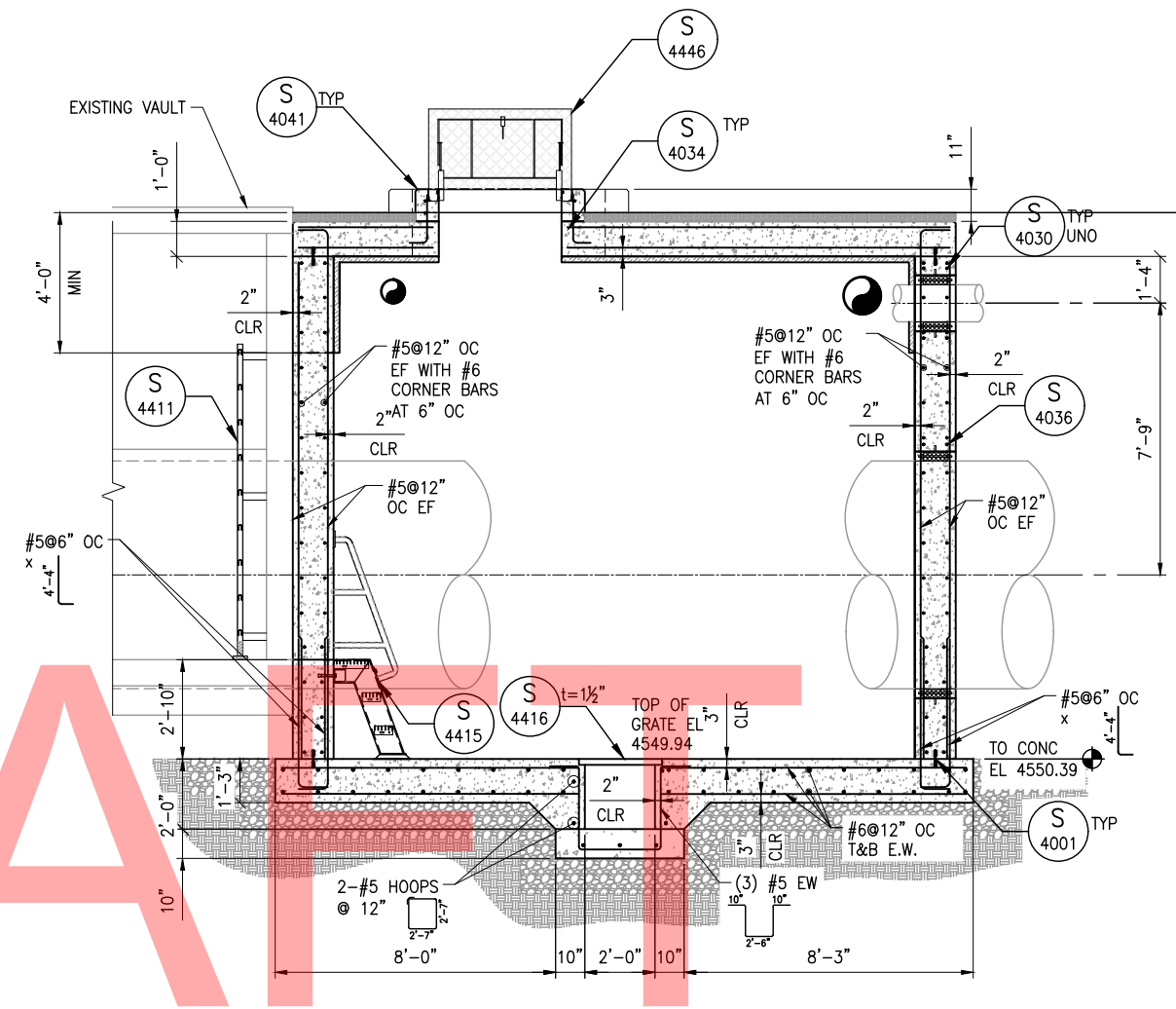
NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT		VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN	REVIEW	CHECKED
S. PUGH	S. COHEN	S. COHEN
DRAWN	APPROVED	
S. PUGH	S. COHEN	

STRUCTURAL	PROJECT NUMBER	DATE
11400 SOUTH VAULT STRUCTURAL MODIFICATIONS - 01	010-23-02	JANUARY 2025



SECTION A
SCALE: 3/8"=1'-0"



SECTION B
SCALE: 3/8"=1'-0"

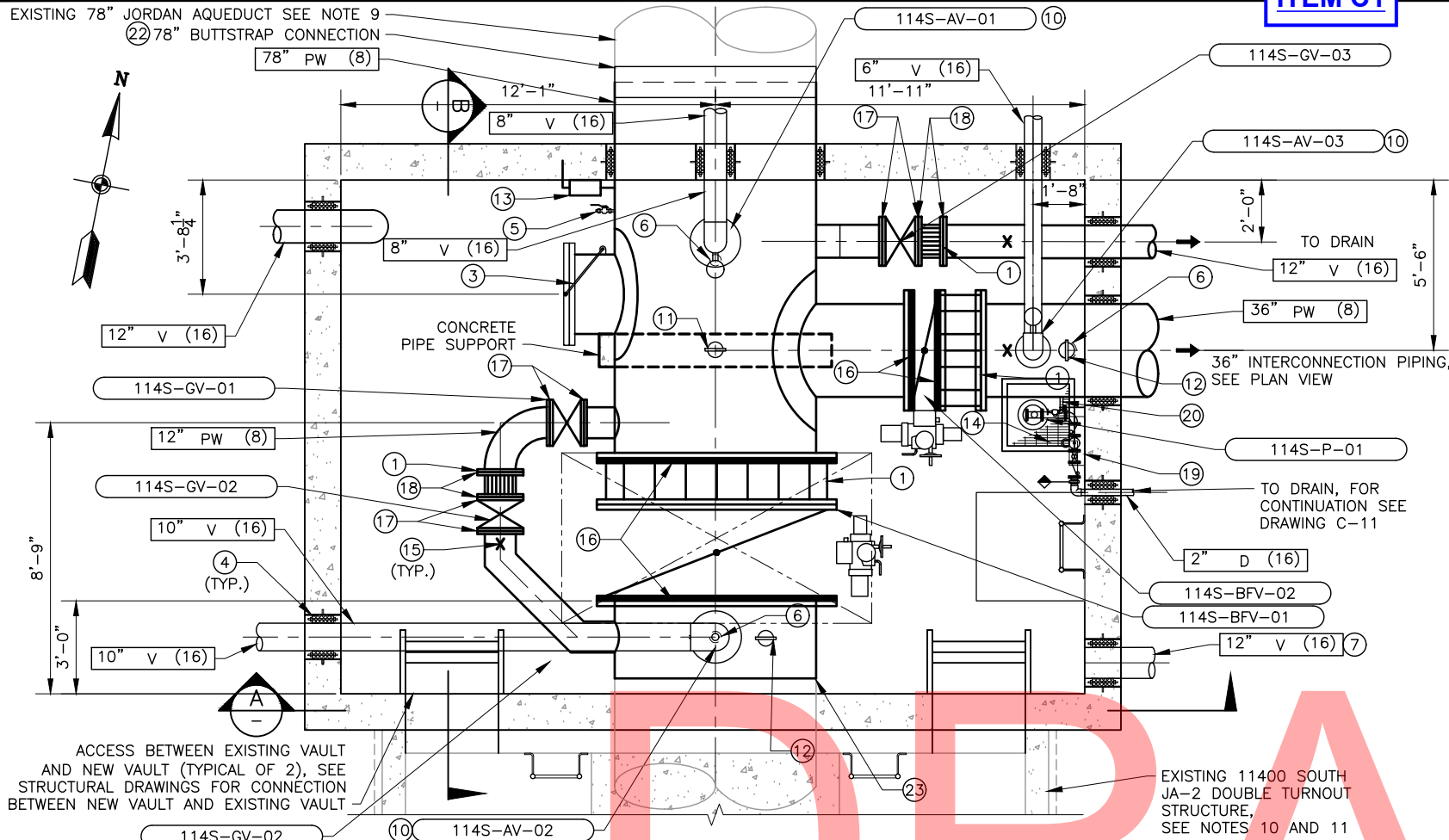
DRAWING NOTES

- FOR GENERAL STRUCTURAL NOTES, REFER TO DRAWING GS-01.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE THE STRUCTURAL DRAWINGS WITH ALL OTHER CONTRACT DOCUMENTS. STRUCTURAL DRAWINGS DO NOT ATTEMPT TO SHOW ALL MECHANICAL AND ELECTRICAL PENETRATIONS AND ROUTINGS.
- OVER EXCAVATE BENEATH BASE SLAB AND PLACE 1'-0" MINIMUM COMPACTED THICKNESS OF GRANULAR STRUCTURAL FILL. EXTEND A MINIMUM OF 2' BEYOND THE EDGE OF THE BASE SLAB.
- THE EXPOSED INTERIOR FACES OF THE CONCRETE WALLS AND TOP SLAB SHALL BE GIVEN A RUBBED FINISH. TOP SURFACE OF BOTH SLABS SHALL BE GIVEN A FLOATED SURFACE FINISH CONSISTENT WITH REQUIREMENTS FOR A PAINTED COATING.
- APPLY FLUID-APPLIED WATERPROOFING TO ALL EXTERIOR BURIED CONCRETE SURFACES OF THE VAULT.
- UNLESS SPECIFICALLY NOTED OTHERWISE, MISCELLANEOUS METAL ITEMS WITHIN THIS STRUCTURE ARE TO BE STAINLESS STEEL.
- UNO, HATCH SHALL HAVE A CONCEALED RECESSED PADLOCK HASP AND SHALL BE INSULATED WITH RIGID FOAM BOARD.
- WALLS AND ROOF SLAB SHALL BE INSULATED WITH RIGID FOAM BOARD.

NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
	REVIEW CHECKED S. COHEN APPROVED S. COHEN
	DESIGN S. PUGH DRAWN S. PUGH
	PROJECT NUMBER 010-23-02

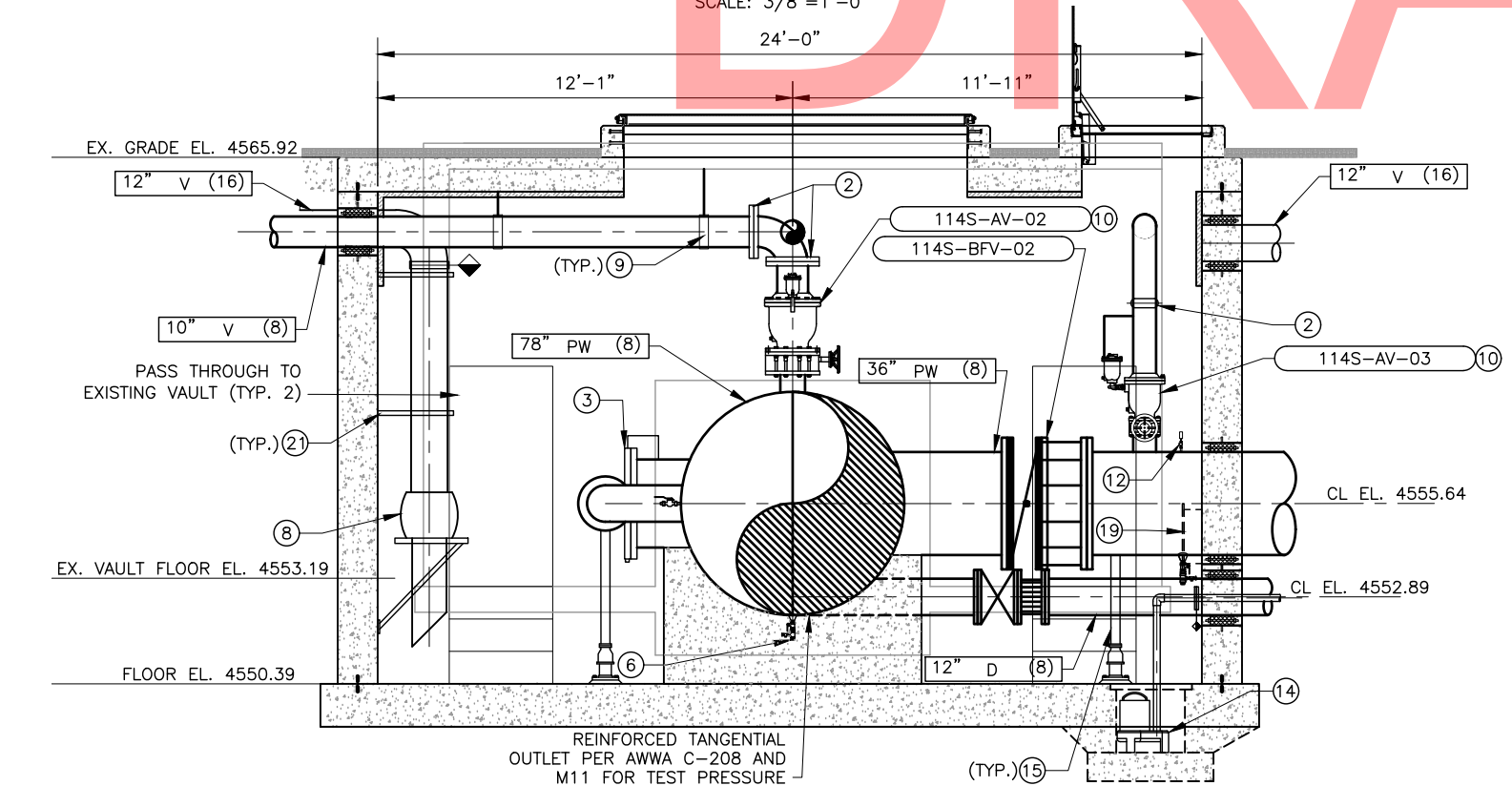
STRUCTURAL 11400 SOUTH VAULT STRUCTURAL MODIFICATIONS - 02	DATE: JANUARY 2025
DRAWING NO. S-04	SHEET 63 OF 99



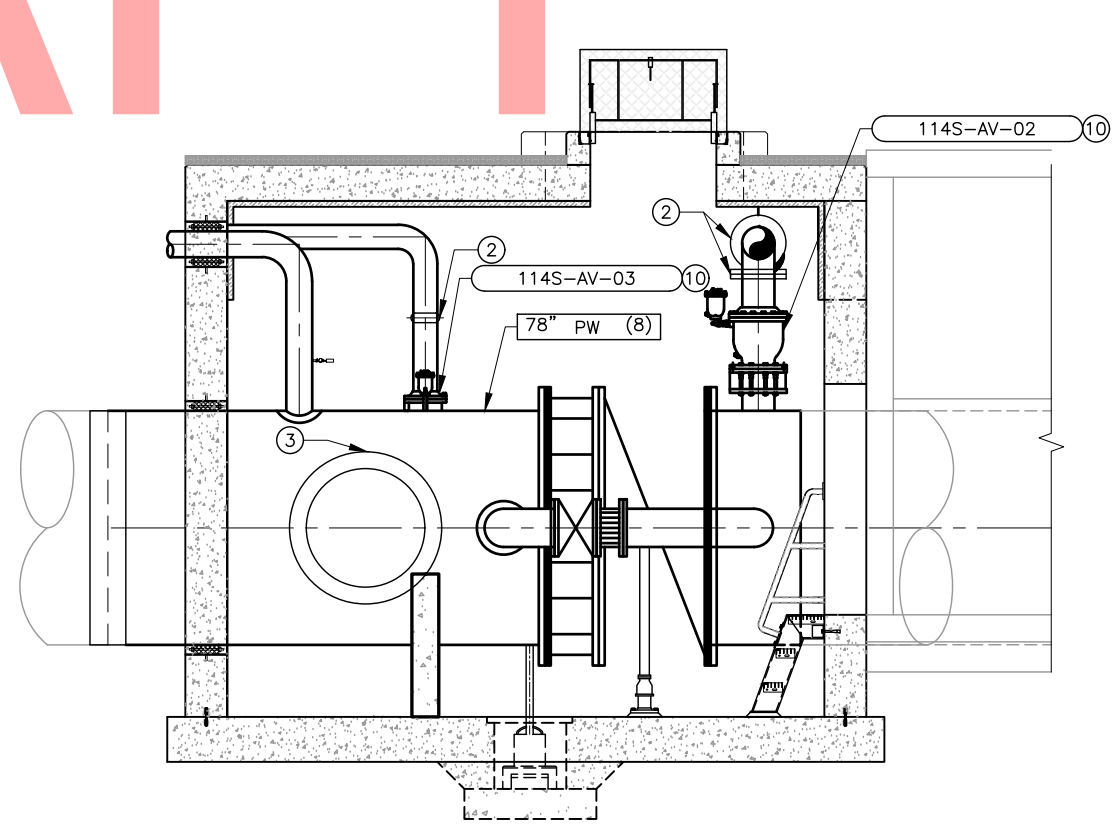
11400 SOUTH VAULT ADDITION PLAN
SCALE: 3/8"=1'-0"

- NOTES:**
1. XX-XX-XX MECHANICAL EQUIPMENT SCHEDULE, SEE DRAWING M-03.
 2. PROVIDE MINIMUM OF 1'-0" CLEARANCE SPACE BETWEEN ALL FLANGES AND PIPE SUPPORTS, WALLS, FITTINGS, ETC. TO ALLOW UNRESTRICTED REMOVAL OF FLANGE BOLTS. NOTIFY ENGINEER OF POTENTIAL CONFLICTS TO ALLOW FOR FIELD ADJUSTMENT PRIOR TO FABRICATION.
 3. COAT INTERIOR FLOOR OF VAULT AND CONCRETE STAIRS WITH PROTECTIVE COATING IN ACCORDANCE WITH SPECIFICATIONS. EXTEND COATING ON WALLS TO AN ELEVATION OF 1'-6" ABOVE FLOOR.
 4. REFER TO ELECTRICAL DRAWINGS FOR LIGHTING PLAN AND POWER AND CONTROL PLANS FOR VAULT.
 5. REFER TO STRUCTURAL DRAWINGS FOR DETAILS RELATED TO MISCELLANEOUS METALS FABRICATION.
 6. COORDINATE ORIENTATION OF VALVE ACTUATORS PRIOR TO MANUFACTURING. ACTUATORS ORIENTED INCORRECTLY WILL BE ROTATED IN THE FIELD AT NO EXPENSE TO THE OWNER.
 7. COAT ALL EXPOSE PIPE PER SPECIFICATIONS. COAT BURIED AND CONCRETE ENCASED STEEL PIPES PER SPECIFICATIONS.
 8. PROVIDE AND INSTALL FLUID APPLIED WATERPROOFING MEMBRANE FOR THE EXTERIOR CONCRETE WALLS.
 9. REPAIR LININGS AND COATINGS OF EXISTING AQUEDUCT AT CONNECTION, PER SPECIFICATION DIVISION 09.
 10. SEE CP-05 FOR EXISTING 11400 SOUTH JA-2 DOUBLE TURNOUT STRUCTURE CATHODIC PROTECTION IMPROVMENTS.
 11. EXISTING JA-2 DOUBLE TURNOUT STRUCTURE RECORD DRAWINGS ARE SHOWN FOR REFERENCE. CONTRACTOR TO VERIFY ACTUAL CONDITIONS IN THE FIELD.

- MATERIAL SCHEDULE**
- | | |
|----|--|
| 1 | RESTRAIN DISMANTLING JOINT COUPLING |
| 2 | GROOVED MECHANICAL COUPLING |
| 3 | 30" DIA MANWAY ACCESS (M 3532) |
| 4 | SLEEVED PIPE OPENING METHOD 'B' (M 3307) |
| 5 | SMOOTH SAMPLE TAP (M 3115) |
| 6 | 2" DRAIN ASSEMBLY (M 3135) |
| 7 | AIR VENT PIPE (M 3326) |
| 8 | WALL MOUNTED INTERIOR EXHAUST FAN (M 3329) |
| 9 | PIPE HANGER, TYP (M 3353) |
| 10 | COMBINATION AIR RELEASE VALVE SEE AIR VALVE SCHEDULE (M 3146) |
| 11 | PRESSURE GAUGE AND PRESSURE INDICATING TRANSMITTER ASSEMBLY (M 3183) |
| 12 | PRESSURE GAUGE (M 3217) |
| 13 | DC BLOCKER (CP 2826, CP 2833) |
| 14 | SUMP PUMP (M 3202) |
| 15 | X DENOTES ADJUSTABLE PIPE SUPPORT WITH U BOLT (M 3389) |
| 16 | INSULATING FLANGE (CP 2777) |
| 17 | FLANGE BOND (CP 2767) |
| 18 | COUPLING BOND (CP 2759) |
| 19 | WALL MOUNTED HOSE RACK (M 3116) |
| 20 | HOSE BIBB H/B-7 (M 3115) |
| 21 | PIPE SUPPORTS AND PIPE CLAMPS @ 4' MAX SPACING (M 3367, M 3371) |
| 22 | 78" BUTT STRAP CONNECTION (C 2719, C 2715) |
| 23 | 78" BUTT WELD CONNECTION (C 2715) |



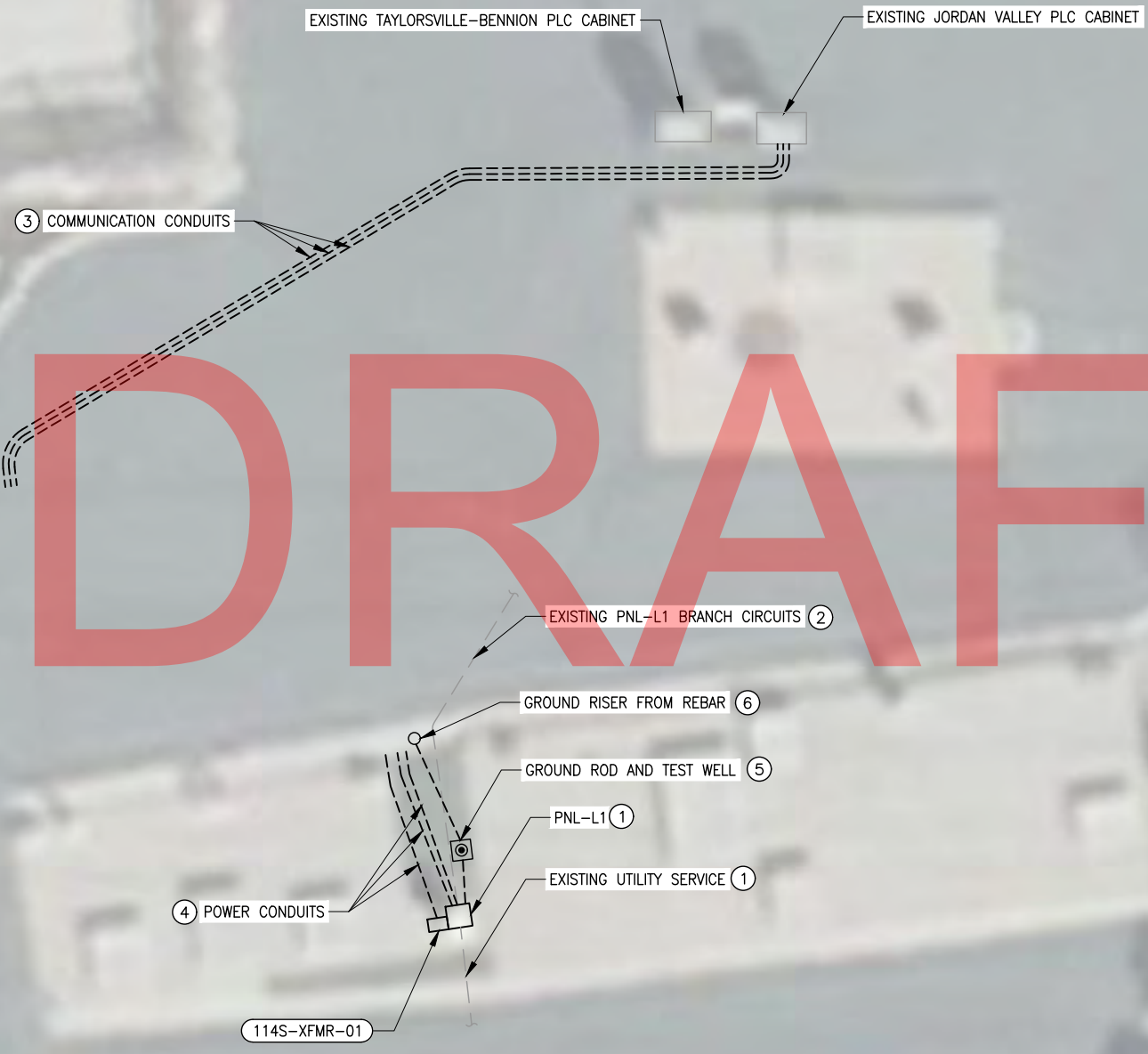
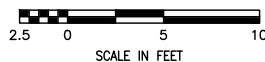
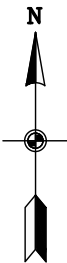
11400 SOUTH VAULT ADDITION PROFILE A
SCALE: 3/8"=1'-0"



11400 SOUTH VAULT ADDITION PROFILE B
SCALE: 3/8"=1'-0"

BOWEN COLLINS ASSOCIATES

<p>JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT</p> <p>SOUTHWEST AQUEDUCT REACH 2</p>	<p>DESIGN: R. EGBERT DRAWN: J. BLACK</p> <p>REVIEW: C. NELSON APPROVED: J. LUETTINGER</p>
<p>INSTRUMENTATION</p> <p>11400 SOUTH JA-2 MAINLINE VALVE VAULT MECHANICAL PLAN</p> <p>PROJECT NUMBER: 010-23-02 DATE: JANUARY 2025</p>	<p>VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING</p> <p>DRAWING NO. M-11</p> <p>SHEET 80 OF 99</p>

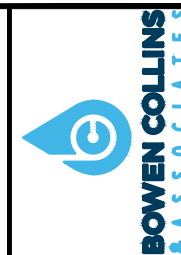


GENERAL NOTES:

- A. SEE VAULT ELECTRICAL PLAN ON SHEET E-10 AND LIGHTING PLAN ON SHEET E-11 FOR INFORMATION REGARDING EQUIPMENT IN THE VAULT.
- B. SEE POWER AND CONTROL ONE-LINE DIAGRAMS ON SHEET E-12 FOR CONDUIT AND CONDUCTOR QUANTITY AND SIZES.
- C. LIGHT LINEWORK INDICATES EXISTING EQUIPMENT. DARK LINEWORK INDICATES NEW EQUIPMENT, CONDUIT, AND CONDUCTORS TO BE INSTALLED BY CONTRACTOR.

KEY NOTES: #

- 1. REPLACE EXISTING POWER PEDESTAL. SEE SHEET E-12 FOR ADDITIONAL INFORMATION.
- 2. PRESERVE AND PROTECT EXISTING BRANCH CIRCUIT CONDUIT AND CONDUCTORS. CONTRACTOR SHALL RELOCATE EXISTING CONDUITS AS REQUIRED SHOULD NEW CONSTRUCTION CONFLICT WITH EXISTING CONDUIT LOCATION.
- 3. COMMUNICATION CONDUIT BETWEEN COMMUNICATION JUNCTION BOX AND EXISTING JORDAN VALLEY PLC CABINET. SEE DRAWING E-12 FOR ADDITIONAL INFORMATION.
- 4. POWER CONDUITS TO POWER JUNCTION BOX. SEE DRAWINGS E-10 AND E-12 FOR ADDITIONAL INFORMATION.
- 5. FURNISH AND INSTALL GROUND ROD AND TEST WELL. SEE SHEET E-12 FOR MORE INFORMATION.
- 6. FURNISH AND INSTALL #8 AWG BARE COPPER GROUND BETWEEN GROUND RISER FROM REBAR AND GROUND ROD.

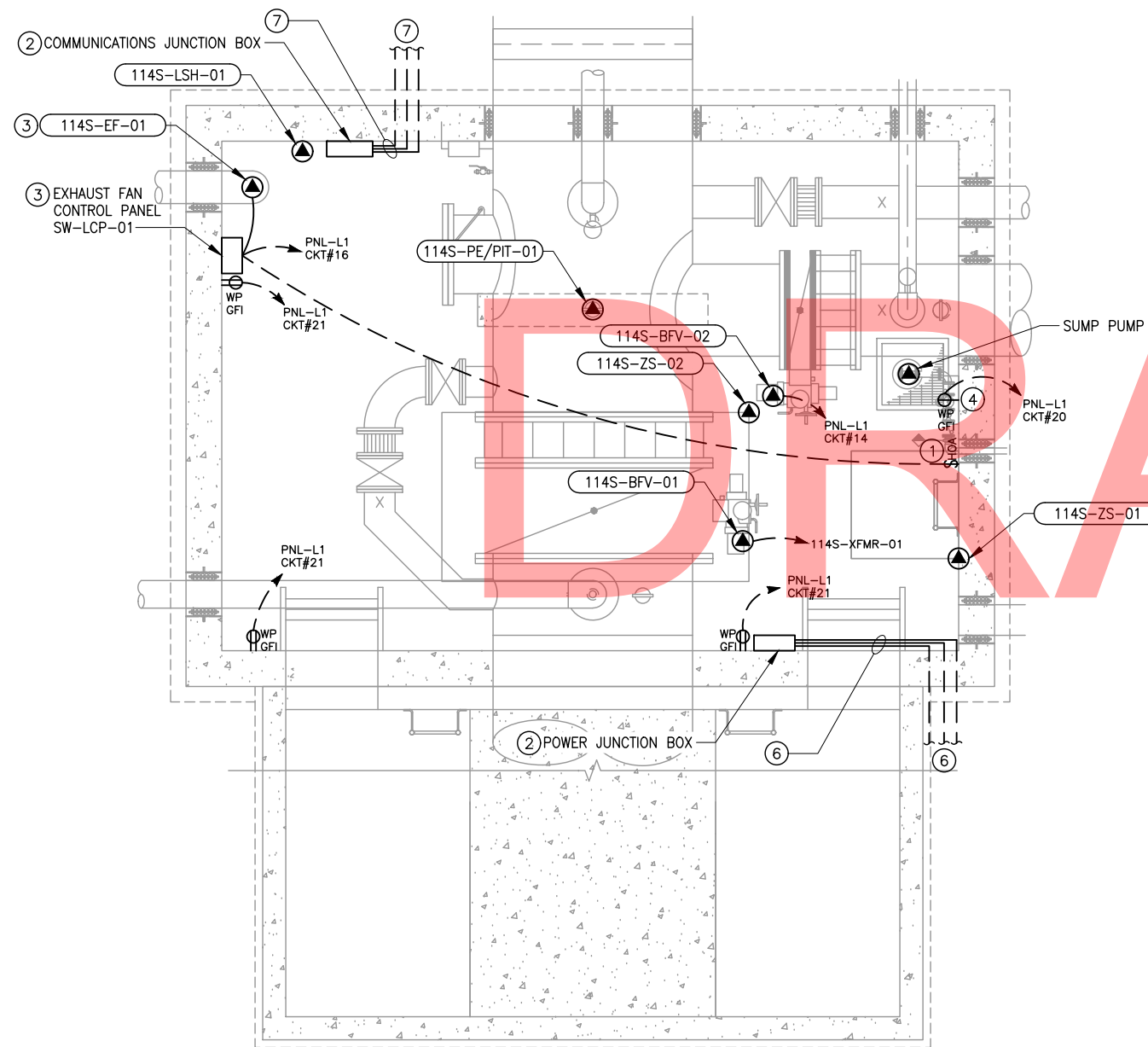


NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT		VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN C. WARDEN	REVIEW S. CAVANAUGH	CHECKED S. CAVANAUGH
DRAWN C. WARDEN	APPROVED S. CAVANAUGH	APPROVED S. CAVANAUGH

ELECTRICAL 11400 SOUTH JA-2 VAULT MODIFICATIONS ELECTRICAL SITE PLAN	DATE: JANUARY 2025 PROJECT NUMBER: 010-23-02
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11400 SOUTH JA-2 VAULT MODIFICATIONS ELECTRICAL SITE PLAN
 SCALE: 1" = 5'-0"



GENERAL NOTES:

- A. SUPPORT ELECTRICAL CONDUITS INDEPENDENT OF PIPING. SUPPORTING THE ELECTRICAL CONDUIT OFF PIPING WILL NO BE ALLOWED.
- B. ALL EXPOSED CONDUIT, BOXES, AND FITTINGS IN THE VAULT SHALL BE GALVANIZED RIGID STEEL SUPPORTED ON ZINC COATED STRUT. SEALTITE (NOT TO EXCEED 24") MAY BE USED WHERE REQUIRED. CONDUIT EMBEDDED IN CONCRETE SHALL BE PVC CONDUIT, TRANSITIONS FROM EMBEDDED CONDUIT TO EXPOSED CONDUIT SHALL BE MADE WITH PVC COATED GALVANIZED RIGID STEEL CONDUIT.
- C. GROUT ALL CONDUIT PENETRATIONS THROUGH VAULT WALL AND CEILING. (E 5012)
- D. CONCEAL CONDUIT IN WALLS AND FLOOR TO EXTENT POSSIBLE. NO HORIZONTAL RUNS OF EXPOSED CONDUIT ALLOWED.
- E. ALL RECEPTACLES IN VAULT SHALL BE WEATHERPROOF, GFCI, AND MOUNTED AT 48" ABOVE FINISHED FLOOR.
- F. CONDUIT BODIES AND BOXES FOR WIRING DEVICES SHALL BE CAST MALLEABLE IRON. BOXES ARE TYPE FS OR FD.
- G. REFER TO POWER ONE-LINE DIAGRAM AND CONTROL BLOCK DIAGRAM ON DRAWING E-12 FOR CONDUIT AND CONDUCTOR SIZES.

KEY NOTES: (#)

- 1. EXHAUST FAN HOA SWITCH. MOUNT JUST BELOW VAULT ACCESS HATCH SO THAT FAN CAN BE TURNED ON BEFORE ENTERING VAULT. SEE DETAIL (E 5008)
- 2. COMMUNICATION JUNCTION BOX. SEE CONTROL ONE-LINE DIAGRAM ON SHEET E-12 FOR MORE INFORMATION. MOUNT PER DETAIL (E 5001). CONDUIT PENETRATIONS PER DETAIL (E 5009)
- 3. EXHAUST FAN. REFER TO PANEL SCHEDULE AND CONTROL ONE-LINE DIAGRAM ON SHEET E-12 AND EQUIPMENT SCHEDULE ON SHEET M-03 FOR MORE INFORMATION.
- 4. SUMP PUMP RECEPTACLE SHALL BE A WEATHERPROOF, GFCI, SIMPLEX RECEPTACLE MOUNTED AT 48" ABOVE FINISHED FLOOR.
- 5. POWER JUNCTION BOX. SEE POWER ONE-LINE DIAGRAM ON SHEET E-12 FOR MORE INFORMATION. MOUNT PER DETAIL (E 5009)
- 6. POWER CONDUIT BETWEEN POWER JUNCTION BOX AND OUTSIDE EQUIPMENT. ROUTE EXPOSED CONDUIT UNDERNEATH STAIRS. SEE SHEET E-12 FOR CONDUIT SIZES AND QUANTITIES. SEE SHEET E-09 FOR CONTINUATION OF CONDUIT ROUTING. INSTALL PER DETAIL (E 5009)
- 7. COMMUNICATION CONDUIT BETWEEN COMMUNICATION JUNCTION BOX AND RTU. SEE SHEET E-12 FOR CONDUIT SIZES AND QUANTITIES. SEE SHEET E-09 FOR CONTINUATION OF CONDUIT ROUTING. INSTALL PER DETAIL (E 5009)

11400 SOUTH VAULT ADDITION ELECTRICAL PLAN
SCALE: 3/8" = 1'-0"



NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
	REVIEW CHECKED: S. CAVANAUGH APPROVED: S. CAVANAUGH
	DESIGN DESIGN: C. WARDEN DRAWN: C. WARDEN

ELECTRICAL 11400 SOUTH JA-2 VAULT MODIFICATIONS ELECTRICAL PLAN	PROJECT NUMBER 010-23-02
DATE: JANUARY 2025	DRAWING NO. E-10



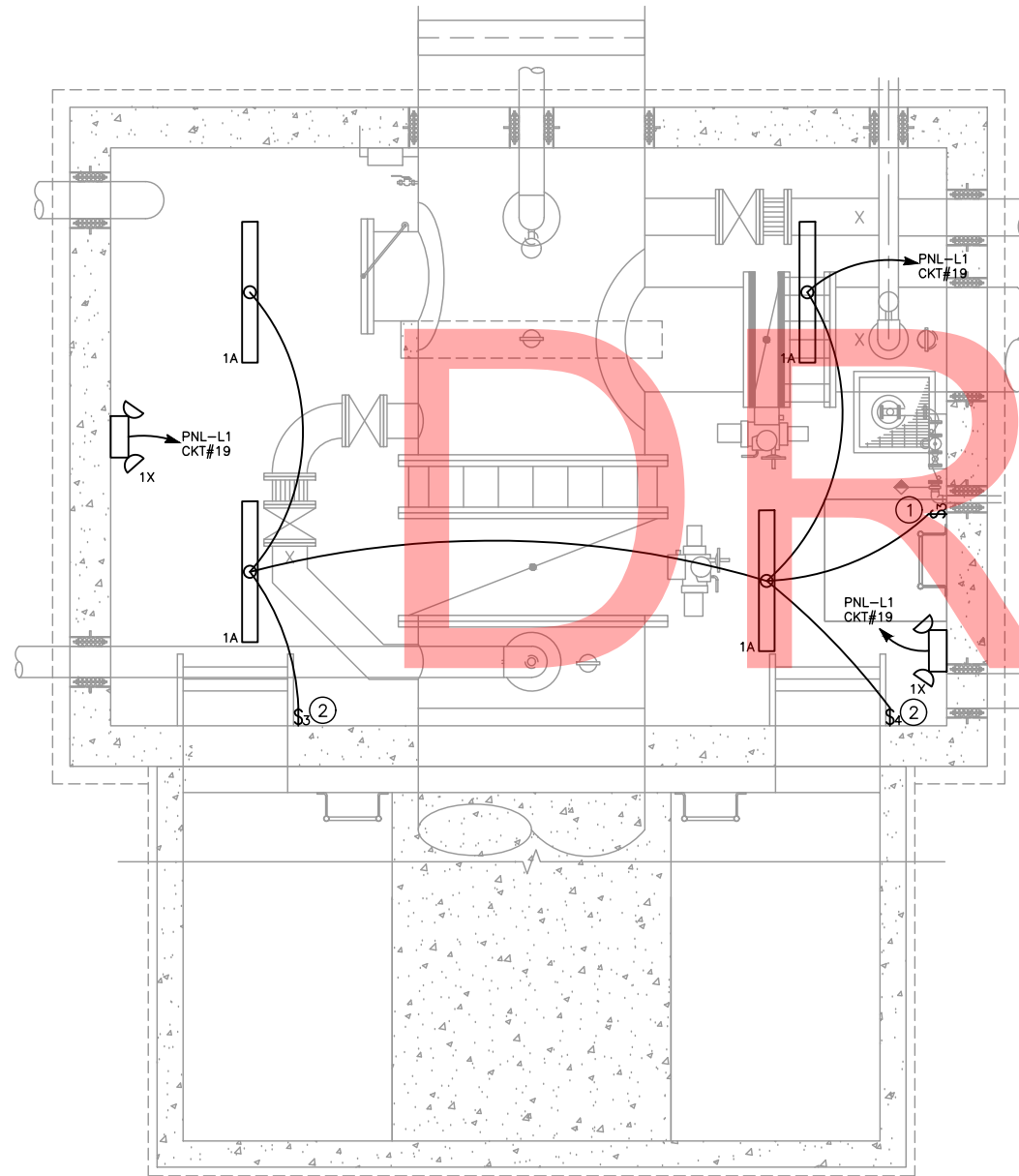
FIXTURE SCHEDULE							
SYMBOL	DESCRIPTION	MANUFACTURER	CATALOG NO.	VA	LAMP	MOUNTING	NOTES
1A	VAPOR TIGHT LED STRIP LIGHT, GASKETED WITH POLYCARBONATE HOUSING, 120 VAC	LITHONIA	CVST-L48-5000LM-MVOLT-40K-80CRI	42	LED	CEILING	
1X	EMERGENCY LIGHT WITH TWO HEADS, 90 MIN BATTERY POWER, WET LOCATION, 120 VAC	HOLOPHANE	DM30-WL-LED	8	LED	WALL	MOUNT AT 8'-0" AFF

GENERAL NOTES:

- A. SUPPORT ELECTRICAL CONDUITS INDEPENDENT OF PIPING. SUPPORTING THE ELECTRICAL CONDUIT OFF PIPING WILL NO BE ALLOWED.
- B. ALL EXPOSED CONDUIT, BOXES, AND FITTINGS IN THE VAULT SHALL BE GALVANIZED RIGID STEEL SUPPORTED ON ZINC COATED STRUT. SEALTITE (NOT TO EXCEED 24") MAY BE USED WHERE REQUIRED. CONDUIT EMBEDDED IN CONCRETE SHALL BE PVC CONDUIT, TRANSITIONS FROM EMBEDDED CONDUIT TO EXPOSED CONDUIT SHALL BE MADE WITH PVC COATED GALVANIZED RIGID STEEL CONDUIT.
- C. CONCEAL CONDUIT IN WALLS AND FLOOR TO EXTENT POSSIBLE. NO HORIZONTAL RUNS OF EXPOSED CONDUIT ALLOWED.
- D. CONDUIT BODIES AND BOXES FOR WIRING DEVICES SHALL BE CAST MALLEABLE IRON. BOXES ARE TYPE FS OR FD.
- E. REFER TO POWER ONE-LINE DIAGRAM AND CONTROL BLOCK DIAGRAM ON DRAWING E-12 FOR CONDUIT AND CONDUCTOR SIZES.

KEY NOTES: (1)

- 1. MOUNT LIGHT SWITCH JUST BELOW VAULT ACCESS HATCH SO THAT LIGHTS CAN BE TURNED ON BEFORE ENTERING VAULT.
- 2. MOUNT LIGHT SWITCH AT 68" ABOVE FINISHED FLOOR.



11400 SOUTH VAULT ADDITION LIGHTING PLAN
SCALE: 3/8" = 1'-0"

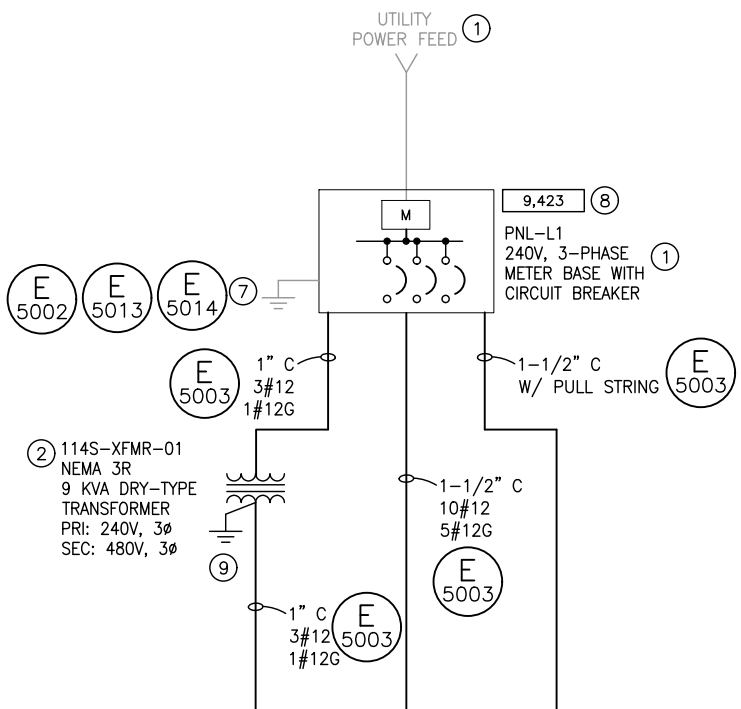


NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT		VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN C. WARDEN	CHECKED S. CAVANAUGH	REVIEW S. CAVANAUGH
DRAWN C. WARDEN	APPROVED S. CAVANAUGH	

ELECTRICAL	11400 SOUTH VAULT ADDITION LIGHTING PLAN	PROJECT NUMBER
		010-23-02
		DATE: JANUARY 2025

DRAWING NO.	E-11
SHEET	95 OF 99



PANEL NAME: L1																				
PANEL RATING:		100 A		UPDATED:		1/7/25		NEMA:		1										
LOCATION:		11400S JVVCD COMPLEX		TOTAL AMPS:		17		PHASE:		3										
MOUNTING:		SURFACE		TOTAL VOLT-AMPS:		7.07 kVA		WIRE:		4										
MAIN TYPE:		100 A MCB		VOLTAGE L-L:		240 V														
GROUND BUS:		YES		VOLTAGE L-N:		120 V														
PHASE DEMAND				3145		2837.5		1082.5												
PHASE CONNECTED				2516		2270		866												
NOTE	CONDUIT	PHASE	NEUTRAL	GROUND	CIRCUIT DESCRIPTION	POLE	RATING	NUMBER	A	B	C	NUMBER	RATING	POLE	CIRCUIT DESCRIPTION	CONDUIT	PHASE	NEUTRAL	GROUND	NOTE
					MAIN	3	100	1	0	0	0	2	20	1	UNKNOWN					4
					UNKNOWN	1	20	7	0	0	0	4	20	1	UNKNOWN					4
					UNKNOWN	1	20	9	0	0	0	6	20	1	OFF (HIGH LEG)					4
					OFF (HIGH LEG)	1	20	11	0	0	0	8	60	3	PUMP SKID					4
					114S-BFV-01 XFMR	3	20	13	866	300	0	14	15	1	114S-BFV-02	3/4"	#12	#12	#12	
					SPACE	1	20	15	0	0	0	16	20	1	114S-EF-01	3/4"	#12	#12	#12	
					114 VAULT LIGHTING	1	20	19	174	1,176	0	18	1	+	SPACE					
					114 VAULT RECEPTACLES	1	20	21	0	0	0	20	20	1	SUMP PUMP RECEPTACLE	3/4"	#12	#12	#12	
					SPACE	1	20	23	0	0	0	22	20	1	SPACE					
					SPACE	1	20	25	0	0	0	24	1	+	SPACE					
					SPACE	1	20	27	0	0	0	26	20	1	SPACE					
					SPACE	1	20	29	0	0	0	28	20	1	SPACE					
					SPACE	1	20	27	0	0	0	30	1	+	SPACE					

PANEL SCHEDULE PNL-L1

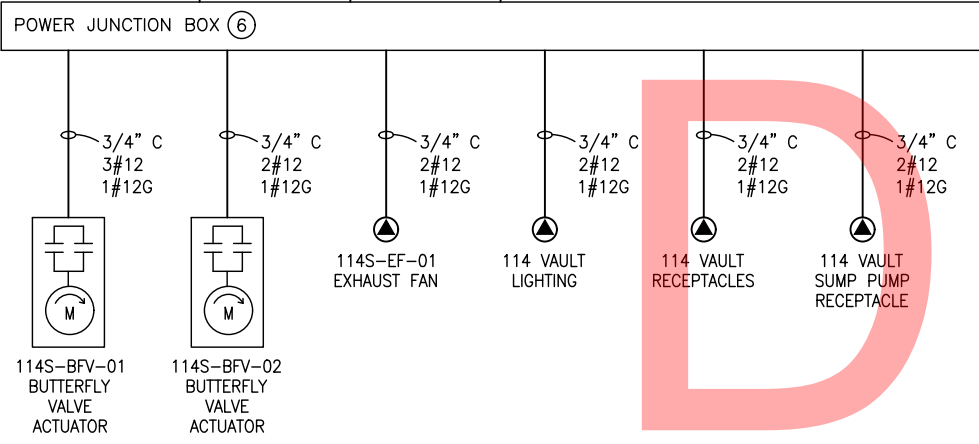
DRAFT

GENERAL NOTES:

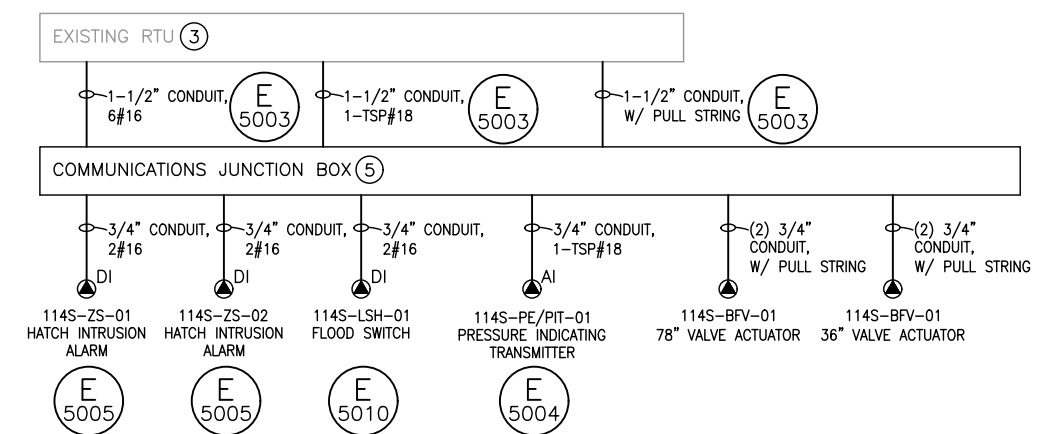
- A. SEE ELECTRICAL SITE PLAN ON SHEET E-09, ELECTRICAL PLAN ON SHEET E-10, AND LIGHTING PLAN ON SHEET E-11 FOR EQUIPMENT LOCATIONS.
- B. UNLESS OTHERWISE NOTED, THE MINIMUM SIZE POWER CONDUCTORS SHALL BE #12 AWG AND THE MINIMUM CONDUIT SIZE SHALL BE 3/4 INCH.
- C. LIGHT LINWORK INDICATES EXISTING EQUIPMENT. DARK LINWORK INDICATES NEW EQUIPMENT, CONDUIT, AND CONDUCTORS TO BE INSTALLED BY CONTRACTOR.

SHEET NOTES: #

1. FURNISH AND INSTALL 240V DELTA, 30 CIRCUIT POWER PEDESTAL APPROVED BY ROCKY MOUNTAIN POWER. CONTRACTOR SHALL PROVIDE MILBANK 3P3B B-STYLED TYPE 3R ENCLOSURE WITH 200A 7 JAW RING TYPE SOCKET OR ENGINEER-APPROVED EQUAL. REMOVE AND DISPOSE OF EXISTING POWER PEDESTAL. PRESERVE AND PROTECT ANY GROUND ELECTRODE CONDUCTORS AND BRANCH CIRCUIT CONDUCTORS FOR RECONNECTION. CONTRACTOR RESPONSIBLE FOR DISCONNECT AND RECONNECT REQUESTS WITH ROCKY MOUNTAIN POWER. CONTRACTOR IS RESPONSIBLE TO RETERMINATE EXISTING CONDUCTORS AND GROUND ELECTRODE CONDUCTORS IN NEW POWER PEDESTAL. ENCLOSURE SHALL BE BONDED AND GROUNDED IN ACCORDANCE WITH NEC GUIDELINES. SEE DETAIL E 5002
2. FURNISH AND INSTALL NEMA 3R, 240V DELTA PRIMARY, 480V THREE PHASE SECONDARY DRY-TYPE TRANSFORMER. EATON MODEL V24G48T09CU WITH WEATHER SHIELD OR ENGINEER-APPROVED EQUAL.
3. CONTRACTOR RESPONSIBLE FOR FURNISHING AND INSTALLING CABLING AND CONDUCTORS, AS WELL AS FIELD TERMINATIONS. CONTRACTOR SHALL LABEL BOTH ENDS OF CONDUCTORS AND LEAVE AMPLE CABLING IN RTU FOR OWNER TERMINATION. OWNER SHALL PROVIDE ANY REQUIRED RTU HARDWARE, PROGRAMMING, AND INTEGRATION.
4. EXISTING CIRCUIT. DISCONNECT FROM EXISTING POWER PEDESTAL AND RECONNECT IN NEW. SEE DRAWING E-09 FOR MORE INFORMATION.
5. FURNISH AND INSTALL NEMA 4X, 316 STAINLESS STEEL JUNCTION BOX FOR CONTROL AND SIGNAL CONDUITS. MINIMUM SIZE SHALL BE 12"H X 18"W X 6"D.
6. FURNISH AND INSTALL NEMA 4X, 316 STAINLESS STEEL JUNCTION BOX FOR POWER CONDUITS. MINIMUM SIZE SHALL BE 12"H X 16"W X 6"D.
7. CONTRACTOR SHALL PRESERVE AND PROTECT ANY EXISTING GROUND CONDUCTOR ELECTRODE PRESENT AT THE VAULT. CONNECT EXISTING GROUND ELECTRODE CONDUCTORS TO NEW POWER PEDESTAL. FURNISH AND INSTALL (1) 8-FOOT LONG, 3/4" DIA. COPPER CLAD STEEL GROUND ROD AND CONNECT WITH #8 BARE COPPER GROUND CABLE.
8. APPROXIMATE AVAILABLE FAULT CURRENT. CONTRACTOR IS RESPONSIBLE TO PERFORM AVAILABLE FAULT CURRENT STUDY AND LABEL ENCLOSURE IN ACCORDANCE WITH NEC 110.24 (A). CONTRACTOR SHALL ALSO LABEL ENCLOSURE WITH IDENTIFICATION OF HIGH LEG IN ACCORDANCE WITH NEC 110.15.
9. CONNECT TRANSFORMER TO GROUNDING ELECTRODE CONDUCTOR WITH #8 BARE COPPER WIRE.



POWER ONE-LINE DIAGRAM



CONTROL ONE-LINE DIAGRAM

NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT
RIVERTON AND SOUTH JORDAN, UT

SOUTHWEST AQUEDUCT REACH 2

DESIGN: C. WARDEN
DRAWN: C. WARDEN

CHECKED: S. CAVANAUGH
APPROVED: S. CAVANAUGH

VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING

ELECTRICAL

11400 SOUTH VAULT ADDITION ONE-LINE DIAGRAMS

DATE: JANUARY 2025
PROJECT NUMBER: 010-23-02

P:\JORDAN VALLEY WCD\010-23-02 SOUTHWEST AQUEDUCT REACH 2 - 13400 S TO 11800 S\2.0 DESIGN PHASE\2.9 DRAWINGS\SH1E-12.dwg Plotted: 1/10/2025 3:44 PM By: Jeremy Black

SECTION 01 71 51
AQUEDUCT PROTECTION AND MONITORING

PART 1 - GENERAL

1.1 THE REQUIREMENTS

- A. The work in this section includes specific measures required to protect the Jordan Aqueduct from potential damages during construction of the Southwest Aqueduct.
- B. The Jordan Aqueduct is owned by the United States Bureau of Reclamation (BOR, USBOR, Reclamation) and operated and maintained by the Jordan Valley Water Conservancy District (JVWCD, District). Both entities may be referred to as Aqueduct Owner in these specifications.
- C. The Jordan Aqueduct is located in the BOR easement and runs parallel to the JVWCD easement for the Southwest Aqueduct. Existing Jordan Aqueduct horizontal and vertical alignment, based upon original BOR design drawings, are shown on the plans. Limits of the BOR right-of-way are shown on the plans.
- D. The existing aqueduct was constructed in the 1970's using gasketed bell and spigot style pipe. The Jordan Aqueduct consists of 78-inch diameter reinforced concrete cylinder pipe (CCP) along 3200 West (Reach 2, JA-2).
- E. The size and age of the aqueduct and lack of joint restraint requires that extreme caution be exercised when operating equipment and constructing facilities along or adjacent to the BOR right-of-way. Excessive vibration, loading, or settlement of the aqueduct may cause joints to leak and the pipeline to fail. The aqueduct must continuously convey water for a significant portion of the population of the Salt Lake Valley. The aqueduct cannot be taken out of service for maintenance and repair without significant advance planning and expense, and then only during limited (low wintertime demand) periods of the year for short and planned schedule durations.
- F. Requirements of this Section are based upon the Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, and 4, and the U.S. Department of the Interior Bureau of Reclamation Engineering and O&M Guidelines for Crossings. Copies of these documents are included in the Reference Document Attachments.
- G. Note that this Section is intended to provide a summary of the key requirements of the above documents as they relate to the Jordan Aqueduct Protection along the 3200 West Corridor for the Southwest Aqueduct Reach 2 Project. It is not intended to be a comprehensive list of BOR requirements. All requirements of these documents shall be adhered to when operating along or adjacent to the Jordan Aqueduct and United States right-of-way.

1.2 RELATED SECTIONS

- A. Section 331111S – Steel Pipe (AWWA C200, Modified)
- B. Section 099000S – Protective Coatings
- C. Section 099010S – Pipeline Coating

1.3 REFERENCES

- A. Engineering and O&M Guidelines for Crossings – Bureau of Reclamation Water Conveyance Facilities, April 2008
- B. Exhibit A Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, & 4 – Protection Criteria
- C. Standard Form 299 – Application for Transportation and Utility Systems and Facilities on Federal Lands
- D. 29 CFR 1926: OSHA Safety and Health Regulations for Construction

1.4 DEFINITIONS NOT USED

1.5 SUBMITTALS

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

1.6 QUALITY CONTROL

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

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

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 BOR ENCROACHMENT APPLICATION PROCESS

- A. The Owner has performed the work required for permitting of the pipeline as part of this project and the regulations are provided for Contractor knowledge and understanding of what is required by the BOR. Contractor shall follow all provision of SF 299 permitting obtained by JWCD.
- B. Requirements for obtaining an authorization to cross Reclamation project land are in the Code of Federal Regulations (CFR) at 43 CFR 429 and Reclamation Manual LND 08-01. Applicants must complete the Standard Form (SF) 299, "Application for Transportation and Utility Systems and Facilities on Federal Lands." The form is included in the Reference Document Attachments and can be obtained electronically at: <https://www.gsa.gov/forms-library/application-transportation-utility-systems-telecommunications-and-facilities-federal>

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

- A. All new construction shall meet requirements of the Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, and 4, included in the Reference Document Attachment for reference.
- B. All new construction and utility crossings shall meet requirements of the Engineering and O&M Guidelines for Crossings by the U.S. Department of the Interior Bureau of Reclamation, included at the end of this Section for reference.
- C. All requests for encroachments on U.S Bureau of Reclamation land, facility, or water body must obtain a written land use authorization from JWCD and BOR.
- D. Storage of hazardous materials is not permitted within the BOR rights-of-way.
- E. All temporary and permanent changes in ground surfaces within the BOR rights-of-way are considered to be encroaching structures and must be handled as such.
- F. All finished grades shall provide a 4-foot minimum cover above the existing Jordan Aqueduct.
- G. Surface structures that will generally be allowed to be constructed within the BOR rights-of-way include standard concrete pavement section, asphalt pavement, non-reinforced parking areas, curbs, gutters, sidewalks, walkways and driveways, and removable barriers.

However, it is understood that all surface structures shall be analyzed and considered on an individual basis.

- H. Structures that may not be constructed in, on, or along the BOR rights-of-way include but are not limited to permanent structures such as retaining walls, street light standards, supports for large signs, power or communication poles, drainage structures, buildings, permanent foundations, permanent traffic barriers, cement or rock walls, sound walls, and longitudinal fences.
 - 1. During the SF299 permitting process, the Owner will obtain an exception from the BOR for any structures required for this project.
- I. Parallel utilities are not permitted within the BOR rights-of-way.
- J. Trees or vines are not permitted within the BOR rights-of-way.
- K. If existing drainage features are to be modified during construction, detailed drawings showing the proposed drainage replacement/restoration should be submitted with the application for review and approval.
- L. Notify the BOR Provo Area Office Field Engineering Division Manager at (801) 379-1000 and the Jordan Valley Water Conservancy District (District) at (801) 565-4300 at least forty-eight (48) hours in advance of commencing construction to permit inspection by the BOR and/or District.
- M. Notify JWCD immediately upon any evidence of suspected damage to the Jordan Aqueduct so that emergency inspection or response efforts can be initiated as determined necessary. The JWCD 24-hour contact is 801-256-4401. Always maintain this 24-hour emergency contact information available to on-site crews and provide contractor's 24-hour contact information to JWCD's on-call staff.

3.3 UTILITY CROSSINGS

- A. Any non-metallic encroaching structure below ground level shall be accompanied with a metallic strip within the BOR rights-of-way.
- B. The points where proposed crossing utilities enter and exit the BOR rights-of-way should be plainly and permanently marked by signposts. Signposts should contain the name of the owner/operator, contents of the pipeline, utility identification, and emergency contact phone number.
- C. Utilities including electrical and communication lines, and pipelines containing sewage, oil, gasoline, natural gas, contaminated waters, non-potable waters, or hazardous materials should only **cross perpendicular (between 70 and 90 degrees)** to the Jordan Aqueduct.
- D. Utilities crossing above or under the Jordan Aqueduct should maintain a vertical clearance between the utility and aqueduct of **at least of 12 inches**.
- E. Sanitary sewer crossings shall be contained within steel pipe casings within the BOR right-of-way.

- F. No vertical or horizontal bends will be permitted on utilities within the BOR right-of-way.
- G. Overhead wires across BOR rights-of-way should be at least 32 feet above all ground levels. For electrical power lines of 69 kilovolts (kV) or higher voltage, the minimum clearance should be 40 feet plus 0.25 inch per kV of line-to-line voltage above 450 kV. Poles or towers are not allowed within the BOR rights-of-way.
- H. High voltage, direct current powerlines are generally not permitted to encroach on the BOR rights-of-way for the Jordan Aqueduct, except in unusual circumstances and with proper cathodic protection considerations.
- I. Refer to the Engineering and O&M Guidelines for Crossings for specific cathodic protection requirements within the BOR rights-of-way.

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

- A. Load restrictions must be carefully observed to protect the Jordan Aqueduct from damages that could be caused by excessive live or dead loading or vibrations during construction. The Load Restricted Area surrounding the Jordan Aqueduct is defined as a zone within 12-feet of both sides of the centerline of the pipeline (24-feet total width).
- B. Limit equipment, operation, procedures, and methods of construction within the Load Restricted Area to ensure that any combination of either live loads or dead loads does not exceed the design capabilities of the aqueduct. Comply with the following constraints, procedures, and load restrictions which apply to all construction activities and operations located within this zone.
- C. The largest equipment loading (live load) which shall be permitted within the Load Restricted Area is HL-93 and there must be a temporary minimum soil cover of 3-feet or greater.
- D. Prevent heavy equipment (exceeding an HL-93 loading) from encroaching within the Load Restricted Area. Dynamic loading of equipment, including soil compaction equipment, shall not exceed HL-93 loading. In all cases there shall be a temporary minimum of 3 feet of cover within the Load Restricted Area.
- E. Operation of backhoes, augers, excavation or lifting equipment which may impose point loads from outriggers, wheels, or jacks is not permitted within the Load Restricted Area.
- F. The allowable soil loading (dead load) or depth of cover over the aqueduct is restricted to a minimum of 4 feet for all pipe classes, and a maximum of 5 feet for Class A pipe, maximum of 10 feet for Class B, maximum of 15 feet for Class C, and maximum of 20 feet for Class D. Note that the aqueduct changes pipe class frequently along its alignment. Class changes are based upon the original design depth of cover that was present along the aqueduct. Pipe classes are shown in Table 1 below, and BOR reference plans.

**Table 1
Jordan Aqueduct Reach 2 at 3200 West
78-inch Concrete Cylinder Pipe (CCP) Classifications**

Location – Segment¹	Begin JA Stationing	End JA Stationing	Approximate Distance from SWA-2 Centerline (ft)	Pipe Class	Max Cover (ft)
13400 S to 13290 S	710+00	718+00	30	B	10
13290 S to 13140 S	718+00	728+60	24	A	5
13140 S to 13074 S	728+60	732+10	26	B	10
13074 S to 12950 S	732+10	740+00	26	A	5
12950 S to 12780 S	740+00	751+15	46	B	10
12780 S to 12615 S	751+15	762+42	46	A	5
12615 S to 12555 S	762+42	766+00	34	B	10
12555 S to 12350 S	766+00	780+00	35	A	5
12350 S to 12330 S	780+00	781+80	39	B	10
12330 S to 12290 S	781+80	784+82	39	A	5
12290 S to 12280 S	784+82	785+32	39	B	10
12280 S to 12210 S	785+32	789+12	38	A	5
12210 S to 12095 S	789+12	796+80	33	B	10
12095 S to 12055 S	796+80	799+54	29	A	5
12055 S to 11690 S	799+54	824+00	30	B	10

1. *Location or Segment is based on residential addresses to identify the approximate location where the pipe class changes. Exact location of class change is based on BOR Reference Plans and requires additional investigation.*

- G. All backfill material within the BOR rights-of-way shall be compacted to a minimum of 95-percent maximum density specified by ASTM Part 19, D-698, method A; unless otherwise shown.
 - H. Backfilling of any excavation or around any structure within the BOR rights-of-way shall be compacted in layers not exceeding 6-inches thick if hand compacted or 8-inches thick if power compacted to the following requirements:
 - 1. cohesive soils to 95 percent maximum density specified by ASTM Part 19, D-698, method A; or
 - 2. noncohesive soils to 95 percent relative compaction specified by ASTM D 7382-08.
 - I. Maintain existing ground cover over the aqueduct unless special exceptions are approved which allow for modifications during construction.
 - J. Do not place fill or temporarily stockpile construction materials in the Load Restricted Area - within 12-feet either side of the centerline of the aqueduct.
- 3.5 SPECIAL PROTECTIONS FOR TEMPORARY LOW COVER CONDITIONS WITHIN THE BOR EASEMENT FOR THE JORDAN AQUEDUCT – (BELOW 3 FEET OF COVER)
- A. Special protections are required for the aqueduct during interim conditions when there is a temporary low cover over the Jordan Aqueduct, such as when replacement of the existing

roadway requires the pavement section and subgrade to be removed and replaced for development of the new roadway section over the aqueduct.

- B. Temporary low cover conditions are present any time there is less than the allowable minimum 3 feet depth of soil over the aqueduct that is required for any equipment loading. Note that permanent finish grade cover over the existing aqueduct requires 4 feet of minimum cover.
- C. Coordinate planned subgrade elevations with Jordan Aqueduct pothole depths. Submit cross sections in low cover areas illustrating the identified depth of cover and proposed subgrade elevation at 25-foot intervals.
- D. Excavation over the aqueduct shall take place from the adjacent existing pavement to allow removal of excavated material while maintaining the minimum cover or sufficient offset distance between the top of aqueduct and construction equipment and not directly loading construction equipment on the aqueduct during low cover conditions.
- E. For placement of granular borrow materials, utilize the adjacent existing pavement for material delivery and place import material using one of the following methods:
 - 1. Side dump trucks, placing material directly on grade.
 - 2. Belly dump trucks, placing material on the existing pavement and blading off of pavement onto grade.
- F. Backfill within 18-inches of the aqueduct shall be compacted using light, hand operated compactors and rollers. Mechanical compaction shall not be allowed within 6-inches of the aqueduct.
- G. Once a working platform has been established, a low ground pressure Dozer/Grader (less than 7 psi ground pressure) shall be used to spread material across the sub grade while maintaining a minimum of 18-inches of cover over the aqueduct.
- H. Utilize static rolling compaction methods with light weight equipment (less than 8,000 lbs.) within the low cover zone between 18-inches and 36-inches cover. Vibratory compaction shall not be used within the Load Restricted Area when cover over the existing Jordan Aqueduct is less than 36-inches.

3.6 SPECIAL PROTECTIONS FOR POTENTIAL GROUND SETTLEMENT

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

3.7 SPECIAL PROTECTIONS FOR VIBRATION CONTROL DURING CONSTRUCTION

- A. Vibration monitoring will be completed by JWCD and the Engineer during construction activities in the BOR easement that may cause vibration to the JA-2. Provide 3 days' notice to Engineer of schedule of activities that may vibrate the JA-2 to allow for monitoring equipment to be set up prior.
- B. Do not exceed the following special vibration limits for the Jordan Aqueduct:
 - 1. 0.1 in/sec for both steady state and impact vibrations along the centerline of the existing aqueduct.
- C. For purposes of these special aqueduct vibration limits, steady state vibrations will be considered as all continuous and frequent intermittent sources including pogo stick compactors, vibratory pile drivers, and vibration compaction equipment.
- D. For purposes of these special aqueduct vibration limits, impact vibrations will be considered as all transient sources which create a single isolated event such as impact pile driving, blasting, jack and boring, or other non-recurring heavy drop impact.

END OF SECTION

DRAFT

SF299 – SWA-2

**APPLICATION FOR TRANSPORTATION, UTILITY SYSTEMS, TELECOMMUNICATIONS AND FACILITIES
ON FEDERAL LANDS AND PROPERTY**

FORM APPROVED
OMB Control Number: 0596-0249
Expiration Date: 1/31/2027

FOR AGENCY USE ONLY

NOTE: Before completing and filing the application for an authorization (easement, right-of-way, lease, license or permit), the applicant should completely review this package, including instructions, and schedule a pre-application meeting with representatives of the agency responsible for processing the application. Each agency may have specific and unique requirements to be met in preparing and processing the application. Many times, with the help of the agency representative, the application can be completed at the pre-application meeting.

Application Number

Date Filed

1. Name and address of applicant

Jordan Valley Water Conservancy District
(JVWCD)

8215 South 1300 West
West Jordan, UT 84088

2. Name and address of authorized agent if different from item 1

Bowen Collins & Associates (BC&A)

154 East 14075 South
Draper, UT 84020

3. Applicant telephone number and email:

801-565-4300
KevinR@jvwcd.org

Authorized agent telephone number and email:

801-495-2224
jluettinger@bowencollins.com

4. As applicant are you? (check one)

- a. Individual
- b. Corporation*
- c. Partnership/Association*
- d. State Government/State Agency
- e. Local Government
- f. Federal Agency

* If checked, complete supplemental page

5. Specify what application is for: (check one)

- a. New authorization
- b. Renewing existing authorization number
- c. Amend existing authorization number
- d. Assign existing authorization number
- e. Existing use for which no authorization has been received *
- f. Other*

* If checked, provide details under item 7

6. If an individual, or partnership, are you a citizen(s) of the United States? Yes No

7. Project description (describe in detail): (a) Type of use or occupancy, (e.g., canal, pipeline, road, telecommunications); (b) related structures and facilities; (c) physical specifications (Length, width, grading, etc.); (d) term of days/years needed; (e) time of year of use or operation; (f) Volume or amount of product to be transported; (g) duration and timing of construction; and (h) temporary work areas needed for activity/construction (Attach additional sheets, if additional space is needed.)

See attached.

DRAFT

8. Attach a map covering area and show location of project proposal.

9. State or Local government approval: Attached Applied for Not Required

10. Nonrefundable application fee: Attached Not required To be determined by agency

11. Does project cross international boundary or affect international waterways? Yes No (if "yes," indicate on map)

12. Give statement of your technical and financial capability to construct, operate, maintain, and terminate system for which authorization is being requested.

Jordan Valley Water Conservancy District is funding this Project internally. They have contracted with Bowen Collins & Associates for design. Operation and maintenance to be performed by JVWCD. This project has been planned and budgeted for over many years and approved to proceed by JVWCD's board.

13a. Describe other alternative locations considered.

No other locations were considered.

b. Why were these alternatives not selected?

SWA-2 is being constructed within public ROW where BOR easements occupy the majority of the roadway. This section of SWA-2 is connecting two existing sections of the previously constructed SWA-2 pipeline. In addition, the proximity of the SWA-2 to the JA-2 is important for their joint operation

c. Give explanation as to why it is necessary to use or occupy Federal assets (lands or buildings).

It is necessary to occupy Federal BOR easements for the effective operation of both the Southwest Aqueduct and Jordan Aqueduct in tandem. The two aqueducts will work together to supply Salt Lake County with drinking water.

14. List authorizations and pending applications filed for similar projects which may provide information to the authorizing agency. (Specify number, date, code, or name)

A separate application is also being submitted for related project work at 11400 South.

15. Provide statement of need for project, including the economic feasibility and items such as: (a) cost of proposal (construction, operation, and maintenance); (b) estimated cost of next best alternative; and (c) expected public benefits.

(a) BC&A estimates the total construction cost of the project to be between 35 and 45 million dollars.

(b) No alternatives considered.

(c) This project benefits the public by ensuring adequate water supply for Salt Lake County in the coming decades. +

16. Describe probable effects on the population in the area, including the social and economic aspects, and the rural lifestyles.

The new Southwest Aqueduct will provide water to the Salt Lake valley, provide redundancy for existing water transmission systems, and ensure constant availability of water for The people of JWCD's Service area in Salt Lake County.

17. Describe likely environmental effects that the proposed project will have on: (a) air quality; (b) visual impact; (c) surface and ground water quality and quantity; (d) the control or structural change on any stream or other body of water; (e) existing noise levels; and (f) the surface of the land, including vegetation, permafrost, soil, and soil stability; and, (g) historic or archaeological resources or properties.

(a) None. (b) No new visual impacts. (c) None. (d) N/A. (e) None. (f) All disturbed areas will be restored to original or better condition. (g) No historic or archaeological resources or properties are within Project area.

18. Describe the probable effects that the proposed project will have on (a) populations of fish, plant life, wildlife, and marine life, including threatened and endangered species; and (b) marine mammals, including hunting, capturing, collecting, or killing these animals.

(a) No effects. Project is in a developed area.

(b) N/A.

19. State whether any hazardous material, as defined in this paragraph, would be used, produced, transported or stored on or in a federal building or federal lands or would be used in connection with the proposed use or occupancy. "Hazardous material" shall mean (a) any hazardous substance under section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9601(14); (b) any pollutant or contaminant under section 101(33) of CERCLA, 42 U.S.C. § 9601(33); (c) any petroleum product or its derivative, including fuel oil, and waste oils; and (d) any hazardous substance, extremely hazardous substance, toxic substance, hazardous waste, ignitable, reactive or corrosive materials, pollutant, contaminant, element, compound, mixture, solution or substance that may pose a present or potential hazard to human health or the environment under any applicable environmental laws. The holder shall not store any hazardous materials at the site without prior written approval from the authorized officer. This approval shall not be unreasonably withheld. If the authorized officer provides approval, this permit shall include (or in the case of approval provided after this permit is issued, shall be amended to include) specific terms addressing the storage of hazardous materials, including the specific type of materials to be stored, the volume, the type of storage, and a spill plan. Such terms shall be proposed by the holder and are subject to approval by the authorized officer.

No hazardous materials will be produced, stored, or transported within federal lands. The only petroleum products used within federal lands will be confined to construction equipment.

20. Name all the Federal Department(s)/Agency(ies) where this application is being filed.

Bureau of Reclamation

I HEREBY CERTIFY, That I am of legal age and authorized to do business in the State and that I have personally examined the information contained in the application and believe that the information submitted is correct to the best of my knowledge.

Signature of Applicant

Date

Title 18, U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

GENERAL INFORMATION
ALASKA NATIONAL INTEREST LANDS

This application will be used when applying for a right-of-way, permit, license, lease, or certificate for the use of Federal lands which lie within conservation system units and National Recreation or Conservation Areas as defined in the Alaska National Interest lands Conservation Act. Conservation system units include the National Park System, National Wildlife Refuge System, National Wild and Scenic Rivers System, National Trails System, National Wilderness Preservation System, and National Forest Monuments.

Transportation utility systems telecommunication installations facility uses for which the application may be used are:

1. Canals, ditches, flumes, laterals, pipes, pipelines, tunnels, and other systems for the transportation of water.
2. Pipelines and other systems for the transportation of liquids other than water, including oil, natural gas, synthetic liquid and gaseous fuels, and any refined product produced therefrom.
3. Pipelines, slurry and emulsion systems, and conveyor belts for transportation of solid materials.
4. Systems for the transmission and distribution of electric energy.
5. Wired and wireless systems for transmission or reception of radio, television, telephone, telegraph, and other electronic signals, and other means of communications.
6. Improved right-of-way for snow machines, air cushion vehicles, and all-terrain vehicles.
7. Roads, highways, railroads, tunnels, tramways, airports, landing strips, docks, and other systems of general transportation.

This application must be filed simultaneously with each Federal department or agency requiring authorization to establish and operate your proposal.

In Alaska, the following agencies will help the applicant file an application and identify the other agencies the applicant should contact and possibly file with:

Department of Agriculture
Regional Forester, Forest Service (USFS)
P.O. Box 21628
Juneau, Alaska 99802-1628
Telephone: (907) 586-7847
(or a local Forest Service Office)

Department of the Interior
Bureau of Indian Affairs (BIA)
Alaska Regional Office
709 West 9th Street
Juneau, Alaska 99802
Telephone: (907) 586-7177

Department of the Interior
Alaska State Office
Bureau of Land Management
222 West 7th Avenue #13
Anchorage, Alaska 99513
Public Room: 907-271-5960
FAX: 907-271-3684
(or a local BLM Office)

U.S. Fish & Wildlife Service (FWS)
Office of the Regional Director
1011 East Tudor Road
Anchorage, Alaska 99503
Telephone: (907) 786-3440

National Park Service (NPS)
Alaska Regional Office
240 West 5th Avenue
Anchorage, Alaska 99501
Telephone: (907) 644-3510

Department of Transportation
Federal Aviation Administration
Alaska Region AAL-4, 222 West 7th Ave., Box 14
Anchorage, Alaska 99513-7587
Telephone: (907) 271-5285

NOTE - The Department of Transportation has established the above central filing point for agencies within that Department. Affected agencies are: Federal Aviation Administration (FAA), Coast Guard (USCG), Federal Highway Administration (FHWA), Federal Railroad Administration (FRA).

OTHER THAN ALASKA NATIONAL INTEREST LANDS

Use of this form is not limited to National Interest Conservation Lands of Alaska.

Individual department/agencies may authorize the use of this form by applicants for transportation, utility systems, telecommunication installations and facilities on other Federal lands outside those areas described above.

For proposals located outside of Alaska, applications will be filed at the local agency office or at a location specified by the responsible Federal agency.

SPECIFIC INSTRUCTIONS
(Items not listed are self-explanatory)

- 7 Attach preliminary site and facility construction plans. The responsible agency will provide instructions whenever specific plans are required.
- 8 Generally, the map must show the section(s), township(s), and range(s) within which the project is to be located. Show the proposed location of the project on the map as accurately as possible. Some agencies require detailed survey maps. The responsible agency will provide additional instructions.
- 9, 10, and 12 The responsible agency will provide additional instructions.
- 13 Providing information on alternate locations in as much detail as possible, discussing why certain locations were rejected and why it is necessary to use Federal assets will assist the agency(ies) in processing your application and reaching a final decision. Include only reasonable alternate locations as related to current technology and economics.
- 14 The responsible agency will provide instructions.
- 15 Generally, a simple statement of the purpose of the proposal will be sufficient. However, major proposals located in critical or sensitive areas may require a full analysis with additional specific information. The responsible agency will provide additional instructions.
- 16 through 19 Providing this information with as much detail as possible will assist the Federal agency(ies) in processing the application and reaching a decision. When completing these items, you should use a sound judgment in furnishing relevant information. For example, if the project is not near a stream or other body of water, do not address this subject. The responsible agency will provide additional instructions.

Application must be signed by the applicant or applicant's authorized representative.

Note - Filings with any Interior agency may be filed with any office noted above or with the Office of the Secretary of the Interior, Regional Environmental Officer, P.O. Box 120, 1675 C Street, Anchorage, Alaska 99513.

PUBLIC BURDEN STATEMENT

The Federal agencies collect this information from proponents and applicants requesting a right-of-way, permit, license, lease, or certification for use of Federal assets. The Federal agencies use this information to evaluate a proponent's or applicant's proposal to use Federal assets. A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995 unless the information collection has a currently valid Office of Management and Budget (OMB) Control Number. The approved OMB Control Number for this information collection is 0596-0249. Without this approval, we could not conduct this information collection. Public reporting for this information collection is estimated to be approximately 8 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. All responses to this information collection are voluntary. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden, to the USDA Forest Service email address SM.FS.InfoCollect@usda.gov and include the OMB Control Number in the subject line. Disclosure of the information is voluntary. If all the information is not provided, the proposal or application may be rejected. Concerns about this form can be sent to Director, Lands, Minerals, and Geology Management Staff, 1st Floor Southeast, 201 14th Street, SW, Washington, DC 20250-1124

USDA NONDISCRIMINATION STATEMENT

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident. Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English. To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at [How to File a Program Discrimination Complaint and at any USDA office](#) or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov. The Privacy Act of 1974 (5 U.S.C. 552a) and the Freedom of Information Act (5 U.S.C. 552) govern the confidentiality to be provided for information received by the Forest Service.

DRAFT

SUPPLEMENTAL

NOTE: The responsible agency(ies) will provide instructions	CHECK APPROPRIATE BLOCK	
I - PRIVATE CORPORATIONS	ATTACHED	FILED *
a. Articles of Incorporation	<input type="checkbox"/>	<input type="checkbox"/>
b. Corporation Bylaws	<input type="checkbox"/>	<input type="checkbox"/>
c. A certification from the State showing the corporation is in good standing and is entitled to operate within the State	<input type="checkbox"/>	<input type="checkbox"/>
d. Copy of resolution authorizing filing	<input type="checkbox"/>	<input type="checkbox"/>
e. The name and address of each shareholder owning 3 percent or more of the shares, together with the number and percentage of any class of voting shares of the entity which such shareholder is authorized to vote and the name and address of each affiliate of the entity together with, in the case of an affiliate controlled by the entity, the number of shares and the percentage of any class of voting stock of that affiliate owned, directly or indirectly, by that entity, and in the case of an affiliate which controls that entity, the number of shares and the percentage of any class of voting stock of that entity owned, directly or indirectly, by the affiliate.	<input type="checkbox"/>	<input type="checkbox"/>
f. If application is for an oil or gas pipeline, describe any related right-of-way or temporary use permit applications, and identify previous applications.	<input type="checkbox"/>	<input type="checkbox"/>
g. If application is for an oil and gas pipeline, identify all Federal lands by agency impacted by proposal.	<input type="checkbox"/>	<input type="checkbox"/>
II - PUBLIC CORPORATIONS		
a. Copy of law forming corporation	<input type="checkbox"/>	<input type="checkbox"/>
b. Proof of organization	<input type="checkbox"/>	<input type="checkbox"/>
c. Copy of Bylaws	<input type="checkbox"/>	<input type="checkbox"/>
d. Copy of resolution authorizing filing	<input type="checkbox"/>	<input type="checkbox"/>
e. If application is for an oil or gas pipeline, provide information required by item "I - f" and "I - g" above.	<input type="checkbox"/>	<input type="checkbox"/>
III - PARTNERSHIP OR OTHER UNINCORPORATED ENTITY		
a. Articles of association, if any	<input type="checkbox"/>	<input type="checkbox"/>
b. If one partner is authorized to sign, resolution authorizing action is	<input type="checkbox"/>	<input type="checkbox"/>
c. Name and address of each participant, partner, association, or other	<input type="checkbox"/>	<input type="checkbox"/>
d. If application is for an oil or gas pipeline, provide information required by item "I - f" and "I - g" above.	<input type="checkbox"/>	<input type="checkbox"/>

* If the required information is already filed with the agency processing this application and is current, check block entitled "Filed." Provide the file identification information (e.g., number, date, code, name). If not on file or current, attach the requested information.

SF 299 Item No. 7 – Project Description

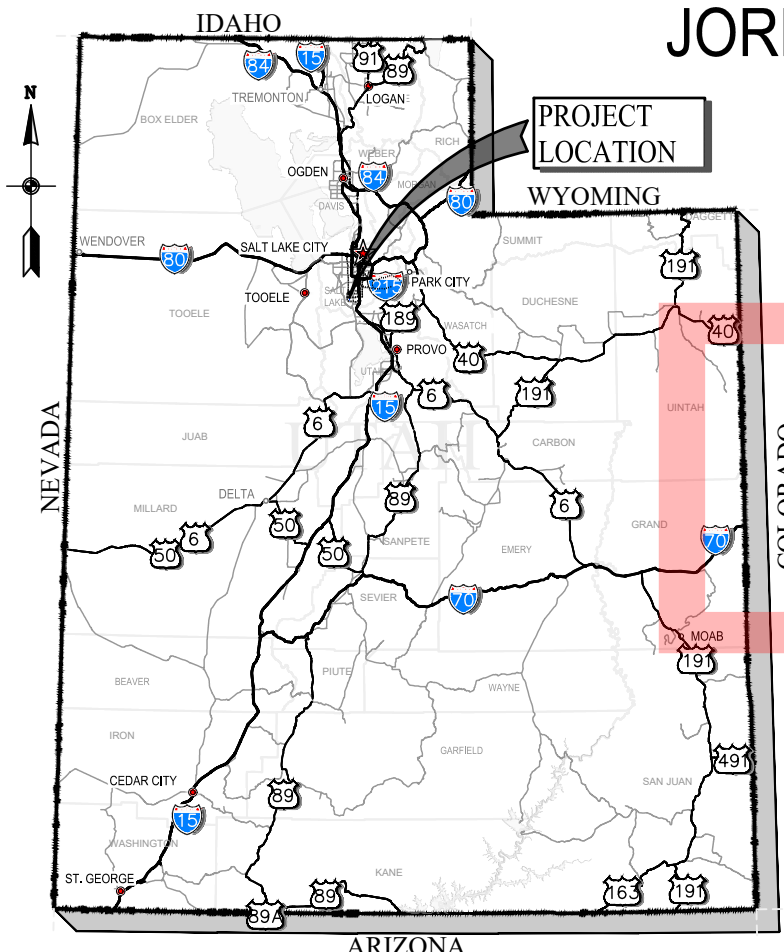
Jordan Valley Water Conservancy District's (JVWCD) Southwest Aqueduct, Reach 2 (SWA-2) Project

SWA-2 is a 66" diameter potable water pipeline which parallels the existing 78" Jordan Aqueduct Reach 2 (JA-2, owned by Reclamation and operated by JVWCD). JVWCD is constructing a new section of SWA-2 between 13400 South and 11800 South in Riverton, Utah. SWA-2 will be constructed within existing JVWCD and BOR easements and/or the public right-of-way. The Project Includes:

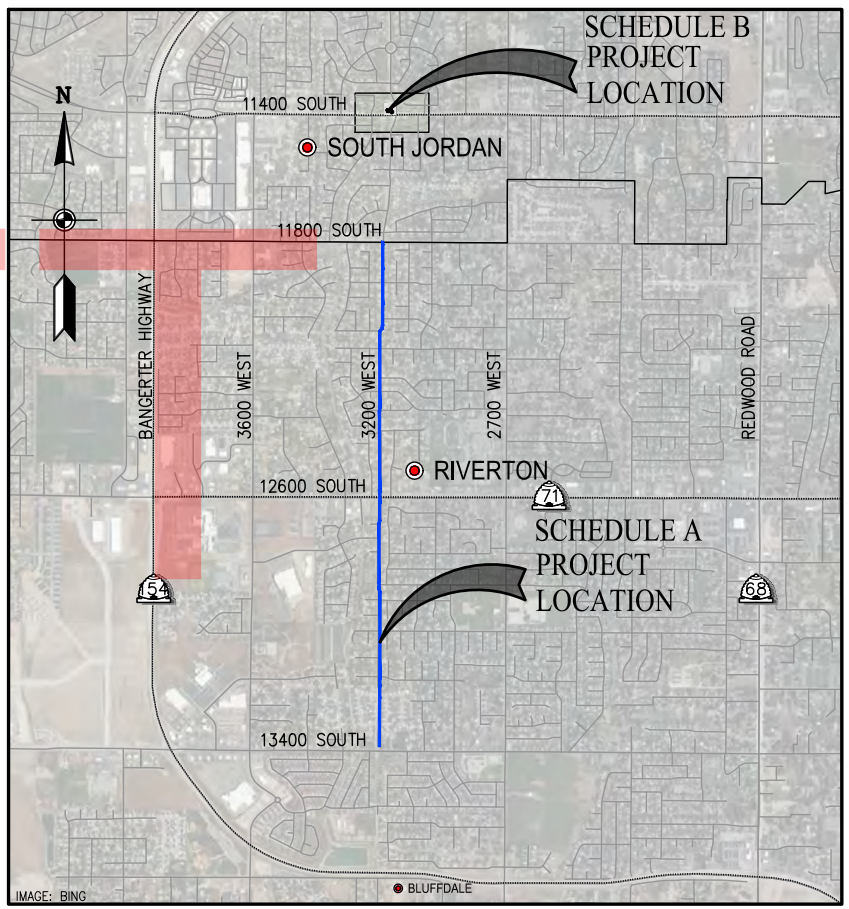
- (a) 66-inch welded steel pipeline for potable water.
- (b) Aqueduct Appurtenances - Cathodic protection test stations and buried test wiring, manway access, air valve, and blowoff/drain vaults, vent piping, concrete vent pads and vent caps, minor drain (manhole) and associated buried drain piping, 24-inch JA-2 interconnection buried piping and other existing JA-2 vault improvements, and a pedestrian access gate.
- (c) Items are numbered C1 through C9 below. This numbering is used in attached drawings for reference. Miscellaneous restoration of existing surface improvements including sidewalk, curb and gutter, roadways, etc. is not specifically identified.
 - (C1) 1,880 LF 66-inch/60-inch buried welded steel water pipe (partially or wholly within BOR easements), STA 406+03 to STA 424+83, including crossing beneath the existing JA-2 with 78" steel casing – See Sheets PP-11 through PP-14
 - At least 12.5 feet horizontal separation maintained between SWA-2 and JA-2 within BOR easements
 - 2-foot minimum vertical clearance at SWA-2 jack and bore crossing beneath JA-2 (SWA-2 STA 406+50)
 - 66-inch SWA-2 in 60-foot long 78-inch WSP casing at crossing
 - (C2) Eleven cathodic protection test stations (post-mounted) and associated buried wiring within BOR easements – See Sheets PP-01 through PP-05, PP-07, PP-09, and CP-02
 - Includes four new JA-2 cathodic protection test stations. Three of these four test stations are Type A test stations and include associated buried galvanic anodes.
 - (C3) Cathodic protection test wiring within BOR easements – See Sheets PP-11 and PP-13
 - (C4) Portion of Maintenance Access Vault with Drain, STA 337+42 – See Sheets PP-03 and C-05
 - Portion of buried structure, buried vent piping, concrete vent pad, mushroom vent caps, sidewalk, curb and gutter located within BOR easement
 - Minor drain (manhole) located within BOR easement with associated drain piping (to tie into existing JA-2 blowoff)
 - (C5) 18 LF of 24-inch diameter buried welded steel pipe, STA 372+29 and 12600 South JA-2 Mainline Valve Vault Modifications within BOR easement – See Sheets PP-07, C-08, S-01, M-04 and M-05, and E-02 through E-05

- 24" diameter buried pipe will extend from SWA-2, through existing spool in west wall of 12600 South JA-2 Mainline Valve Vault and connect with JA-2 at existing blind flanges
 - An additional equipment hatch and mezzanine level grating will be added to the vault along with new 24" butterfly valves, water quality monitoring equipment, sampling lines, 10" JA-2 bypass
- (C6) Portion of Air Valve Vault with Manway Access, STA 372+72– See Sheet PP-07
- Portion of buried structure, access hatch, vent piping, mushroom, vent caps, and bollards located within BOR easement
- (C7) Portion of Air Valve Vault with Manway Access, STA 422+19– See Sheet PP-13
- Portion of buried structure and vent piping located within BOR easement
- (C8) 4-ft Pedestrian Access Gate – See Sheet PP-10
- Installed along existing vinyl fence to provide JWCD with access to existing JA-2 cathodic protection facility within BOR easement (at 3176 W Durham Woods Way)
- (d) Permanent.
- (e) SWA-2 will operate continuously, year-round except when taken offline for maintenance or inspection.
- (f) Flows range from approximately 14 MGD (winter months) to 102 MGD (summer months, JA-2 offline).
- (g) It is anticipated that construction of the SWA-2 Project will take place between April/May of 2025 and April/May of 2027 over approximately 24 months.
- (h) Contractor will comply with Specification Section 015110 - Aqueduct Protection and Monitoring (see attached). No storage or staging permitted within the BOR easement. Contractor will delineate existing JA-2 and its load protection area and abide by BOR aqueduct protection and monitoring criteria.

DRAWINGS FOR CONSTRUCTION OF THE SOUTHWEST AQUEDUCT REACH 2 13400 SOUTH TO 11800 SOUTH AND 11400 SOUTH JA-2 MAINLINE VAULT JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT



PROJECT LOCATION MAP

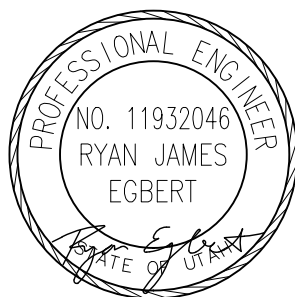


PROJECT VICINITY MAP

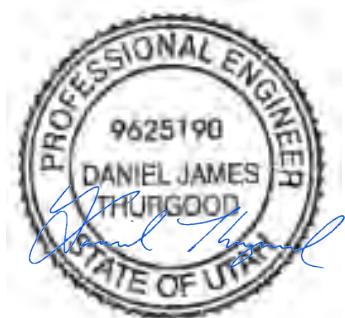
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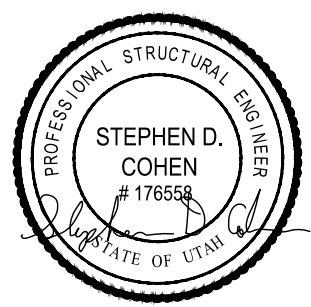
SCHEDULE A
CIVIL/MECHANICAL



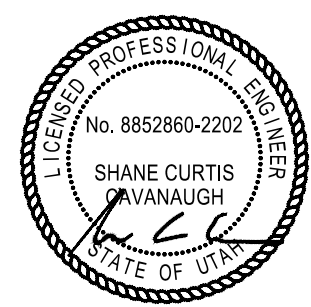
SCHEDULE B
CIVIL/MECHANICAL



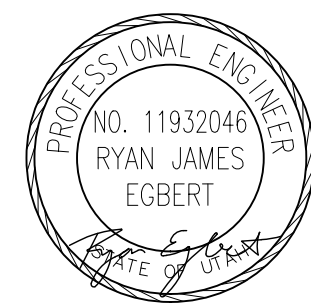
TRAFFIC CONTROL



STRUCTURAL



ELECTRICAL/INSTRUMENTATION



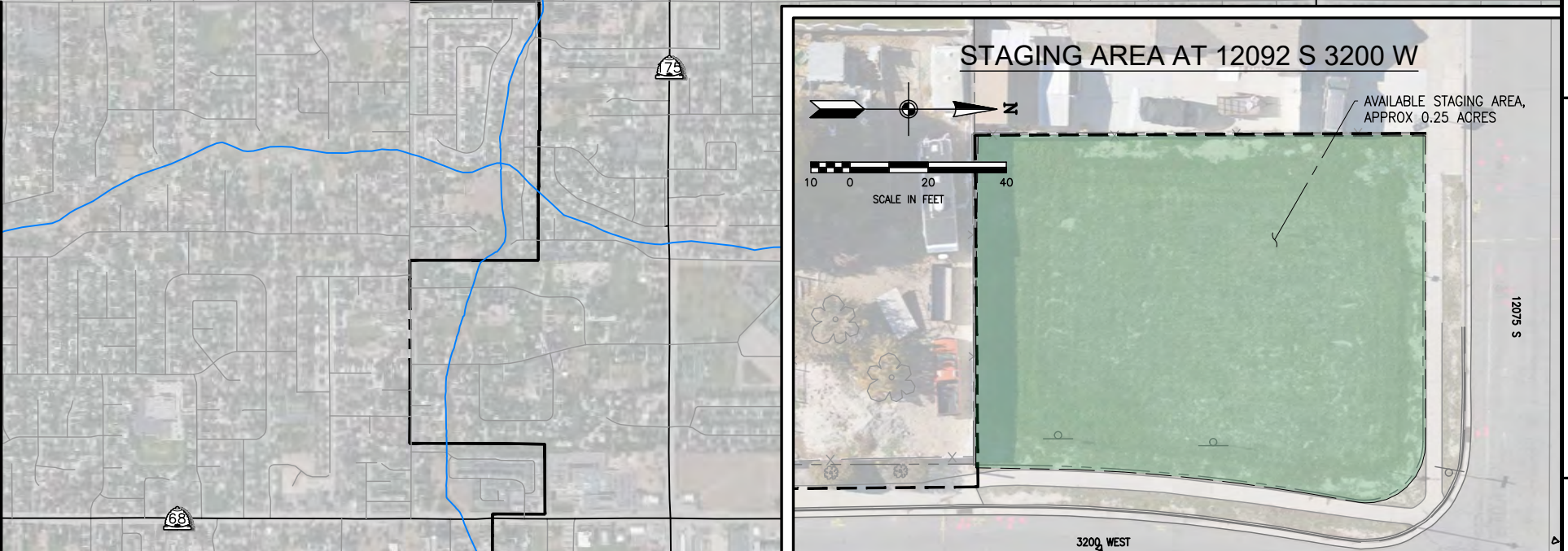
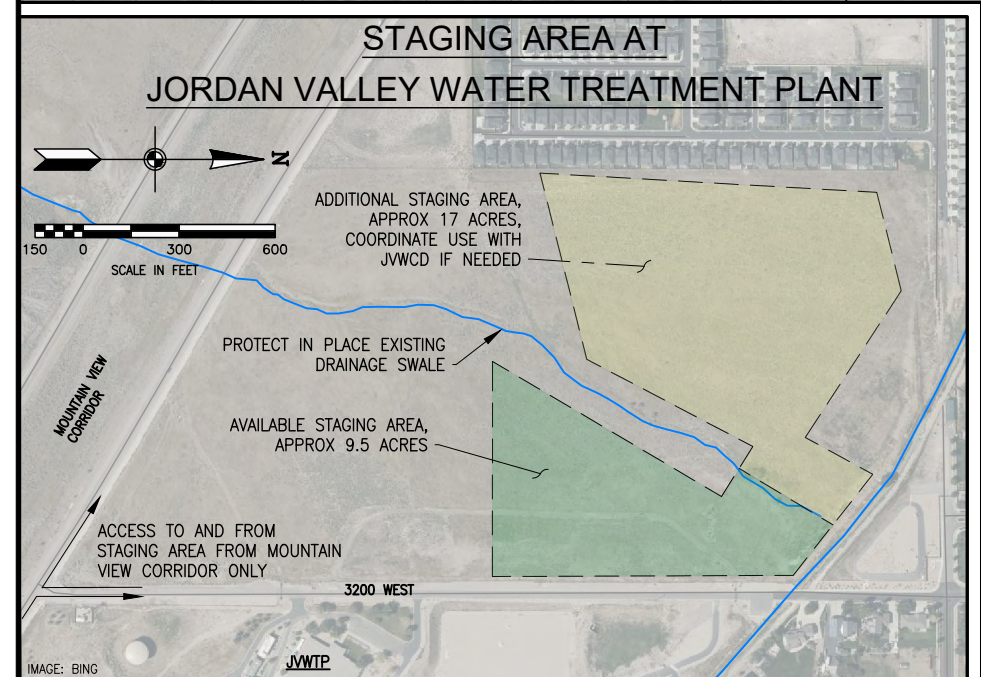
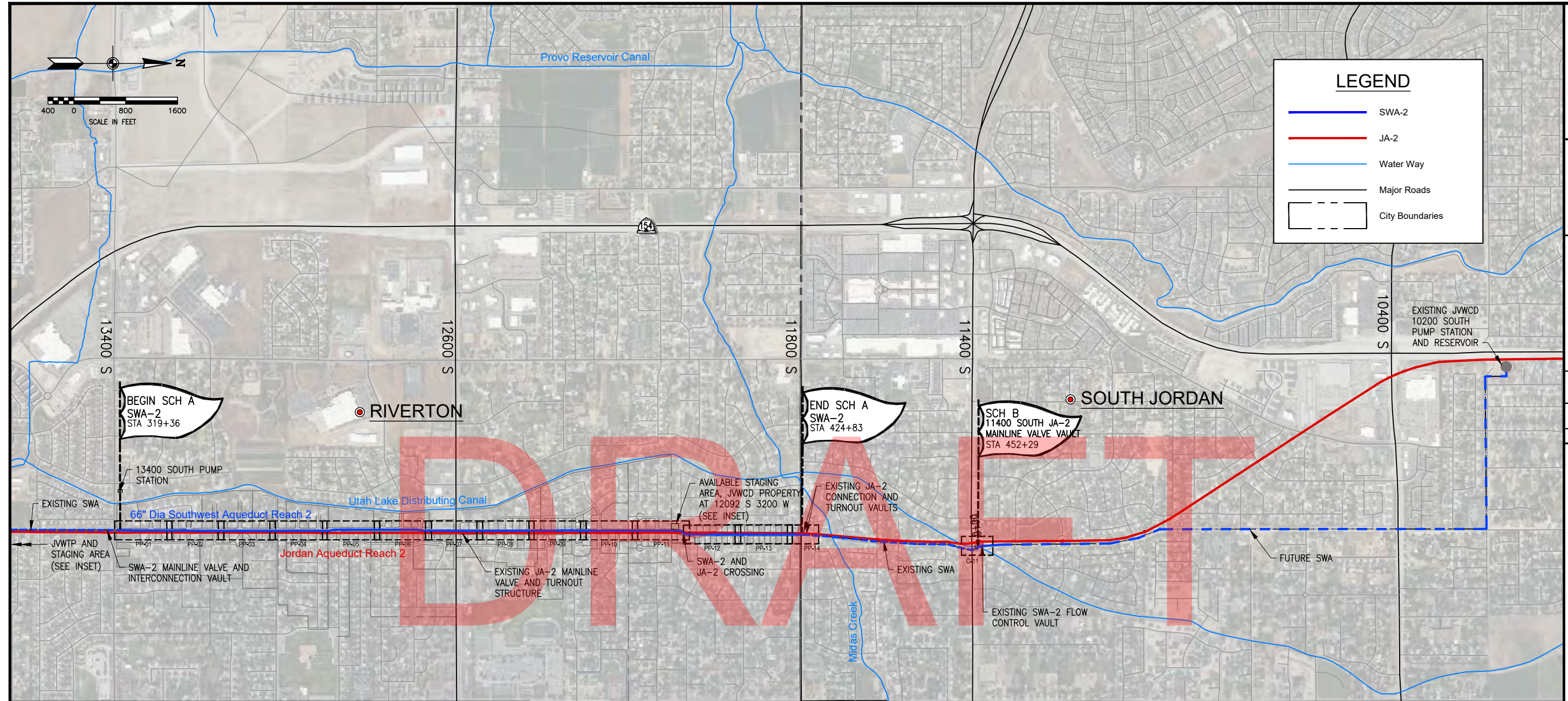
CATHODIC PROTECTION

NO.	DATE	REV. BY	DESCRIPTION

DESIGN L. MINCK J. BLACK		CHECKED T. OLSEN	APPROVED J. LUETTINGER
VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING		REVIEW	

GENERAL		PROJECT NUMBER	DATE
TITLE PAGE PROJECT LOCATION MAP AND VICINITY MAP		010-23-02	JANUARY 2025

DRAWING NO.	G-01
SHEET	01 OF 99



NO.	DATE	REV. BY	DESCRIPTION

VERIFY SCALE
 BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
 CHECKED: T. OLSEN
 APPROVED: J. LUETTINGER

DESIGN
 DESIGN: L. MINCK
 DRAWN: J. BLACK

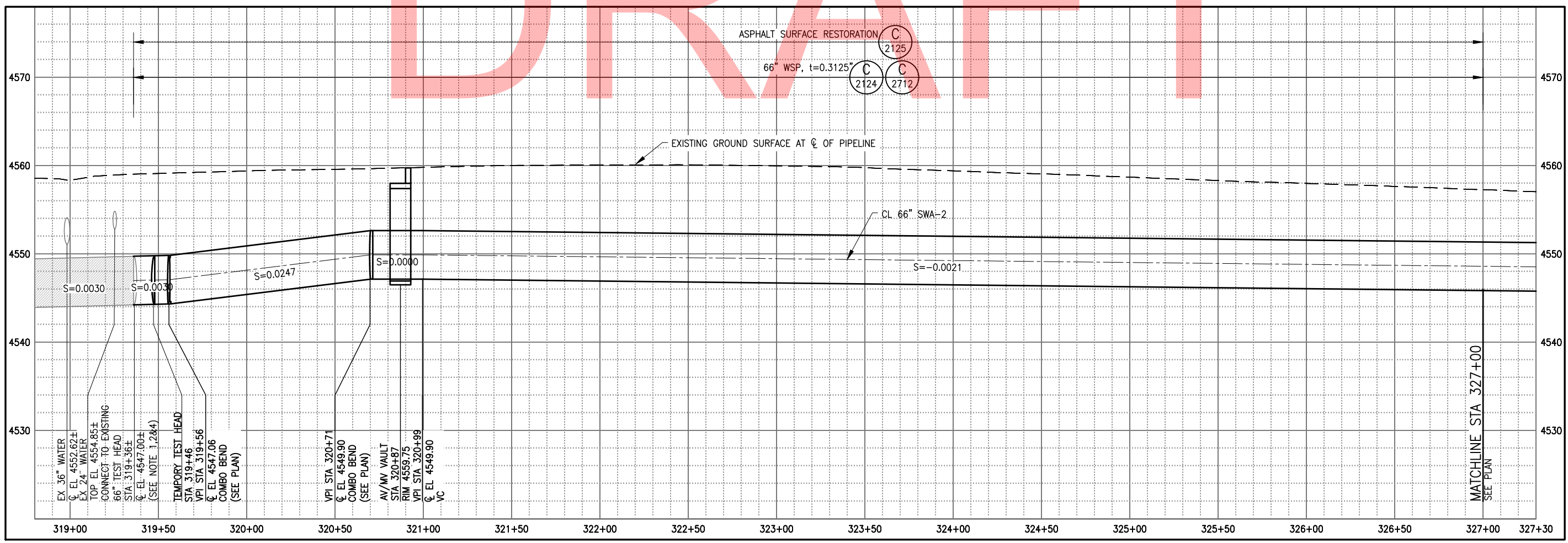
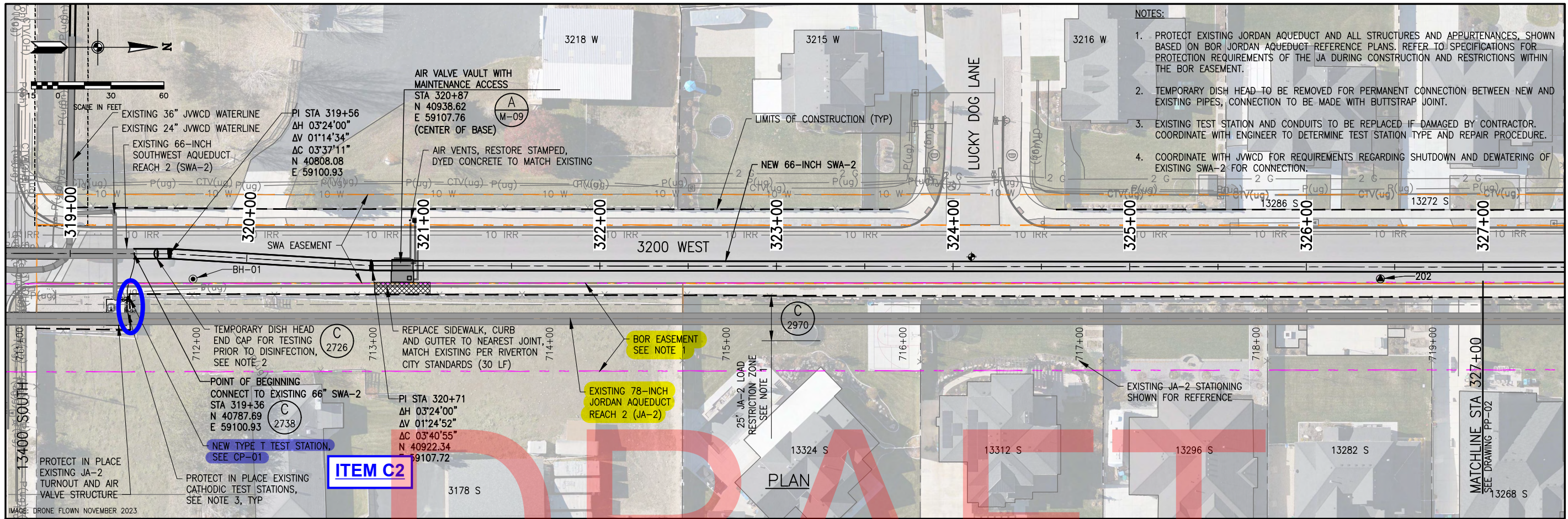
GENERAL

SWA OVERALL SYSTEM LAYOUT

DATE: JANUARY 2025
 PROJECT NUMBER: 010-23-02

DRAWING NO.
G-06

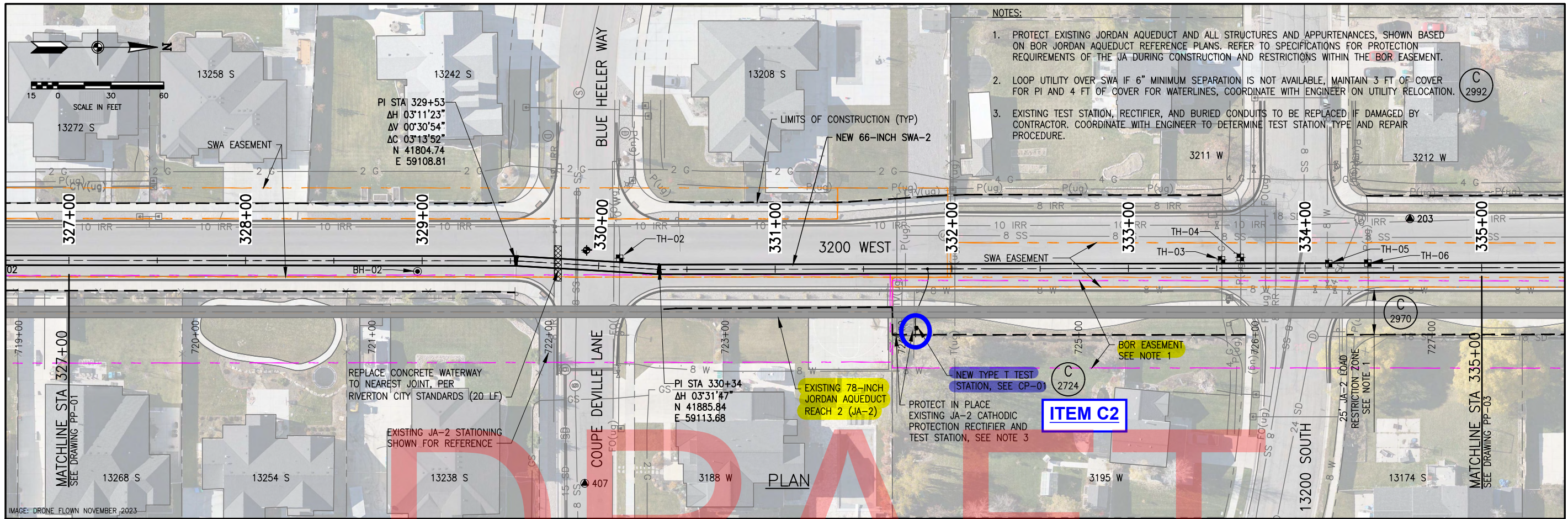
SHEET 06 OF 99



NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT	DESIGN	REVIEW
	DESIGN: L. MINCK DRAWN: J. BLACK	CHECKED: T. OLSEN APPROVED: J. LUETTINGER

JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT	PROJECT NUMBER: 010-23-02
DATE: JANUARY 2025	
DRAWING NO. PP-01	
SHEET 16 OF 99	



- NOTES:
1. PROTECT EXISTING JORDAN AQUEDUCT AND ALL STRUCTURES AND APPURTENANCES, SHOWN BASED ON BOR JORDAN AQUEDUCT REFERENCE PLANS. REFER TO SPECIFICATIONS FOR PROTECTION REQUIREMENTS OF THE JA DURING CONSTRUCTION AND RESTRICTIONS WITHIN THE BOR EASEMENT.
 2. LOOP UTILITY OVER SWA IF 6" MINIMUM SEPARATION IS NOT AVAILABLE, MAINTAIN 3 FT OF COVER FOR PI AND 4 FT OF COVER FOR WATERLINES, COORDINATE WITH ENGINEER ON UTILITY RELOCATION.
 3. EXISTING TEST STATION, RECTIFIER, AND BURIED CONDUITS TO BE REPLACED IF DAMAGED BY CONTRACTOR. COORDINATE WITH ENGINEER TO DETERMINE TEST STATION TYPE AND REPAIR PROCEDURE.



NO.	DATE	REV. BY	DESCRIPTION

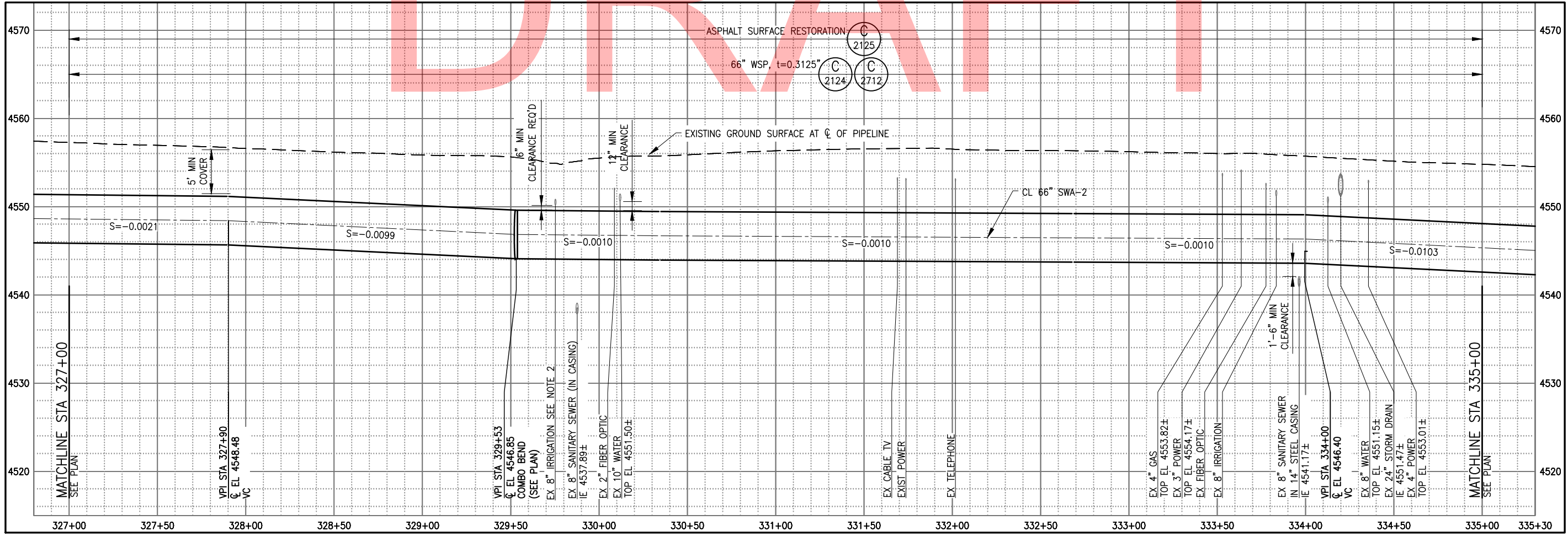
VERIFY SCALE
 BAR IS ONE INCH ON ORIGINAL DRAWING

JORDAN VALLEY WATER CONSERVANCY DISTRICT
 RIVERTON AND SOUTH JORDAN, UT

SOUTHWEST AQUEDUCT REACH 2

DESIGN: L. MINKO
 DRAWN: J. BLACK

REVIEW: T. OLSEN
 CHECKED: T. OLSEN
 APPROVED: J. LUETTINGER



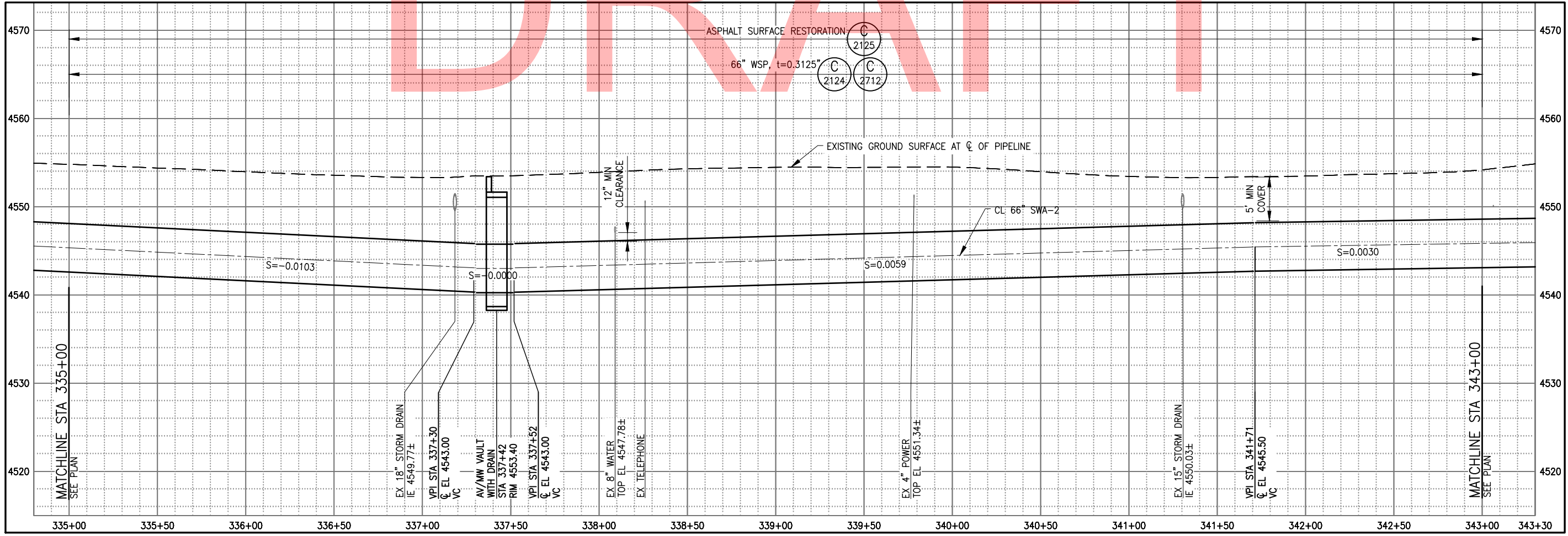
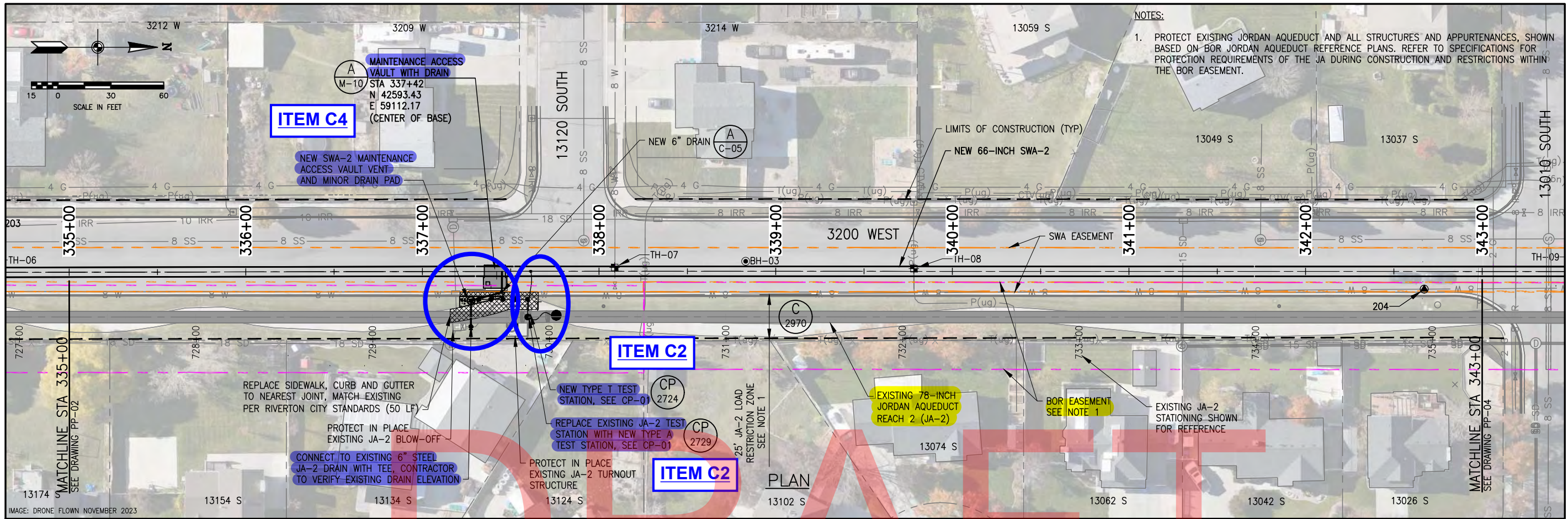
PLAN & PROFILE

PLAN & PROFILE - 2

DATE: JANUARY 2025
 PROJECT NUMBER: 010-23-02

DRAWING NO.
PP-02

SHEET 17 OF 99

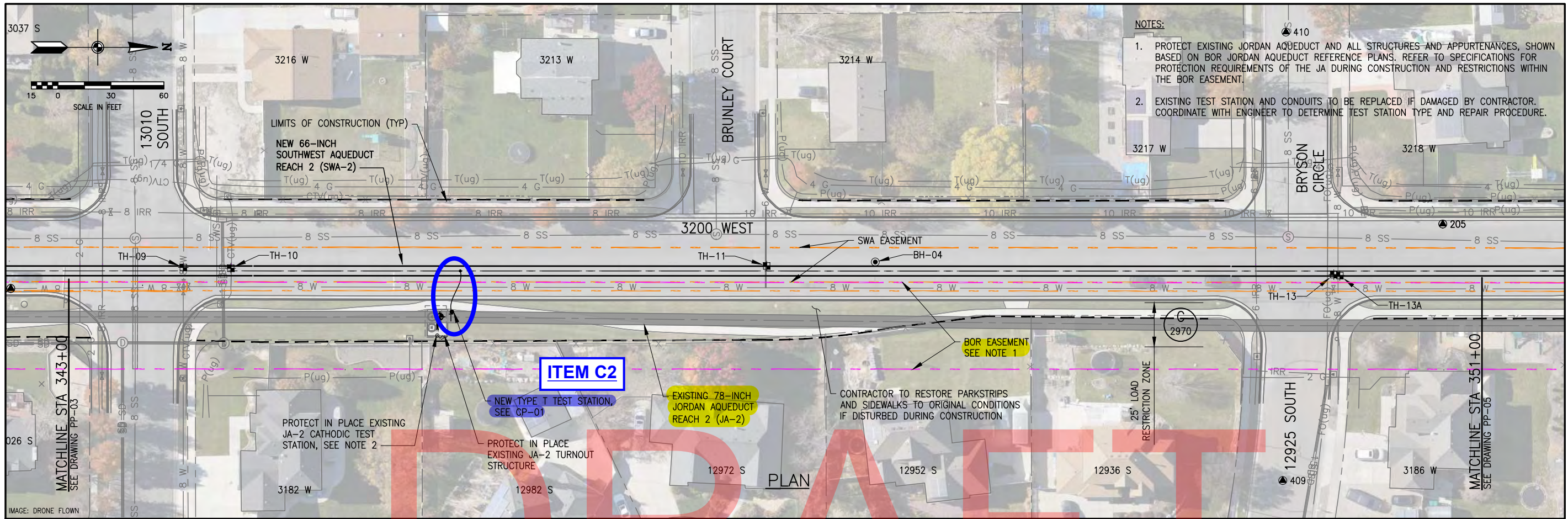


NO.	DATE	REV. BY	DESCRIPTION

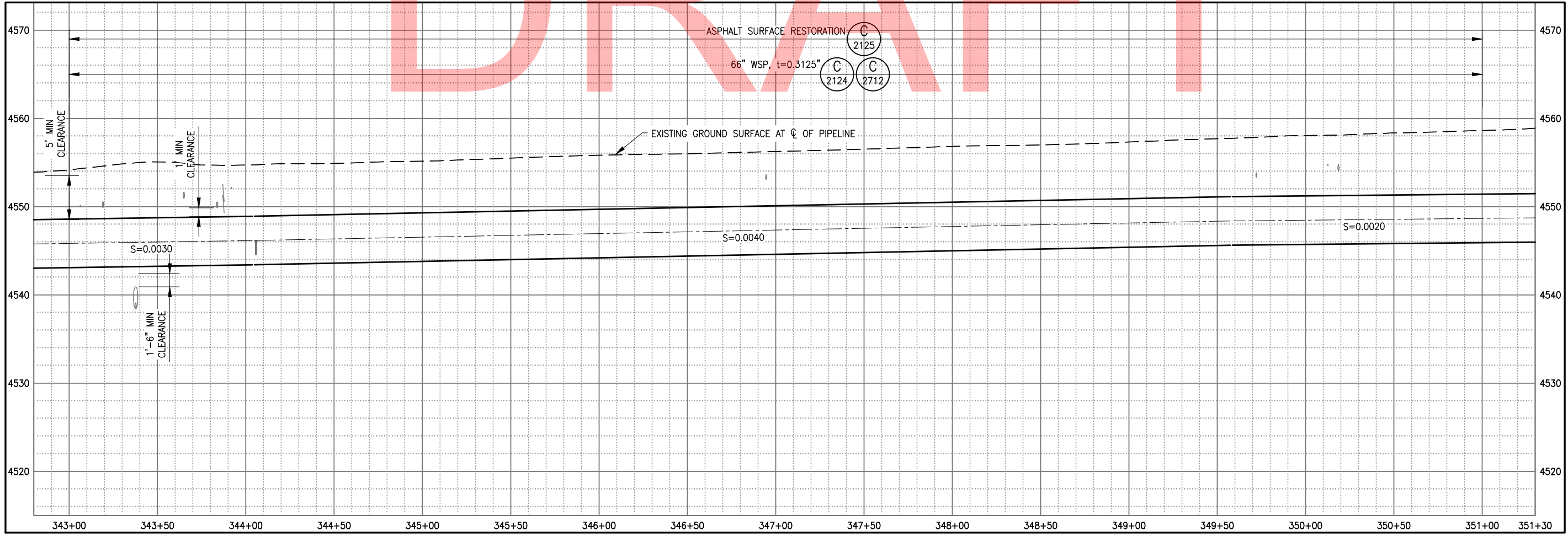
VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING	
DESIGN L. MINICK	REVIEW T. OLSEN
DRAWN J. BLACK	APPROVED J. LUETTINGER

JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT
SOUTHWEST AQUEDUCT REACH 2
PLAN & PROFILE - 3
DATE: JANUARY 2025
PROJECT NUMBER: 010-23-02

P:\JORDAN VALLEY WCD\010-23-02 SOUTHWEST AQUEDUCT REACH 2 - 13400 S TO 11800 S\2.0 DESIGN PHASE\2.9 DRAWINGS\SH1\PP-03.dwg Plotted: 1/10/2025 2:25 PM By: Jeremy Black



- NOTES:**
1. PROTECT EXISTING JORDAN AQUEDUCT AND ALL STRUCTURES AND APPURTENANCES, SHOWN BASED ON BOR JORDAN AQUEDUCT REFERENCE PLANS. REFER TO SPECIFICATIONS FOR PROTECTION REQUIREMENTS OF THE JA DURING CONSTRUCTION AND RESTRICTIONS WITHIN THE BOR EASEMENT.
 2. EXISTING TEST STATION AND CONDUITS TO BE REPLACED IF DAMAGED BY CONTRACTOR. COORDINATE WITH ENGINEER TO DETERMINE TEST STATION TYPE AND REPAIR PROCEDURE.



NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT
RIVERTON, UT

SOUTHWEST AQUEDUCT REACH 2

DESIGN: L. MINCK
DRAWN: J. BLACK

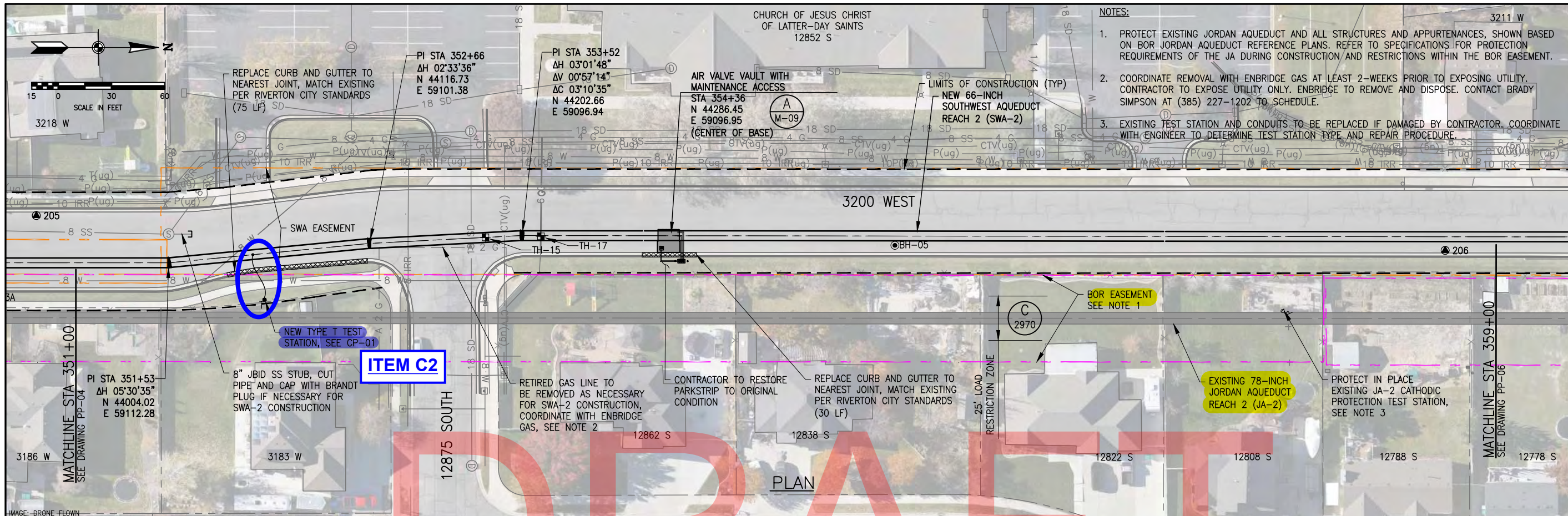
REVIEW: T. OLSEN
CHECKED: T. OLSEN
APPROVED: J. LUETTINGER

PLAN & PROFILE

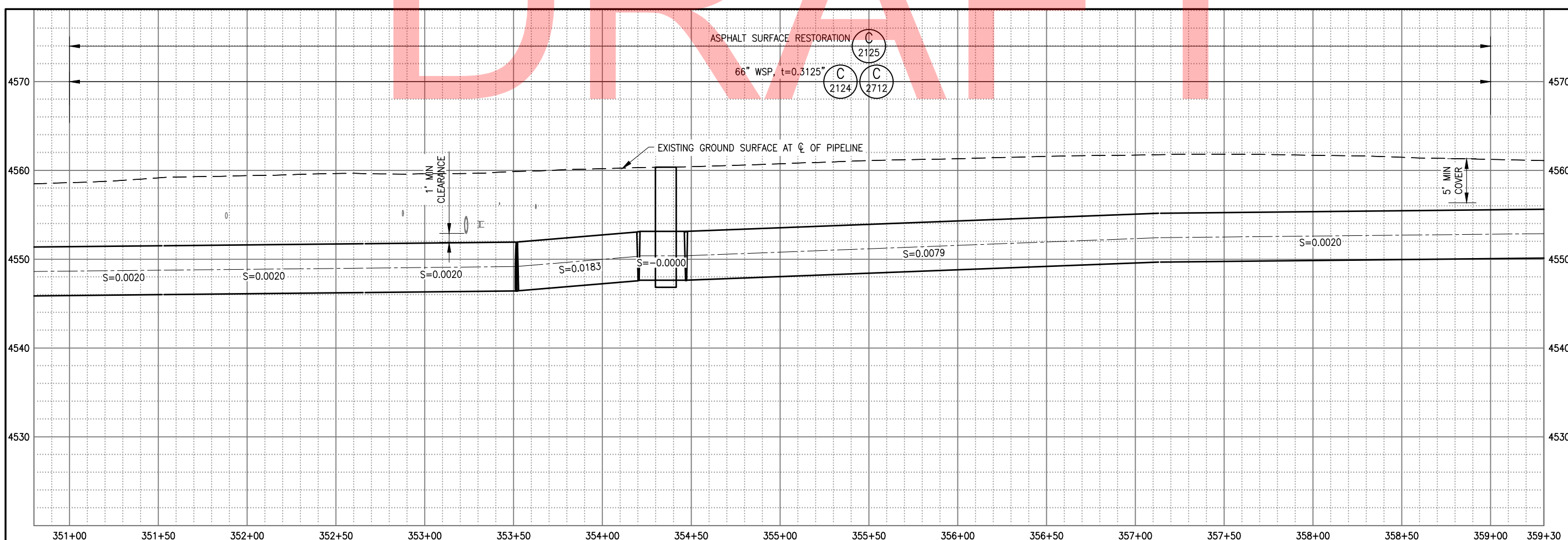
PLAN & PROFILE - 4

DATE: JANUARY 2025
PROJECT NUMBER: 010-23-02

P:\JORDAN VALLEY WCD\010-23-02 SOUTHWEST AQUEDUCT REACH 2 - 13400 S TO 11800 S\2.0 DESIGN PHASE\2.9 DRAWINGS\SH10102302_PP-04.dwg Plotted: 12/27/2024 8:01 AM By: Jeremy Black



- NOTES:
1. PROTECT EXISTING JORDAN AQUEDUCT AND ALL STRUCTURES AND APPURTENANCES, SHOWN BASED ON BOR JORDAN AQUEDUCT REFERENCE PLANS. REFER TO SPECIFICATIONS FOR PROTECTION REQUIREMENTS OF THE JA DURING CONSTRUCTION AND RESTRICTIONS WITHIN THE BOR EASEMENT.
 2. COORDINATE REMOVAL WITH ENBRIDGE GAS AT LEAST 2-WEEKS PRIOR TO EXPOSING UTILITY. CONTRACTOR TO EXPOSE UTILITY ONLY. ENBRIDGE TO REMOVE AND DISPOSE. CONTACT BRADY SIMPSON AT (385) 227-1202 TO SCHEDULE.
 3. EXISTING TEST STATION AND CONDUITS TO BE REPLACED IF DAMAGED BY CONTRACTOR. COORDINATE WITH ENGINEER TO DETERMINE TEST STATION TYPE AND REPAIR PROCEDURE.



NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT
RIVERTON, UT

SOUTHWEST AQUEDUCT REACH 2

DESIGN: L. MINKO
DRAWN: J. BLACK

REVIEW: CHECKED T. OLSEN
APPROVED: J. LUETTINGER

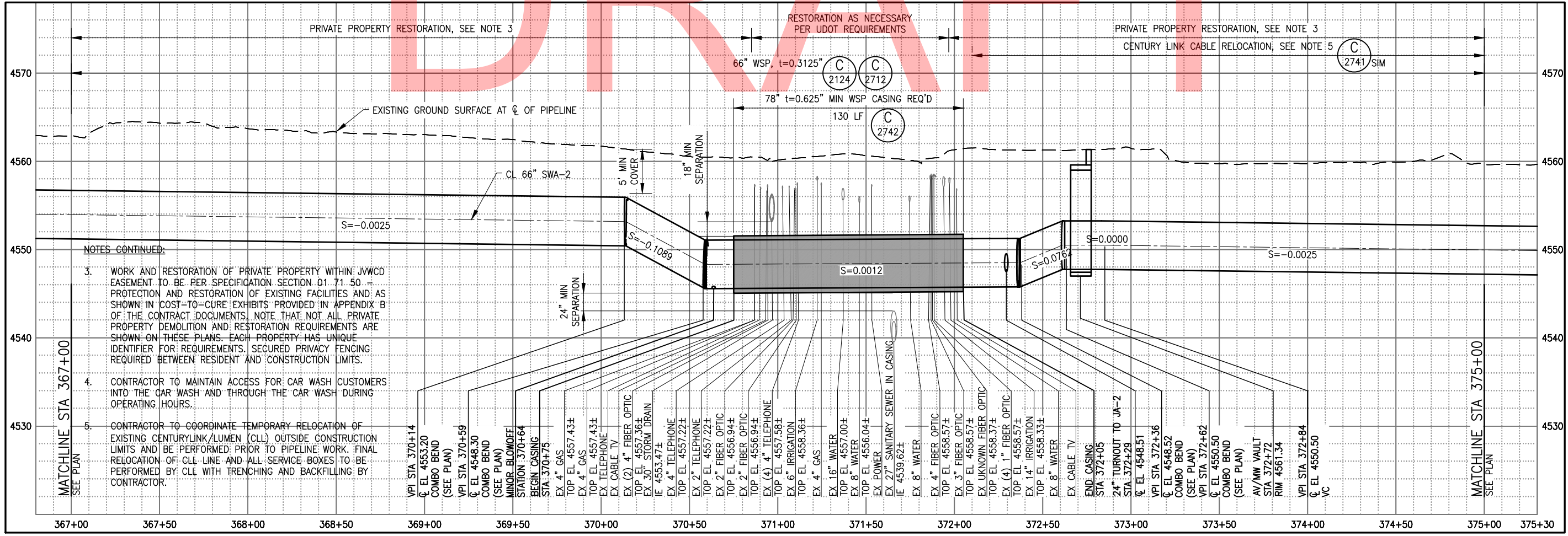
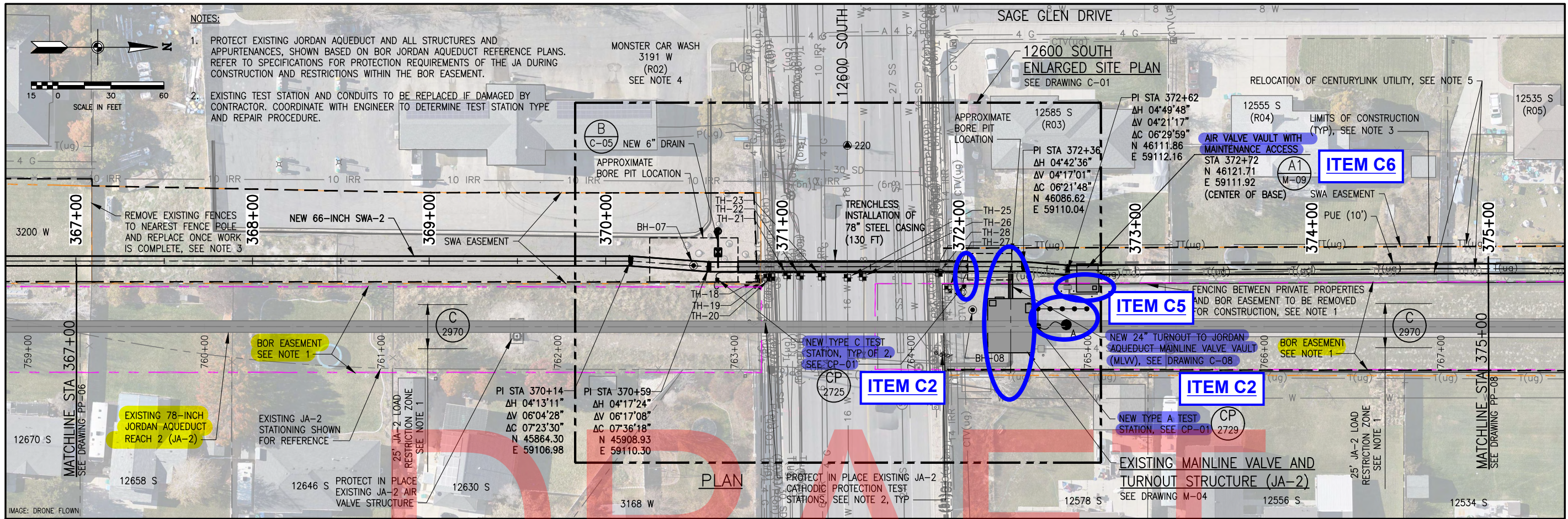
VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING

PLAN & PROFILE

PLAN & PROFILE - 5

DATE: JANUARY 2025
PROJECT NUMBER: 010-23-02

P:\JORDAN VALLEY WCD\010-23-02 SOUTHWEST AQUEDUCT REACH 2 - 13400 S TO 11800 S\2.0 DESIGN PHASE\2.9 DRAWINGS\SH1\0102302_PP-05.dwg Plotted: 12/27/2024 8:03 AM By: Jeremy Black



NOTES CONTINUED:

- WORK AND RESTORATION OF PRIVATE PROPERTY WITHIN JWCD EASEMENT TO BE PER SPECIFICATION SECTION 01.71.50. PROTECTION AND RESTORATION OF EXISTING FACILITIES AND AS SHOWN IN COST-TO-CURE EXHIBITS PROVIDED IN APPENDIX B OF THE CONTRACT DOCUMENTS, NOTE THAT NOT ALL PRIVATE PROPERTY DEMOLITION AND RESTORATION REQUIREMENTS ARE SHOWN ON THESE PLANS. EACH PROPERTY HAS UNIQUE IDENTIFIER FOR REQUIREMENTS. SECURED PRIVACY FENCING REQUIRED BETWEEN RESIDENT AND CONSTRUCTION LIMITS.
- CONTRACTOR TO MAINTAIN ACCESS FOR CAR WASH CUSTOMERS INTO THE CAR WASH AND THROUGH THE CAR WASH DURING OPERATING HOURS.
- CONTRACTOR TO COORDINATE TEMPORARY RELOCATION OF EXISTING CENTURYLINK/LUMEN (CLL) OUTSIDE CONSTRUCTION LIMITS AND BE PERFORMED PRIOR TO PIPELINE WORK. FINAL RELOCATION OF CLL LINE AND ALL SERVICE BOXES TO BE PERFORMED BY CLL WITH TRENCHING AND BACKFILLING BY CONTRACTOR.

NO.	DATE	REV. BY	DESCRIPTION

VERIFY SCALE
 BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN
 DESIGN: L. MINICK
 DRAWN: J. BLACK

REVIEW
 CHECKED: T. OLSEN
 APPROVED: J. LUETTINGER

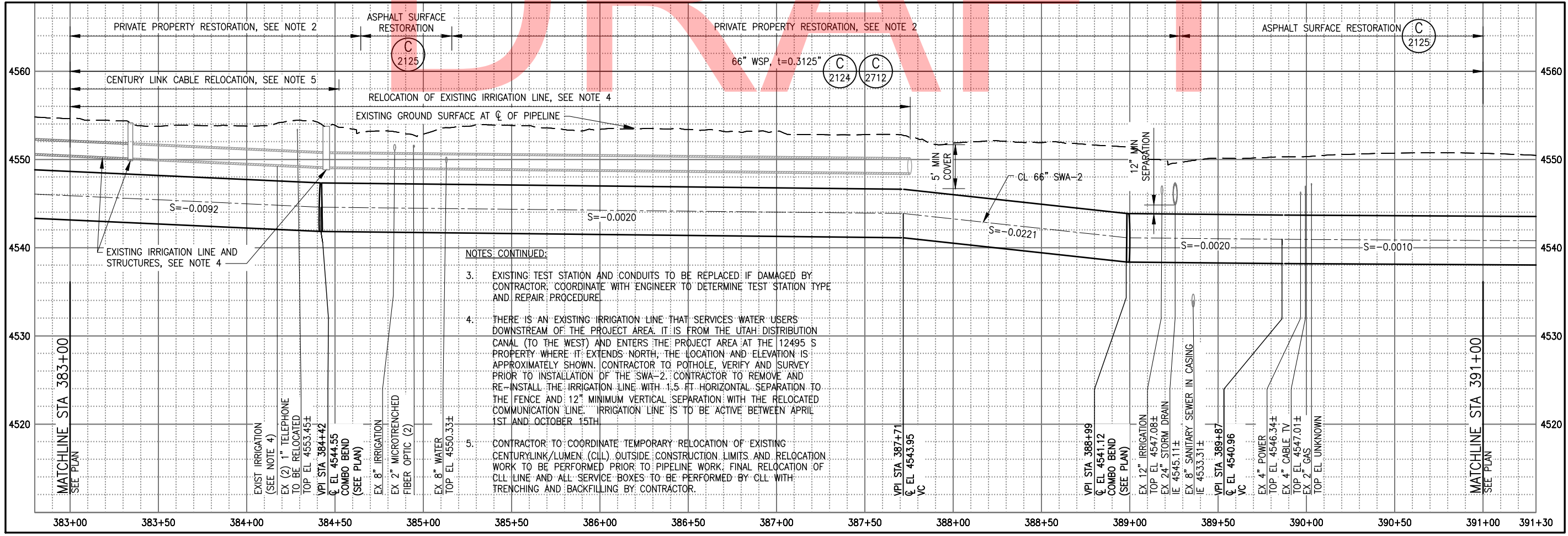
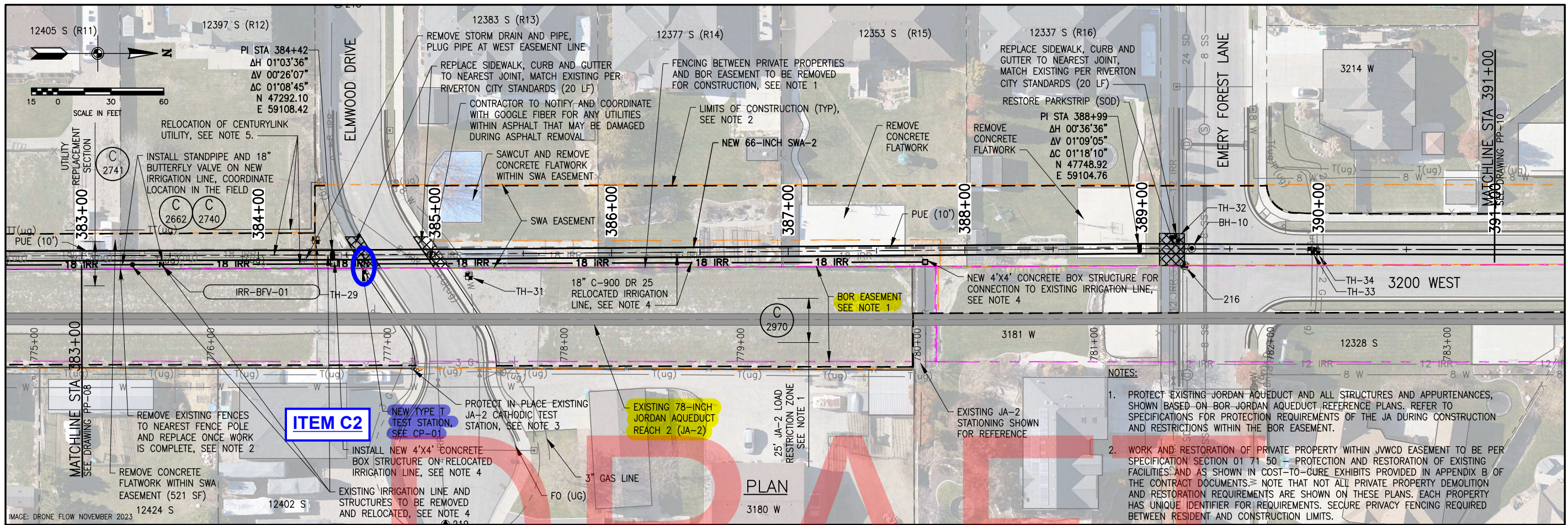
JORDAN VALLEY WATER CONSERVANCY DISTRICT
 SOUTHWEST AQUEDUCT REACH 2
 RIVERTON AND SOUTH JORDAN, UT

PLAN & PROFILE
PLAN & PROFILE - 7

DATE: JANUARY 2025
 PROJECT NUMBER: 010-23-02

DRAWING NO.
PP-07

SHEET 22 OF 99



- NOTES: CONTINUED:
- EXISTING TEST STATION AND CONDUITS TO BE REPLACED IF DAMAGED BY CONTRACTOR. COORDINATE WITH ENGINEER TO DETERMINE TEST STATION TYPE AND REPAIR PROCEDURE.
 - THERE IS AN EXISTING IRRIGATION LINE THAT SERVICES WATER USERS DOWNSTREAM OF THE PROJECT AREA. IT IS FROM THE UTAH DISTRIBUTION CANAL (TO THE WEST) AND ENTERS THE PROJECT AREA AT THE 12495 S PROPERTY WHERE IT EXTENDS NORTH. THE LOCATION AND ELEVATION IS APPROXIMATELY SHOWN. CONTRACTOR TO POTHOLE, VERIFY AND SURVEY PRIOR TO INSTALLATION OF THE SWA-2. CONTRACTOR TO REMOVE AND RE-INSTALL THE IRRIGATION LINE WITH 1.5 FT HORIZONTAL SEPARATION TO THE FENCE AND 12" MINIMUM VERTICAL SEPARATION WITH THE RELOCATED COMMUNICATION LINE. IRRIGATION LINE IS TO BE ACTIVE BETWEEN APRIL 1ST AND OCTOBER 15TH.
 - CONTRACTOR TO COORDINATE TEMPORARY RELOCATION OF EXISTING CENTURYLINK/LUMEN (CLL) OUTSIDE CONSTRUCTION LIMITS AND RELOCATION WORK TO BE PERFORMED PRIOR TO PIPELINE WORK. FINAL RELOCATION OF CLL LINE AND ALL SERVICE BOXES TO BE PERFORMED BY CLL WITH TRENCHING AND BACKFILLING BY CONTRACTOR.

BOWEN COLLINS ASSOCIATES

NO.	DATE	REV. BY	DESCRIPTION

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN
DESIGN: L. MINICK
DRAWN: J. BLACK

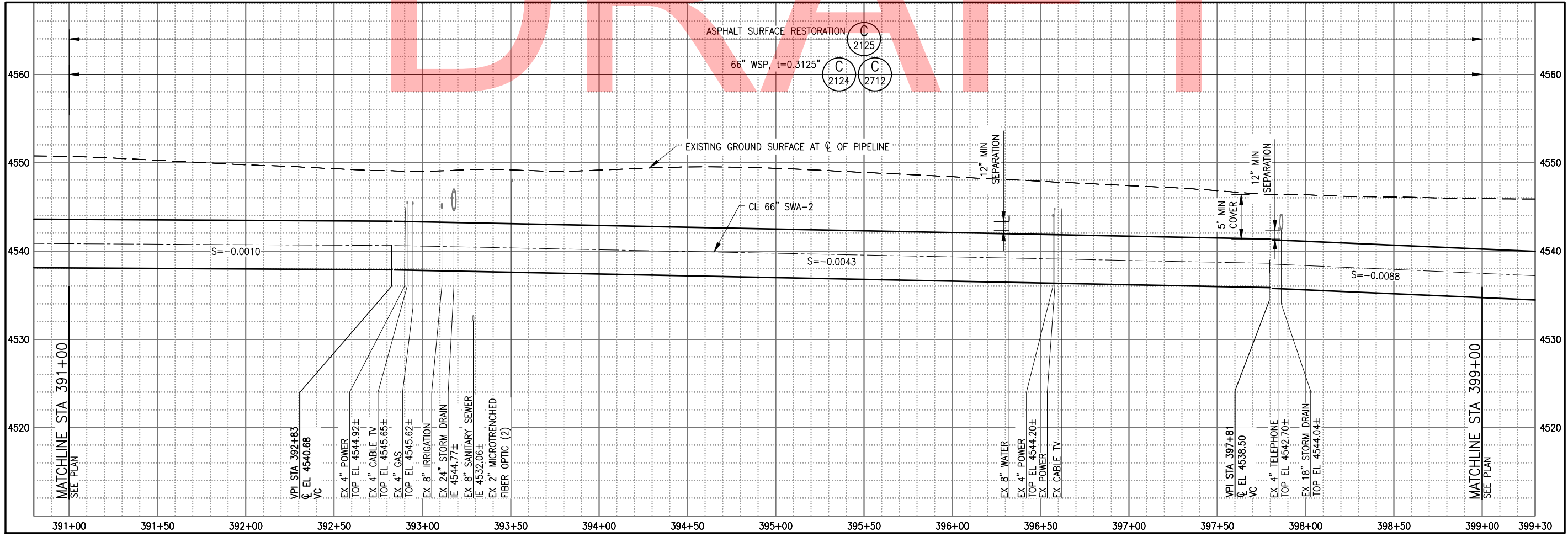
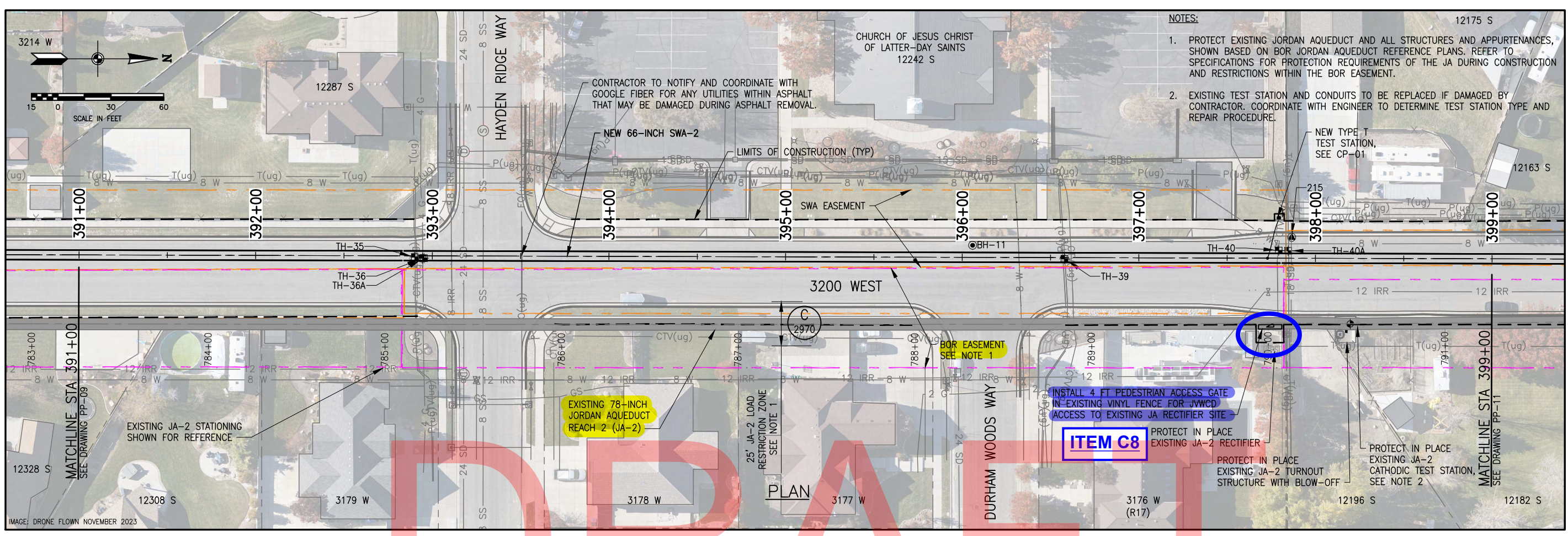
REVIEW
CHECKED: T. OLSEN
APPROVED: J. LUETTINGER

PLAN & PROFILE - 9

DRAWING NO. **PP-09**

DATE: JANUARY 2025 PROJECT NUMBER 010-23-02

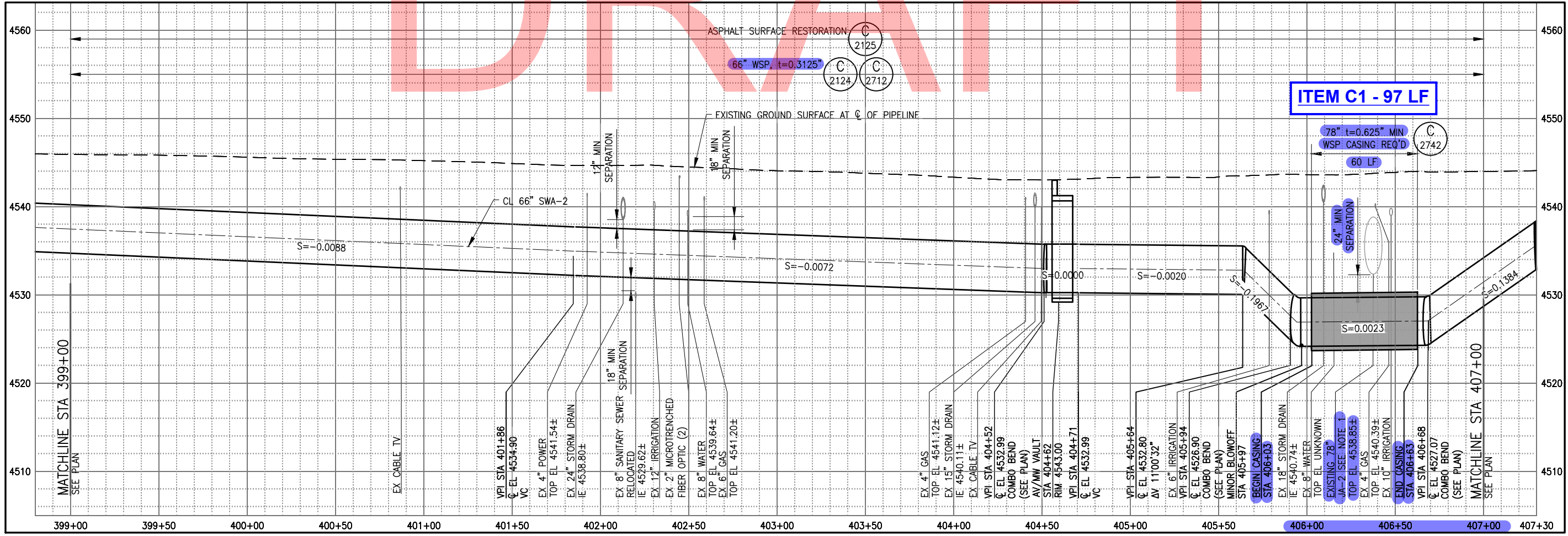
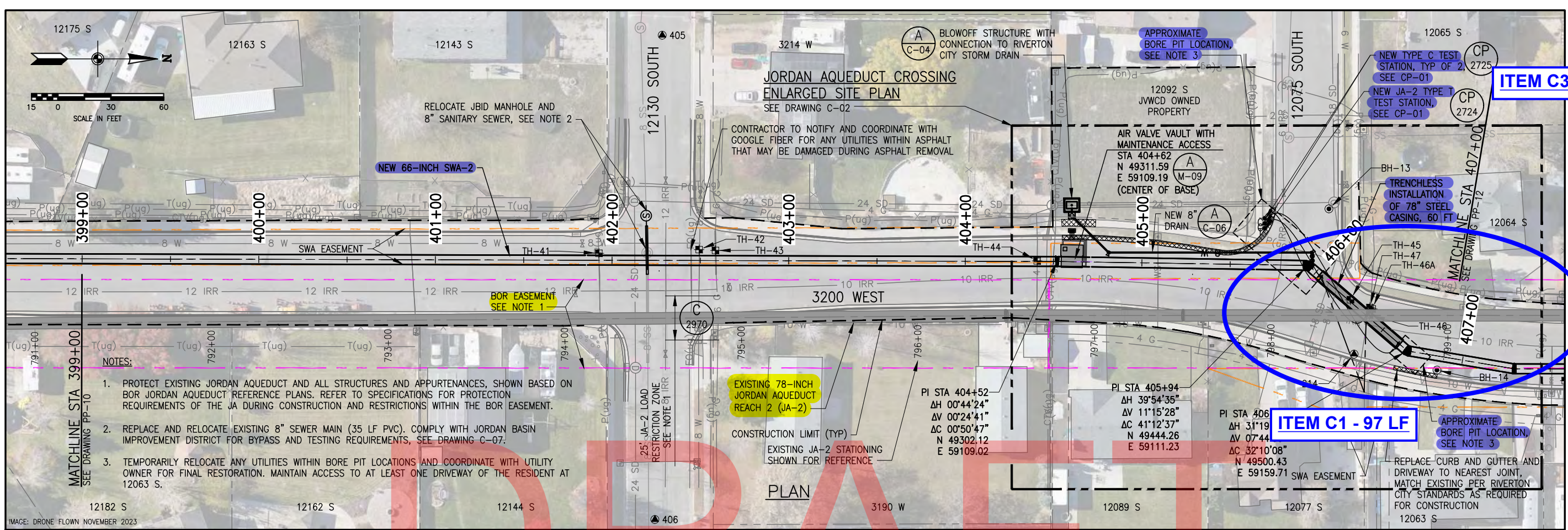
SHEET 24 OF 99



NO.	DATE	REVIEW	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
	DESIGN: L. MINCK DRAWN: J. BLACK
SOUTHWEST AQUEDUCT REACH 2	REVIEW: T. OLSEN CHECKED: T. OLSEN APPROVED: J. LUETTINGER

PLAN & PROFILE - 10	DATE: JANUARY 2025 PROJECT NUMBER: 010-23-02
DRAWING NO. PP-10	SHEET 25 OF 99



BOWEN COLLINS ASSOCIATES

JORDAN VALLEY WATER CONSERVANCY DISTRICT
RIVERTON AND SOUTH JORDAN, UT

SOUTHWEST AQUEDUCT REACH 2

PLAN & PROFILE

PLAN & PROFILE - 11

DRAWING NO. PP-11

SHEET 26 OF 99

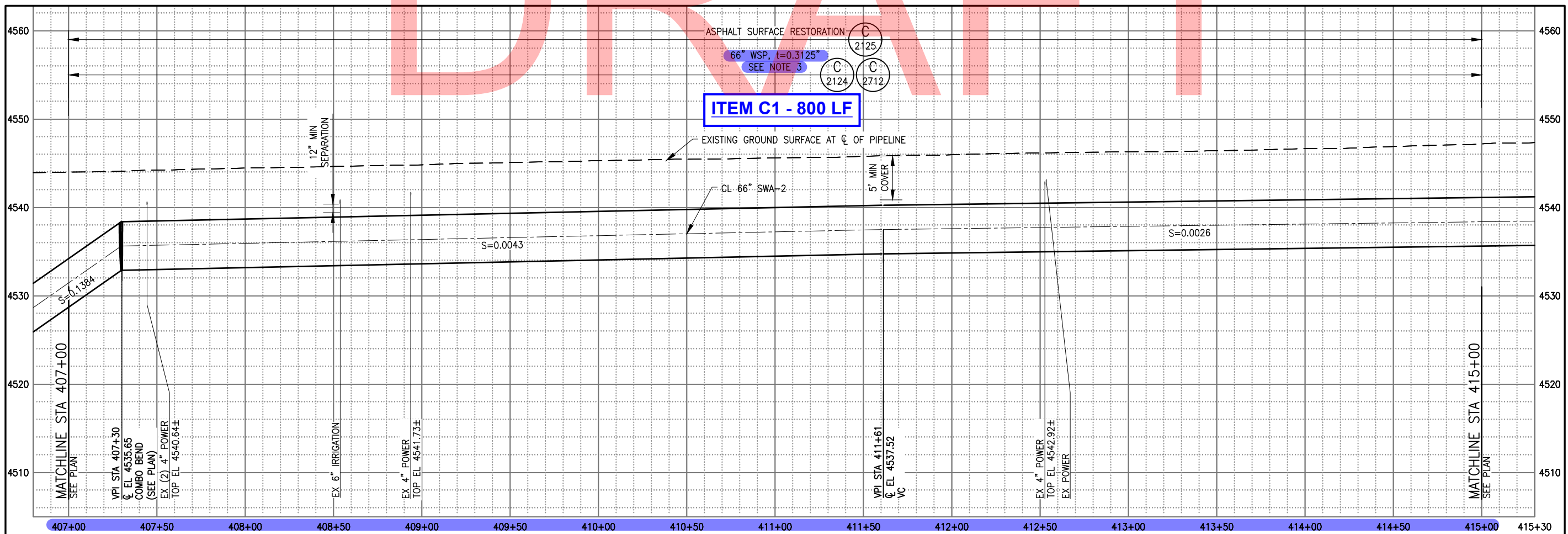
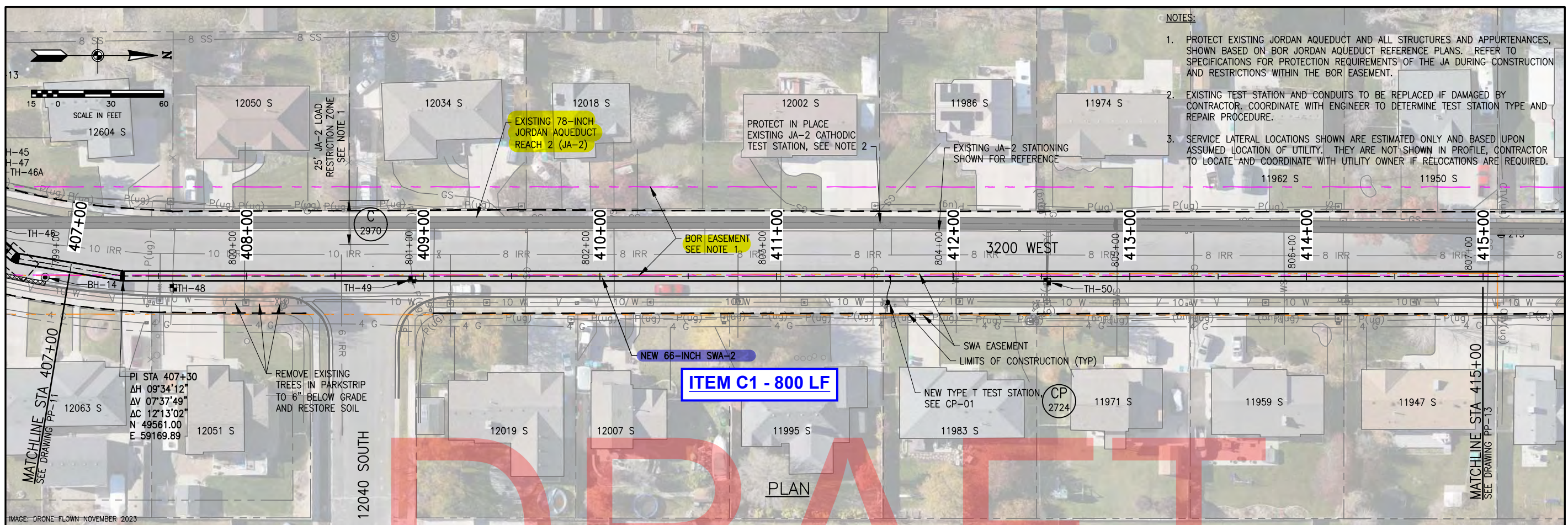
NO.	DATE	REVISION	DESCRIPTION

DESIGN: L. MINCK
DRAWN: J. BLACK

CHECKED: T. OLSEN
APPROVED: J. LUETTINGER

DATE: JANUARY 2025
PROJECT NUMBER: 010-23-02

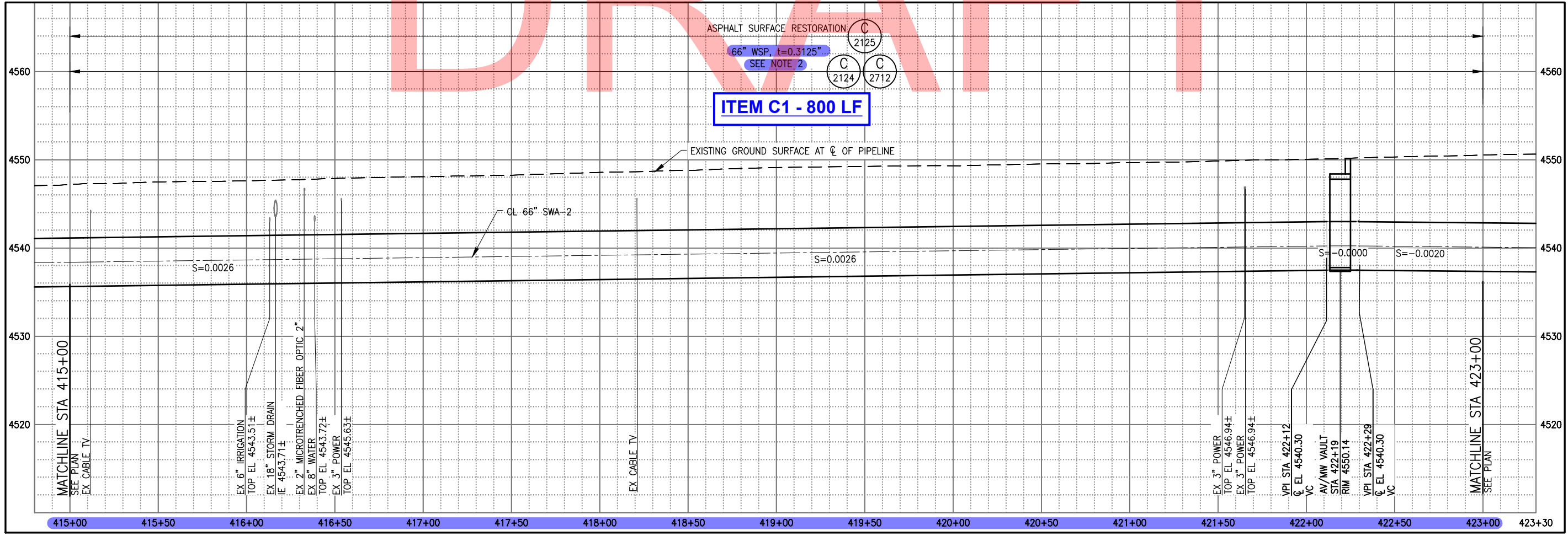
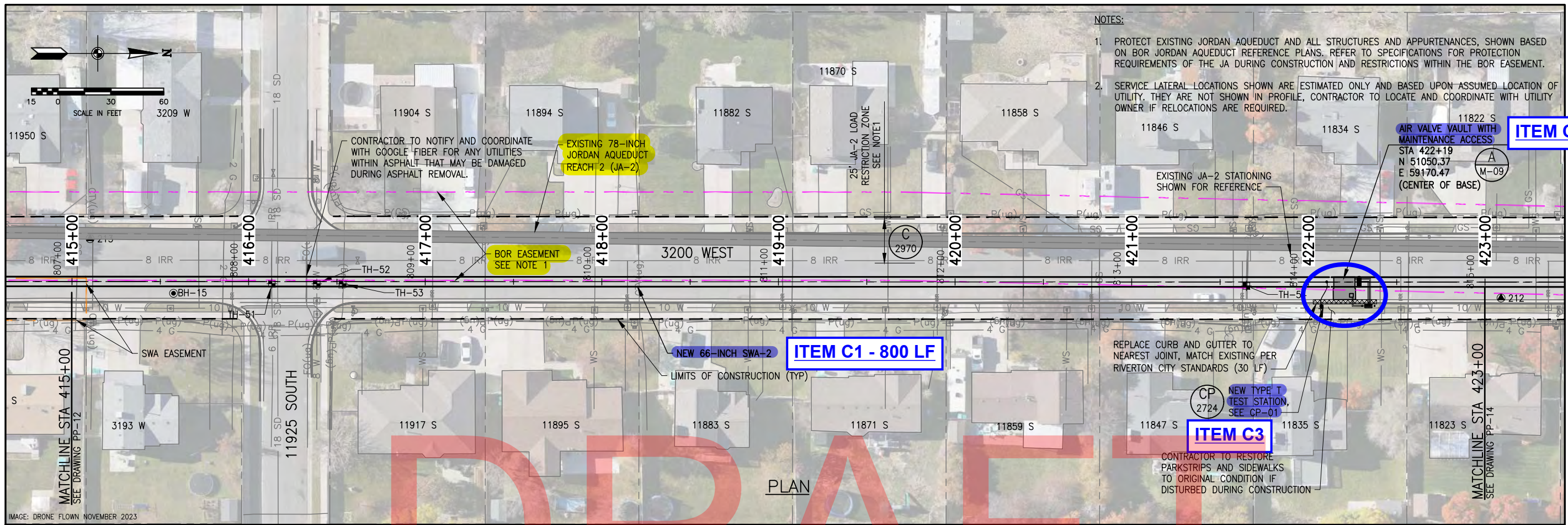
VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING



NO.	DATE	REVIEW	DESCRIPTION

DESIGN	REVIEW
DESIGN: L. MINCK	CHECKED: T. OLSEN
DRAWN: J. BLACK	APPROVED: J. LUETTINGER

DATE: JANUARY 2025	PROJECT NUMBER: 010-23-02
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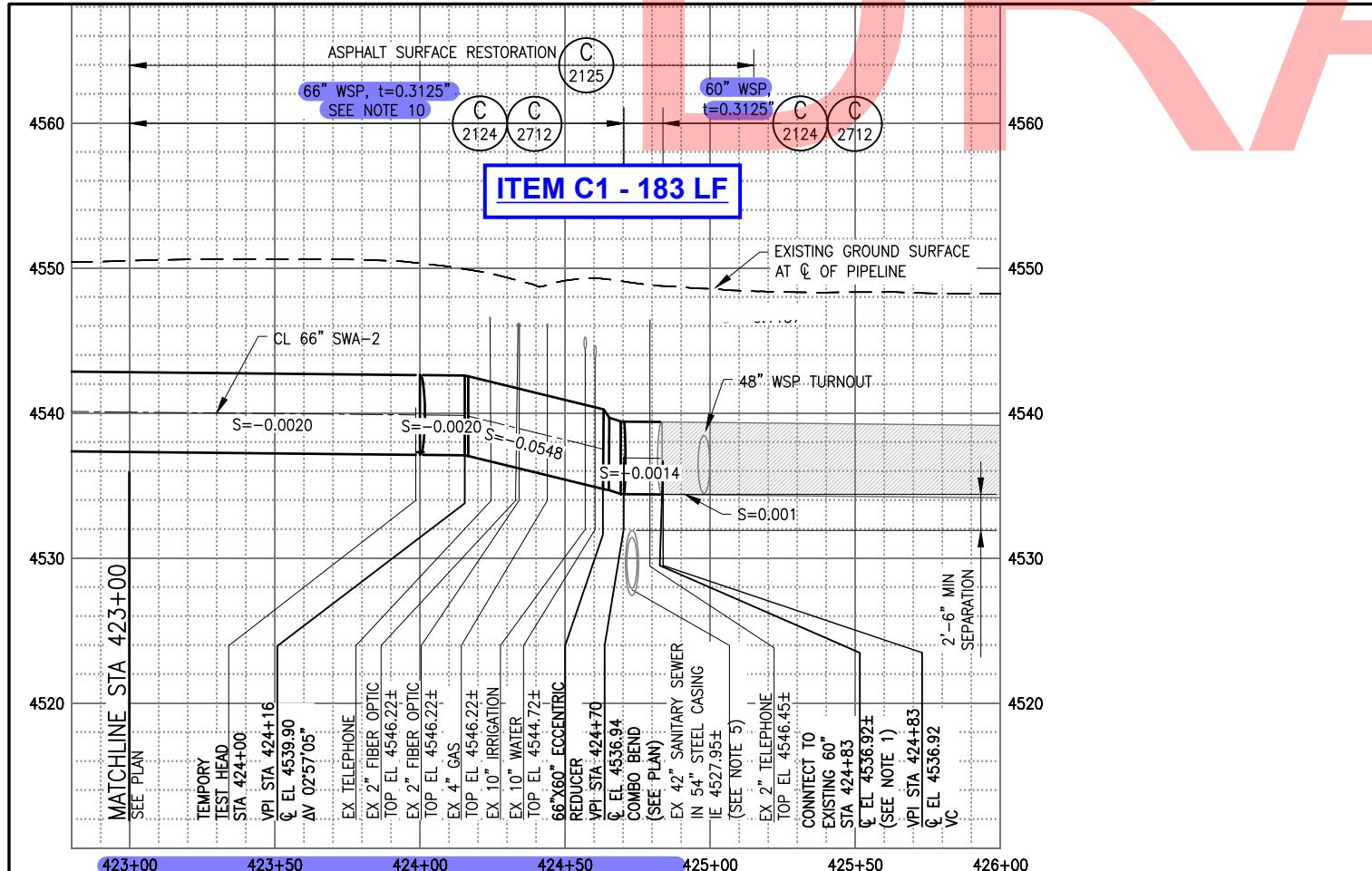
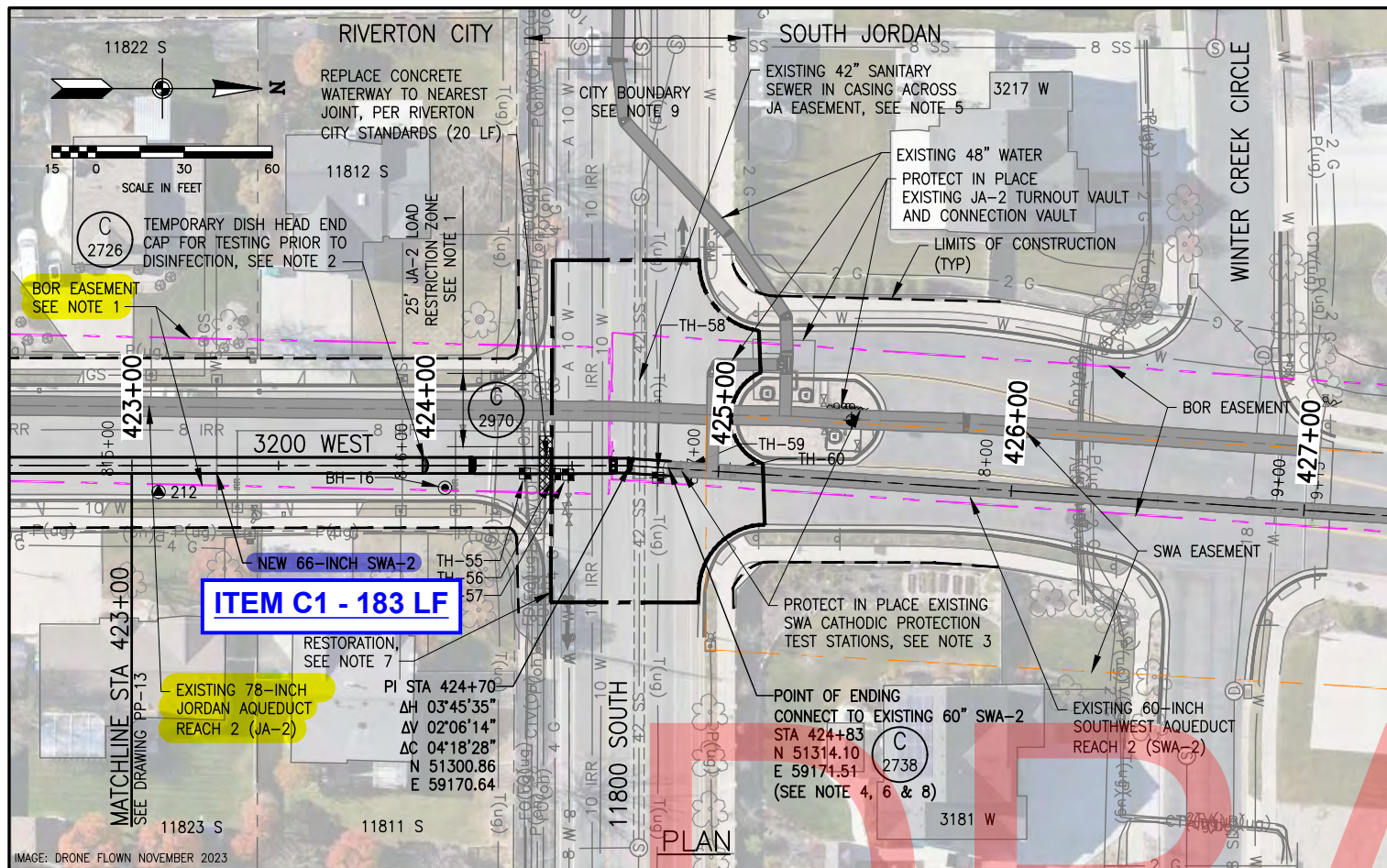


NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT	DESIGN L. MINCK J. BLACK	REVIEW T. OLSEN J. LUETTINGER	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
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PROJECT NUMBER 010-23-02	DATE JANUARY 2025
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P:\Jordan Valley WCD\010-23-02 Southwest Aqueduct Reach 2 - 13400 S to 11800 S\2.0 Design Phase\2.9 Drawings\PP-13.dwg Plotted: 1/13/2025 9:39 AM By: Justin Hunter



NOTES:

1. PROTECT EXISTING JORDAN AQUEDUCT AND ALL STRUCTURES AND APPURTENANCES, SHOWN BASED ON BOR JORDAN AQUEDUCT REFERENCE PLANS. REFER TO SPECIFICATIONS FOR PROTECTION REQUIREMENTS OF THE JA DURING CONSTRUCTION AND RESTRICTIONS WITHIN THE BOR EASEMENT.
2. TEMPORARY DISH HEAD TO BE REMOVED FOR PERMANENT CONNECTION BETWEEN NEW AND EXISTING PIPES, CONNECTION TO BE MADE WITH BUTTSTRAP JOINT.
3. EXISTING TEST STATION AND CONDUITS TO BE REPLACED IF DAMAGED BY CONTRACTOR. COORDINATE WITH ENGINEER TO DETERMINE TEST STATION TYPE AND REPAIR PROCEDURE.
4. CONTRACTOR TO POTHOLE AND LOCATE EXISTING SWA-2 PRIOR TO FABRICATING CONNECTION FITTINGS.
5. 54" SEWER CASING (JORDAN BASIN IMPROVEMENT DISTRICT) IS BACKFILLED WITH CLSM UP TO THE SPRINGLINE OF THE JORDAN AQUEDUCT WITHIN THE BOR EASEMENT.
6. CONNECTION WITH EXISTING PIPE TO OCCUR AFTER HYDROSTATIC TESTING AND DISINFECTION OF SWA-2. CONTRACTOR TO COORDINATE DRAINING OF EXISTING SWA WITH JWCD, REMOVE EXISTING DISH HEAD AND MAKE FINAL CONNECTION WITH BUTTSTRAP.
7. RESTORATION OF 11800 SOUTH INTERSECTION TO INCLUDE ENTIRE WIDTH OF 11800 SOUTH FROM LIP OF CURB AND GUTTER TO LIP OF CURB AND GUTTER FOR THE LIMITS OF EXTENTS SHOWN.
8. CONTRACTOR TO MAKE REPAIRS TO COATINGS AND LININGS OF EXISTING SWA-2 AT CONNECTION. THE EXISTING PIPE COATING WAS DAMAGED DURING PREVIOUS EXCAVATIONS AND IS TO BE REPAIRED WITH REPAIR KIT. EXISTING COATING IS POLYURETHANE.
9. CENTERLINE OF 11800 SOUTH REPRESENTS THE BOUNDARY BETWEEN RIVERTON CITY AND SOUTH JORDAN CITY. COORDINATE PERMITTING CONSTRUCTION WORK, AND SURFACE RESTORATION WITH APPROPRIATE CITY AS REQ'D.
10. SERVICE LATERAL LOCATIONS SHOWN ARE ESTIMATED ONLY AND BASED UPON ASSUMED LOCATION OF UTILITY. THEY ARE NOT SHOWN IN PROFILE, CONTRACTOR TO LOCATE AND COORDINATE WITH UTILITY OWNER IF RELOCATIONS ARE REQUIRED.



NO.	DATE	REV. BY	DESCRIPTION

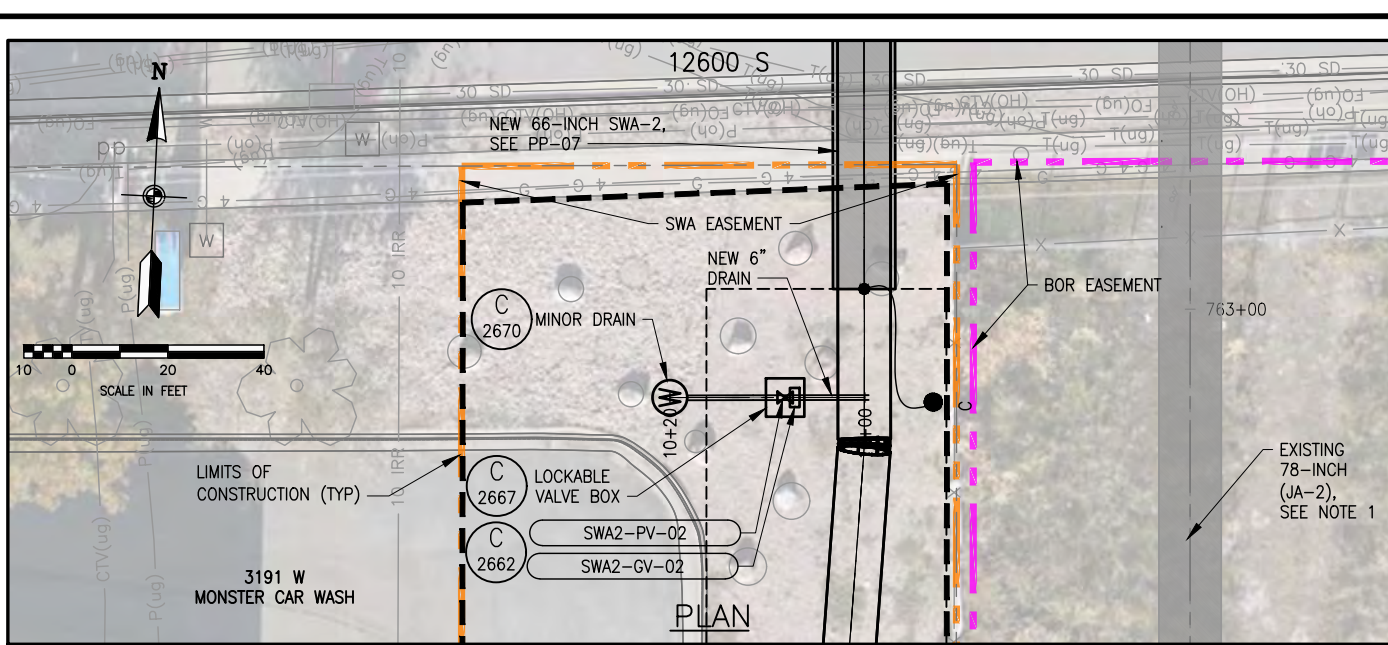
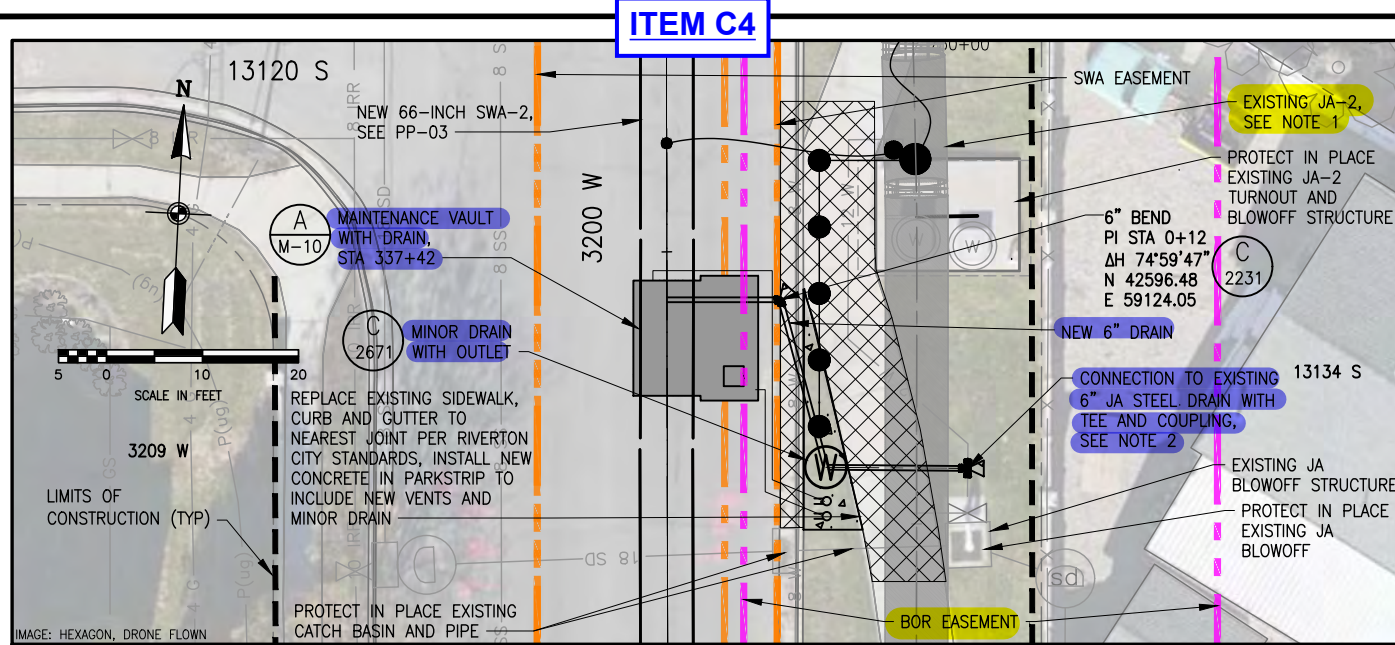
VERIFY SCALE
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DESIGN
 DESIGN L. MINCK
 DRAWN J. BLACK

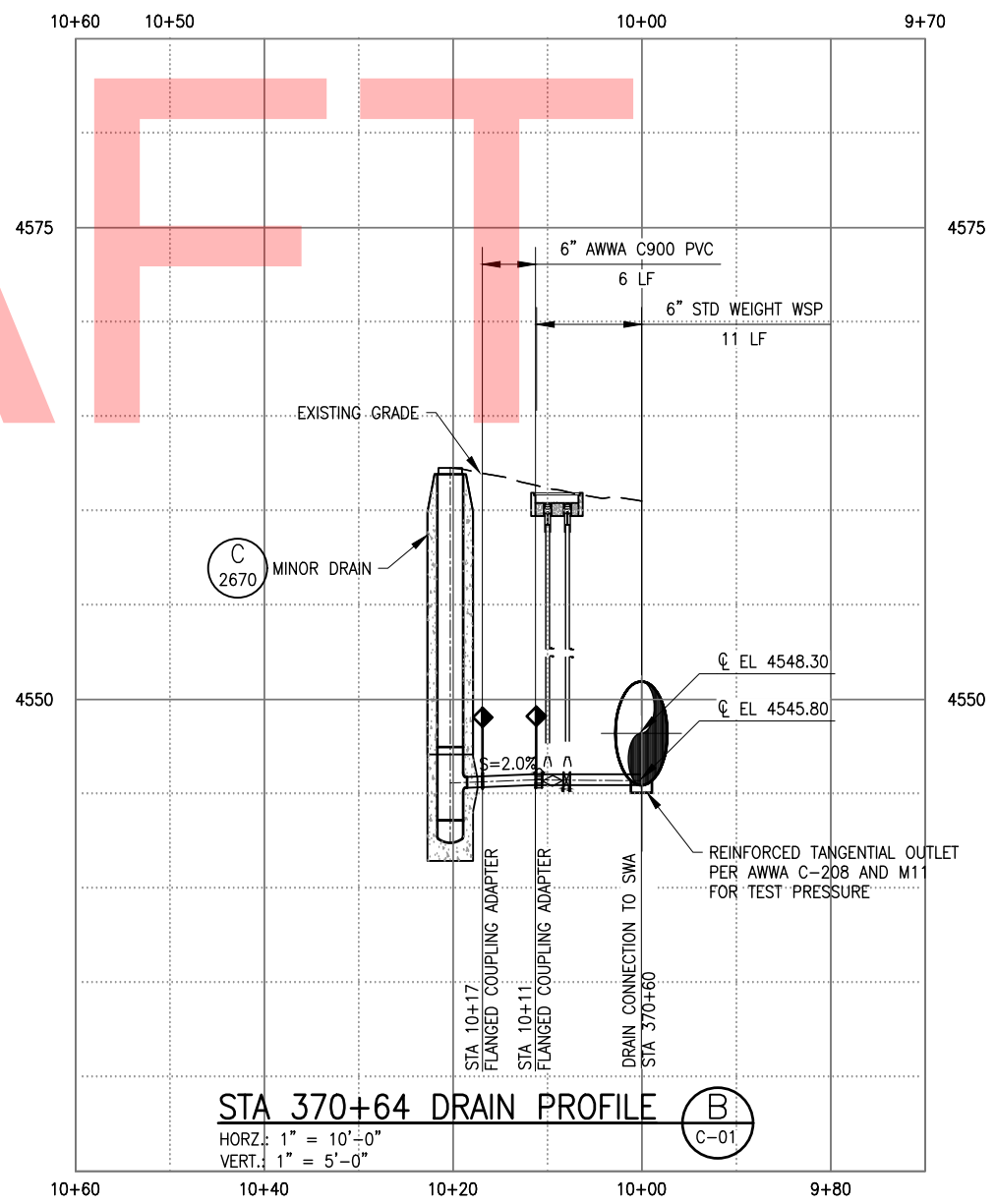
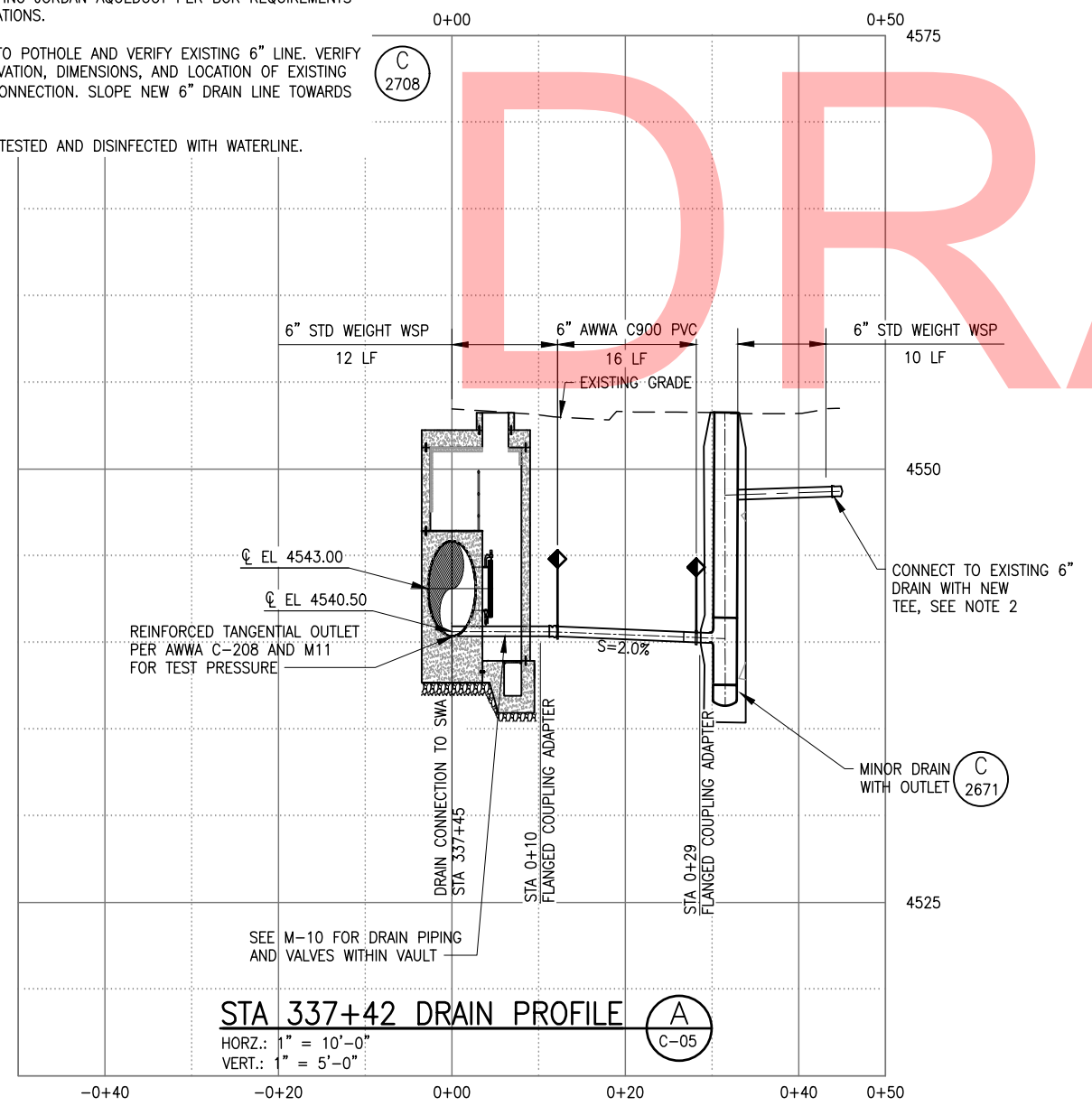
REVIEW
 CHECKED T. OLSEN
 APPROVED J. LUETTINGER

JORDAN VALLEY WATER CONSERVANCY DISTRICT
 RIVERTON AND SOUTH JORDAN, UT
SOUTHWEST AQUEDUCT REACH 2
 PLAN & PROFILE - 14
 DATE: JANUARY 2025
 PROJECT NUMBER: 010-23-02

P:\JORDAN VALLEY WCD\010-23-02 SOUTHWEST AQUEDUCT REACH 2 - 13400 S TO 11800 S\2.0 DESIGN PHASE\2.9 DRAWINGS\SH1\PP-14.dwg Plotted: 1/10/2025 2:53 PM By: Jeremy Black



- NOTES:**
1. PROTECT EXISTING JORDAN AQUEDUCT PER BOR REQUIREMENTS AND SPECIFICATIONS.
 2. CONTRACTOR TO POTHOLE AND VERIFY EXISTING 6" LINE. VERIFY MATERIAL, ELEVATION, DIMENSIONS, AND LOCATION OF EXISTING UTILITY FOR CONNECTION. SLOPE NEW 6" DRAIN LINE TOWARDS MINOR DRAIN.
 3. DRAIN TO BE TESTED AND DISINFECTED WITH WATERLINE.

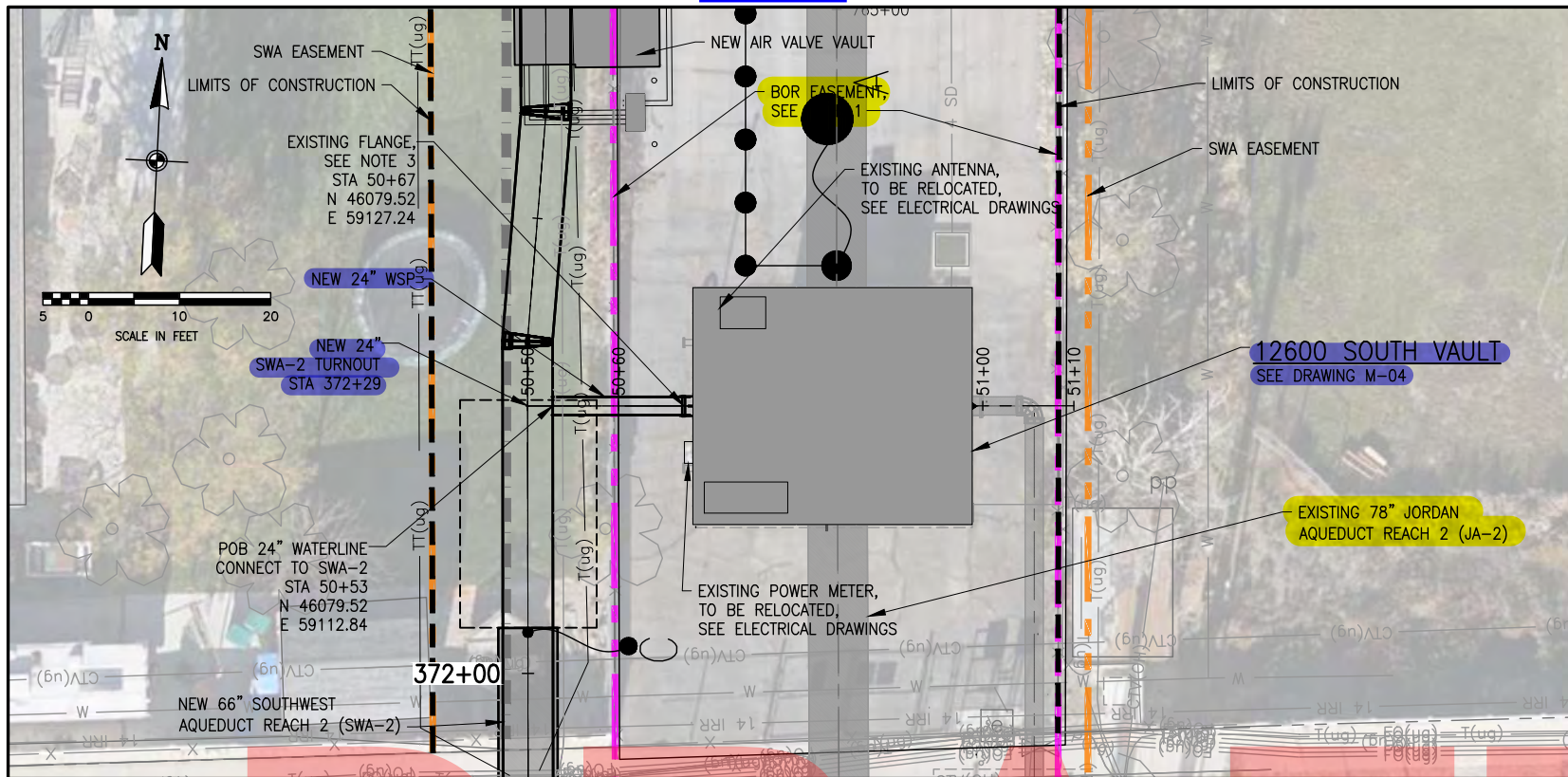


NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT	DESIGN L. MINCK	REVIEW T. OLSEN	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
SOUTHWEST AQUEDUCT REACH 2		APPROVED J. LUETTINGER	
DRAWN J. BLACK		CHECKED T. OLSEN	

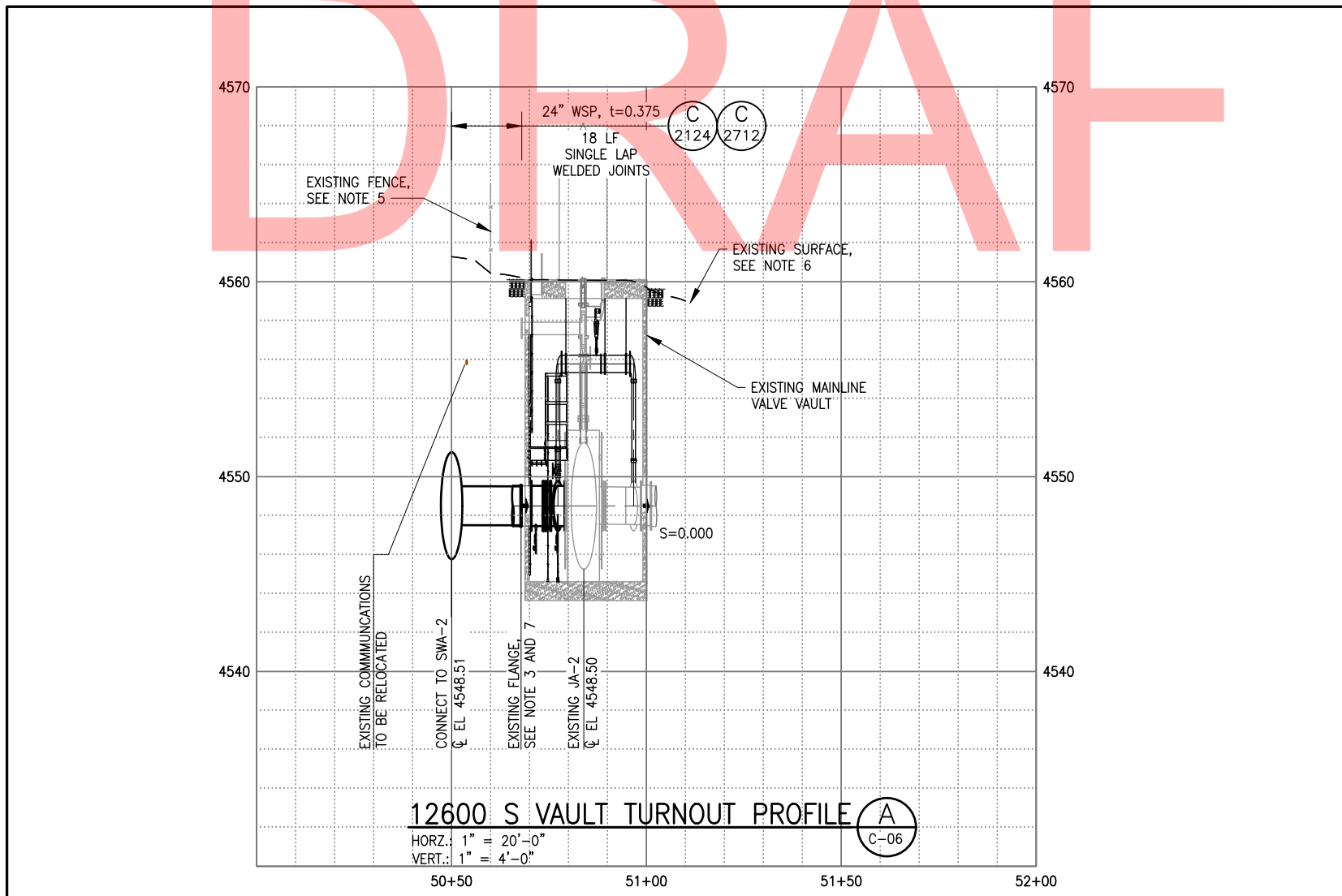
CIVIL	DATE JANUARY 2025	PROJECT NUMBER 010-23-02
DRAWING NO. C-05		
SHEET 34 OF 99		

ITEM C5



NOTES:

1. PROTECT EXISTING JORDAN AQUEDUCT AND ALL STRUCTURES AND APPURTENANCES, REFER TO SPECIFICATIONS FOR PROTECTION REQUIREMENTS DURING CONSTRUCTION AND RESTRICTIONS WITHIN THE BOR EASEMENT.
2. EXISTING JORDAN AQUEDUCT TO REMAIN IN SERVICE DURING PIPELINE INSTALLATION, SEE SPECIFICATIONS FOR SHUTDOWN REQUIREMENTS FOR CONNECTION TO 12600 SOUTH VAULT PIPING.
3. REMOVE EXISTING 24" BURIED FLANGE AND SPOOL THROUGH VAULT WALL AND INSTALL NEW 24" WSP THROUGH WALL, SEE M-04. SALVAGE SPOOL TO OWNER.
4. DISINFECTION AND TESTING OF 24" WATERLINE TO OCCUR WITH DISINFECTION AND TESTING OF SWA-2.
5. EXISTING FENCE TO BE REMOVED AND REPLACED FOR CONSTRUCTION, SEE SPECIFICATION SECTION 01 71 50 FOR WORK AND RESTORATION REQUIREMENTS OF PRIVATE PROPERTY.
6. RESTORE JWCD SITE TO ORIGINAL CONDITIONS.



REVISIONS			
NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT
RIVERTON AND SOUTH JORDAN, UT

SOUTHWEST AQUEDUCT REACH 2

DESIGN: L. MINCK
DRAWN: J. BLACK

REVIEW: T. OLSEN
CHECKED: T. OLSEN
APPROVED: J. LUETTINGER

VERIFY SCALE: 1" = 10'-0"
BAR IS ONE INCH ON ORIGINAL DRAWING

CIVIL

**12600 SOUTH VAULT
PLAN AND PROFILE**

DATE: JANUARY 2025
PROJECT NUMBER: 010-23-02

CATHODIC PROTECTION GENERAL NOTES

TEST STATIONS:

- USE POST MOUNT STYLE UNLESS OTHERWISE SPECIFIED.
- MARK POST MOUNT STYLE STATIONS WITH UTILITY APPROVED LABEL MARKER ON POST, SEE SPECIFICATIONS.
- PROVIDE WIRE LOOP AT BASE OF TEST STATION AND AT PIPE CONNECTIONS TO MINIMIZE SETTLEMENT STRESSES ON WIRE.
- USE STANDARD COLOR CODE AS SHOWN ON DETAILS AND AS FOLLOWS:
 WHITE - DISTRICT PIPELINE
 GREEN - UNPROTECTED PIPELINE
 BLUE - INSULATION
 ORANGE - CASING
 RED - FOREIGN/GAS CROSSING
 YELLOW - REFERENCE ELECTRODE
 BLACK - ANODES
- ALL TEST STATION WIRES TO BE INSTALLED SPLICE FREE.
- IN UNDEVELOPED OR CULTIVATED AREAS, BURY WIRES A MINIMUM OF 30-INCHES OR PLACE IN RIGID CONDUIT, SEE OFFSET TEST STATION DETAIL FOR CONDUIT REQUIREMENTS.
- ALL TEST WIRE CONNECTIONS TO PIPE SHALL BE THERMITE WELDED CONNECTIONS, INDIVIDUAL WIRES SHALL BE CONNECTED TO PIPE WITH A MINIMUM OF 6-INCHES SEPARATION.
- QUANTITY OF TERMINALS AND WIRING CONNECTIONS VARIES, SEE APPLICABLE TEST STATION TYPE.
- ALL WIRES UNDER ROADWAY MUST BE PROTECTED BY PVC COATED STEEL CONDUIT AS SHOWN IN DETAIL, SEAL ENDS OF PIPE DUCT COMPOUND OR URETHANE FOAM, PROVIDE 2" CONDUIT FOR WIRES ONLY, DO NOT CONNECT ROADWAY CONDUIT TO TEST STATION CONDUIT.
- CONFIRM LOCATION OF TEST STATIONS WITH OWNER AND ENGINEER IN THE FIELD PRIOR TO INSTALLATION. TEST STATIONS PLACED IN UNAPPROVED LOCATIONS WILL BE MOVED AT THE CONTRACTOR'S EXPENSE.



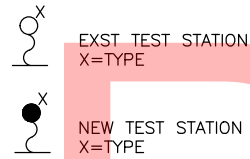
CASED CROSSINGS

- ALL CASED CROSSINGS WITH METALLIC CASINGS SHALL BE TESTED FOR ELECTRICAL ISOLATION BETWEEN THE CARRIER PIPE AND CASING BY CATHODIC PROTECTION SPECIALIST.
- ISOLATION TESTING SHALL BE CONDUCTED BEFORE AND AFTER BACKFILLING CASING.
- CATHODIC PROTECTION SPECIALIST TO PERFORM TEST USING ENGINEER APPROVED TEST PROCEDURE.
- ELECTRICAL CONTACTS BETWEEN THE PIPE AND CASING SHALL BE REMOVED BY THE CONTRACTOR.

ELECTRICAL ISOLATION:

- PROVIDE INSULATING JOINTS IN PIPELINE WHERE INDICATED ON THE DRAWINGS.
- TEST ALL INSULATING JOINTS FOR ELECTRICAL ISOLATION BEFORE PIPE IS BACKFILLED AS SPECIFIED.
- ALL MISCELLANEOUS PIPING AND ELECTRICAL CONDUITS TO BE ELECTRICALLY ISOLATED FROM PIPES.
- MAINTAIN AND VERIFY ELECTRICAL ISOLATION BETWEEN PIPING AND STEEL VAULT REINFORCEMENT.

PIPE LINE PLAN AND PROFILE TEST STATION LEGEND



ELECTRICAL CONTINUITY

- ALL BURIED OR VAULT JOINTS SHALL BE BONDED FOR ELECTRICAL CONTINUITY.
- PROVIDE TWO BONDS, MINIMUM, ON EACH JOINT UNLESS SPECIFIED OTHERWISE FOR PIPE DIAMETER. SEE SPECIFICATIONS.
- FLEXIBLE COUPLINGS, FLANGE COUPLING ADAPTERS, OR DEPEND-O-LOC JOINTS SHALL BE BONDED SIMILAR TO FLEXIBLE JOINT.
- BURIED OR VAULT FLANGE JOINTS SHALL BE BONDED.

TEST STATION SCHEDULE

PIPE	STATION	STYLE	TYPE	OFFSET	COMMENTS	SHEET
78" JA-2	645+02	POST	A	EAST 20'	4 EACH 32 LB MAGNESIUM ANODES, LOCATE TS POST NE CORNER OF EXISTING JA-2 14600 S TURNOUT STRUCTURE.	CP-02
66" SWA-2	317+18	POST	A	EAST 20'	4 EACH 32 LB MAGNESIUM ANODES, LOCATE TS POST NE CORNER OF EXISTING SWA-2 13400 S TURNOUT STRUCTURE.	CP-02
66" SWA-2	319+40	POST	T	EAST 30'	LOCATE TS POST NEAR NW CORNER OF EXISTING JA-2 TURNOUT STRUCTURE, ADJACENT TO EXISTING TEST STATIONS	PP-01
66" SWA-2	331+85	POST	T	EAST 40'	LOCATE TS POST ON NORTH SIDE OF EXISTING JA-2 CATHODIC PROTECTION FACILITY CONCRETE PAD	PP-02
66" SWA-2	337+60	POST	T	EAST 30'	LOCATE TS POST ON NORTH SIDE OF EXISTING JA-2 TURNOUT STRUCTURE, ADJACENT TO EXISTING TEST STATION	PP-03
78" JA-2	729+80	POST	A	EAST 5'	4 EACH 32 LB MAGNESIUM ANODES, LOCATE TS POST NEAR NE CORNER OF EXISTING JA-2 TURNOUT STRUCTURE. IN SIMILAR LOCATION TO EXISTING TS.	PP-03
66" SWA-2	345+20	POST	T	EAST 30'	LOCATE TS POST ON NORTH SIDE OF EXISTING JA-2 TURNOUT STRUCTURE, ADJACENT TO EXISTING PIPELINE MARKER POST	PP-04
66" SWA-2	352+00	POST	T	EAST 30'	LOCATE TS POST WITHIN BOR EASEMENT, AGAINST FENCELINE	PP-05
66" SWA-2	365+70	POST	T	EAST 15'	LOCATE TS POST WITHIN SWA-2 EASEMENT, ADJACENT TO NEW VAULT AND VENT PAD	PP-06
66" SWA-2	370+75	POST	C	SOUTHEAST 20'	LOCATE TS POST WITHIN SWA-2 EASEMENT, NEAR FENCELINE	PP-07 & C-01
66" SWA-2	372+05	POST	C	EAST 25'	LOCATE TS POST ON JWCD PROPERTY NEAR WEST FENCELINE	PP-07 & C-01
78" JA-2	764+25	POST	A	WEST 10'	4 EACH 32 LB MAGNESIUM ANODES, LOCATE TS POST NEAR SW CORNER OF EXISTING JA-2 TURNOUT STRUCTURE. IN SIMILAR LOCATION TO EXISTING TS.	PP-07 & C-01
66" SWA-2	384+60	POST	T	EAST 15'	LOCATE TS POST AT FENCELINE CORNER BEHIND SIDEWALK	PP-09
66" SWA-2	397+75	POST	T	WEST 30'	LOCATE TS POST WITHIN SWA-2 EASEMENT, AT FENCELINE CORNER BEHIND SIDEWALK	PP-10
66" SWA-2	406+10	POST	C	SOUTHWEST 45'	LOCATE TS POST IN PARK STRIP, BEHIND STOP SIGN	PP-11 & C-02
78" JA-2	798+55	POST	T	SOUTHWEST 80'	LOCATE TS POST IN PARK STRIP, BEHIND STOP SIGN	PP-11 & C-02
66" SWA-2	406+65	POST	C	SOUTHWEST 100'	LOCATE TS POST IN PARK STRIP, BEHIND STOP SIGN	PP-11 & C-02
66" SWA-2	411+65	POST	T	EAST 20'	LOCATE TS POST WITHIN SWA-2 EASEMENT, ADJACENT TO EXISTING LIGHT POLE IN PARK STRIP	PP-12
66" SWA-2	422+10	POST	T	EAST 20'	LOCATE TS POST ADJACENT TO NEW VENT PAD IN PARK STRIP	PP-13



NO.	DATE	REV. BY	DESCRIPTION

SOUTHWEST AQUEDUCT REACH 2
 RIVERTON AND SOUTH JORDAN, UT

DESIGN: R. EGBERT
 DRAWN: J. BLACK

REVIEW: C. NELSON
 CHECKED: C. NELSON
 APPROVED: J. LUETTINGER

VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING

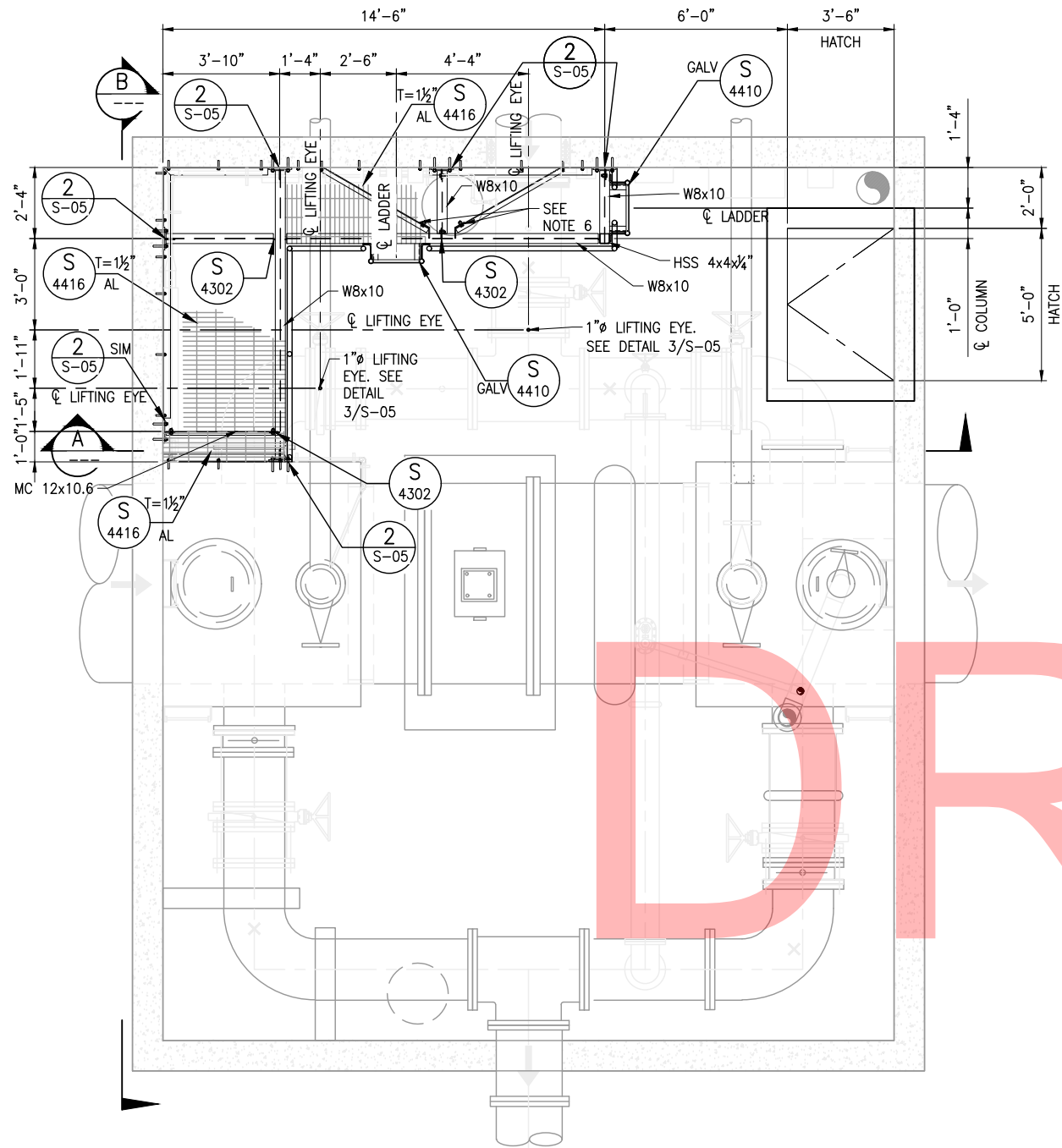
CATHODIC PROTECTION

CATHODIC SCHEDULE GENERAL NOTES AND DETAILS - 1

PROJECT NUMBER: 010-23-02
 DATE: JANUARY 2025

P:\Jordan Valley WCD\010-23-02 Southwest Aqueduct Reach 2 - 13400 S to 11800 S\2.0 Design Phase\2.9 Drawings\sheet\0102302_CP-01.dwg Plotted: 1/13/2025 9:09 AM By: Justin Hunter

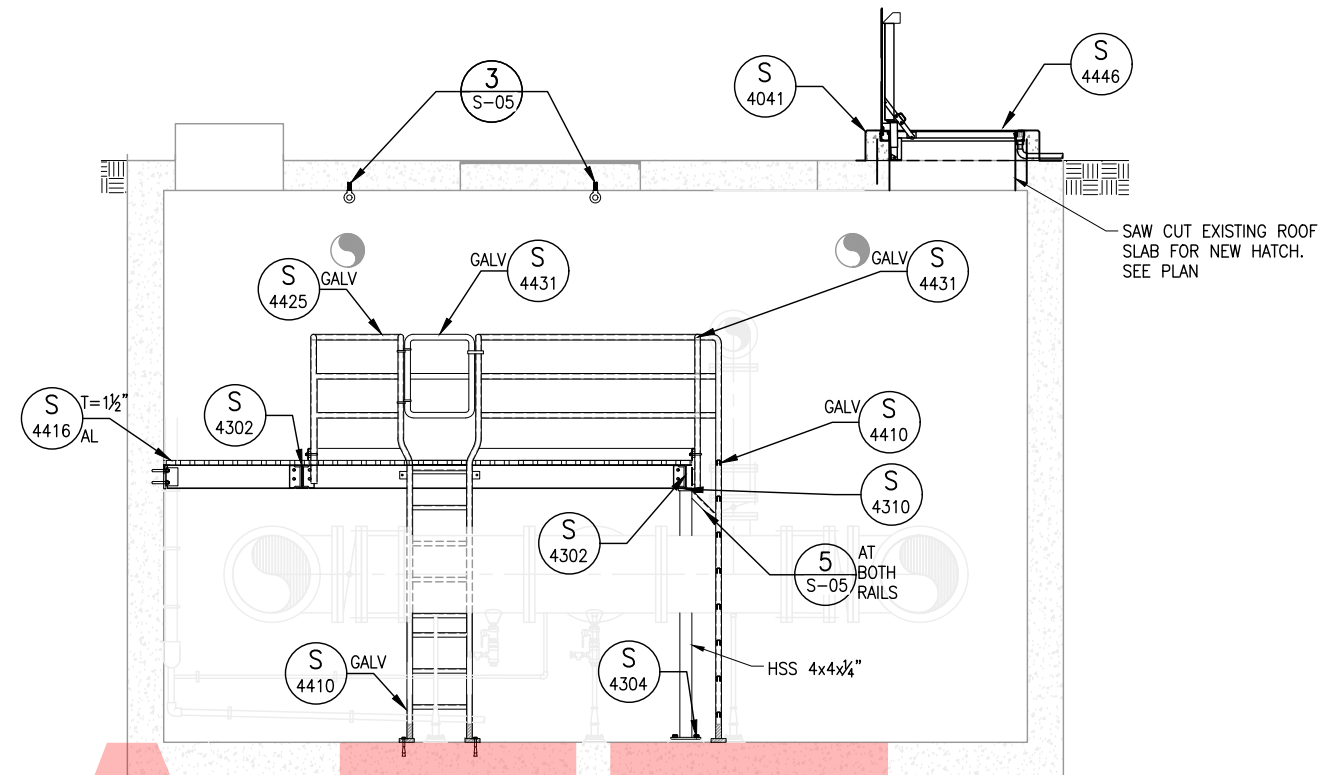
ITEM C5



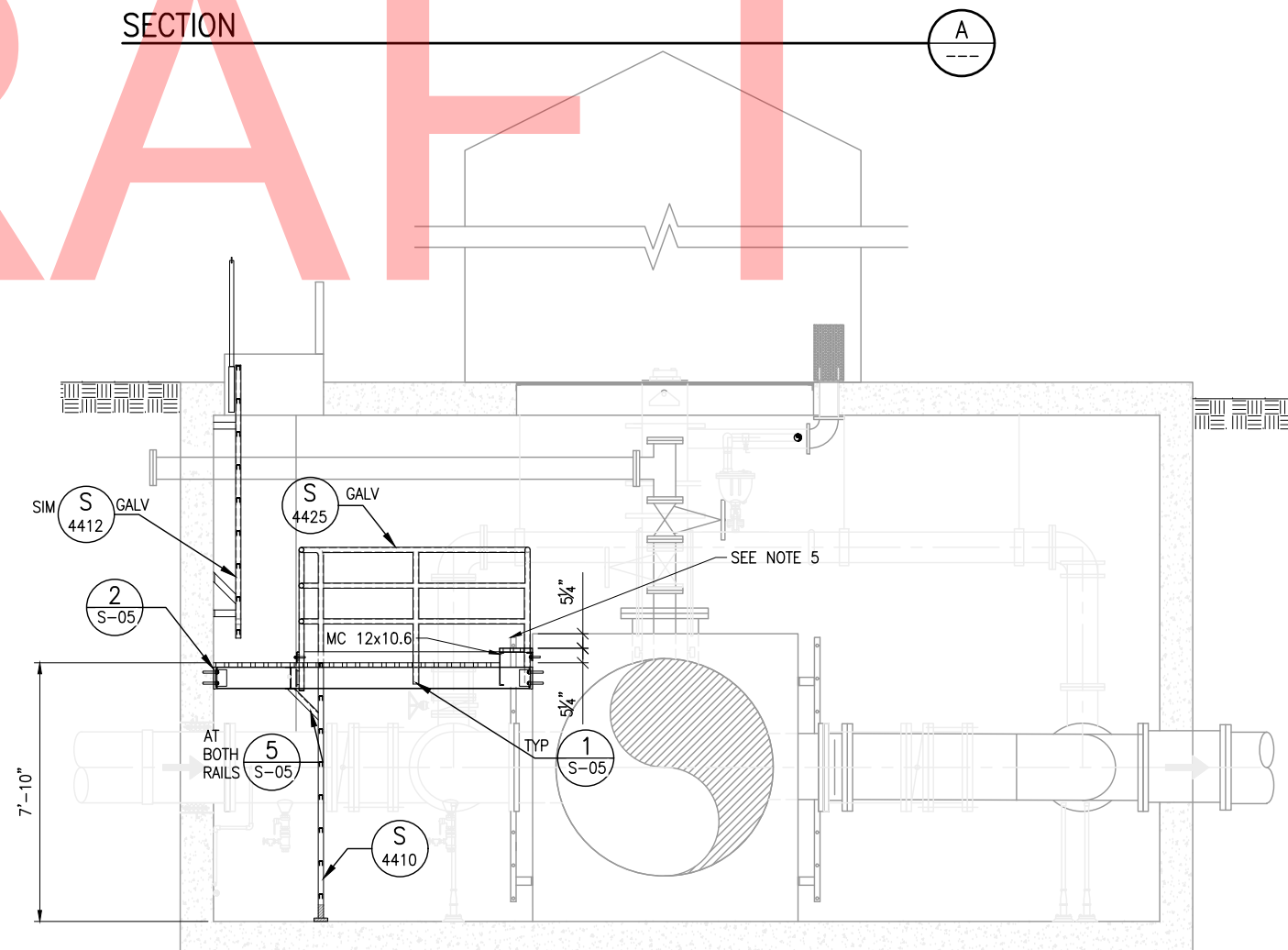
PLAN VIEW
SCALE: 3/8"=1'-0"

NOTES:

- FOR GENERAL STRUCTURAL NOTES, REFER TO DRAWINGS GS-01.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE THE STRUCTURAL DRAWINGS WITH ALL OTHER CONTRACT DOCUMENTS. STRUCTURAL DRAWINGS DO NOT ATTEMPT TO SHOW ALL MECHANICAL AND ELECTRICAL PENETRATIONS AND ROUTINGS.
- UNLESS SPECIFICALLY NOTED OTHERWISE, MISCELLANEOUS METAL ITEMS WITHIN THIS STRUCTURE ARE TO BE GALVANIZED STEEL.
- NEW HATCH SHALL HAVE A CONCEALED RECESSED PADLOCK HASP.
- REMOVE AND SALVAGE EXISTING LADDER.
- DIAGONAL BRACING L2x2x1/4. SEE DETAIL 4/S-05



SECTION A-A



SECTION B-B



NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT RIVERTON AND SOUTH JORDAN, UT	DESIGN S. PUGH	CHECKED S. COHEN	REVIEW S. COHEN	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
SOUTHWEST AQUEDUCT REACH 2				
12600 SOUTH VAULT MODIFICATIONS				

DATE: JANUARY 2025	PROJECT NUMBER: 010-23-02
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DRAWING NO. S-01

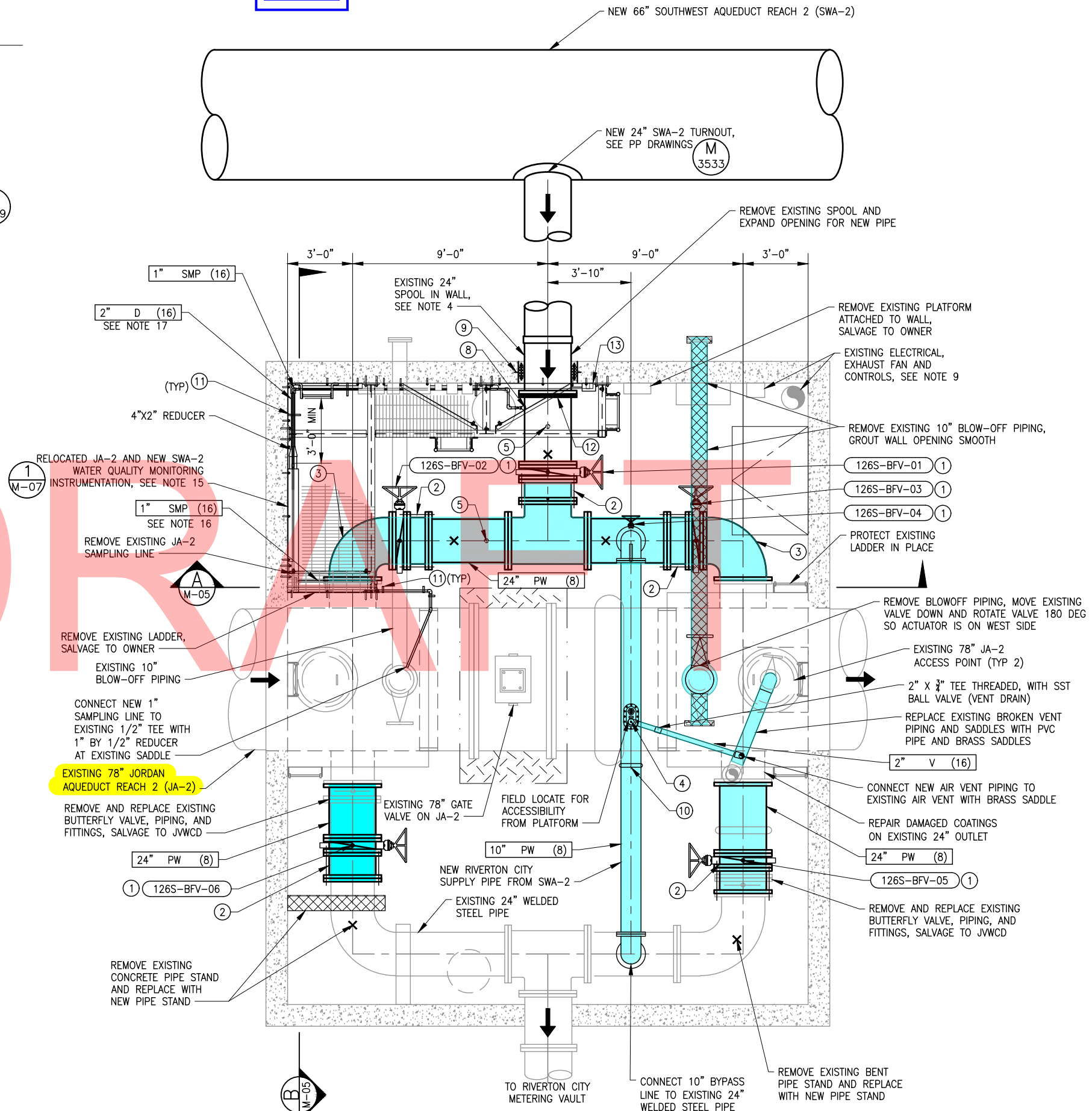
ITEM C5

MATERIAL SCHEDULE


- ① BUTTERFLY VALVE
- ② RESTRAINED DISMANTLING JOINT COUPLING
- ③ 24" SHORT RADIUS ELBOW
- ④ COMBINATION AIR VALVE, SEE AIR VALVE SCHEDULE (M 3146)
- ⑤ 2" DRAIN WITH BALL VALVE (M 3135)
- ⑥ PIPE HANGER, TYP (M 3353)
- ⑦ ✕ DENOTES ADJUSTABLE PIPE SUPPORT WITH U BOLT (M 3389)
- ⑧ 1" SAMPLING LINE CONNECTION (M 3167)
- ⑨ SLEEVED PIPE OPENING, TYPE 'A' (M 3307)
- ⑩ GROOVED MECHANICAL COUPLING
- ⑪ PIPE SUPPORT (M 3367)
- ⑫ INSULATING FLANGE (CP 2777)
- ⑬ DC BLOCKER, INSTALL PER (CP 2827)
- SHADED ITEMS, SEE NOTE 19

NOTES:

1. (XX-XX-XX) DENOTES EQUIPMENT TAG FOR MECHANICAL EQUIPMENT SCHEDULE, SEE DRAWING M-03.
2. PROVIDE MINIMUM OF 1'-0" CLEARANCE SPACE BETWEEN ALL FLANGES AND PIPE SUPPORTS, WALLS, FITTINGS, ETC. TO ALLOW UNRESTRICTED REMOVAL OF FLANGE BOLTS. NOTIFY ENGINEER OF POTENTIAL CONFLICTS TO ALLOW FOR FIELD ADJUSTMENT PRIOR TO FABRICATION.
3. COORDINATE ORIENTATION OF VALVE ACTUATORS PRIOR TO MANUFACTURING. ACTUATORS ORIENTED INCORRECTLY WILL BE ROTATED IN THE FIELD AT NO EXPENSE TO THE OWNER.
4. REMOVE EXISTING SPOOL AND BURIED WOODEN BULKHEAD. SALVAGE BULKHEAD TO OWNER. REMOVE SPOOL AND EXPAND OPENING, GRIND SMOOTH FOR INSTALLATION OF NEW PIPE AND PIPE OPENING FITTINGS. ENSURE VAULT METAL REINFORCEMENT IS NOT TOUCHING NEW PIPE.
5. EPOXY LINE ALL PIPE IN VAULT WITH SYSTEM NO. 1 AND COAT ALL EXPOSED PIPE AFTER INSTALLATION WITH SYSTEM NO. 4. COAT BURIED AND CONCRETE ENCASED STEEL PIPES IN ACCORDANCE WITH SPECIFICATIONS.
6. ALL PIPING, NUTS, BOLTS AND HARDWARE TO BE CARBON STEEL, ZINC PLATED AND FIELD COATED TO MATCH STEEL PIPE AFTER INSTALLATION, UNO.
7. ALL PIPING AND VALVES TO HAVE 150 PSI PRESSURE CLASS, BE NSF 61 CERTIFIED AND BE FULLY LINED AND COATED PER SPECIFICATIONS.
8. ALL STEEL SHALL BE STD WEIGHT WITH FITTING REINFORCEMENT PER AWWA M-11 MANUAL, FOR TEST PRESSURE.
9. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL RELOCATIONS.
10. REFER TO STRUCTURAL DRAWINGS FOR DETAILS RELATED TO MISCELLANEOUS METALS FABRICATION AND STRUCTURAL WORK.
11. EXISTING HATCH AND NEW LARGER HATCH TO BE USED FOR INSTALLATION OF NEW EQUIPMENT INTO THE EXISTING VAULT, SEE STRUCTURAL DRAWINGS FOR NEW HATCH, COORDINATE ALL SHOP DRAWINGS WITH HATCH OPENINGS.
12. BACKGROUND DRAWINGS DEPICTING EXISTING VAULT ARE BASED ON RECORD DRAWINGS. CONTRACTOR TO VERIFY ALL DIMENSIONS, CONFIGURATIONS, ORIENTATIONS AND ELEVATIONS PRIOR TO ORDERING EQUIPMENT AND COMMENCING WORK. NOTIFY ENGINEER OF ANY DISCREPANCIES OR UNDISCLOSED CONDITIONS BEFORE BEGINNING WORK.
13. CONTRACTOR TO REPAIR DAMAGE CAUSED BY CONSTRUCTION TO THE EXISTING LININGS AND COATINGS OF THE EXISTING PIPE AND APPURTENANCES PER SPECIFICATIONS DIVISION 09.
14. ALL ITEMS NOT IDENTIFIED FOR REMOVAL ARE TO BE PROTECTED IN PLACE.
15. EXISTING JA-2 WATER QUALITY MONITORING INSTRUMENTATION TO BE RELOCATED TO MEZZANINE LEVEL WITH NEW SWA-2 INSTRUMENTATION. NOTIFY ENGINEER OF CONFLICTS IMMEDIATELY.
16. EXISTING JA-2 SAMPLING LINE TO BE REMOVED AND REPLACED WITH NEW 1" SAMPLING LINE, SECURE NEW SAMPLING LINE TO MEZZANINE LEVEL GRATING WITH SST BANDS AND ROUTE TO RELOCATED INSTRUMENTATION ON MEZZANINE LEVEL.
17. DRAIN PIPING FROM WATER QUALITY MONITORING INSTRUMENTATION TO BE ROUTED TO EXISTING SUMP ON WEST SIDE OF VAULT. ROUTE BELOW ALL EXISTING WALL MOUNTED ELECTRICAL EQUIPMENT, SLOPE AT 2% MIN AND NOTIFY ENGINEER OF ANY CONFLICTS IMMEDIATELY.
18. SALVAGE BLIND FLANGES, EXISTING LADDERS AND OTHER EQUIPMENT TO JWCD.
19. ITEMS WITH SHADING ARE PART OF SCHEDULE A WITH INSTALLATION RESTRICTED BY JA SHUTDOWN REQUIREMENTS AND THESE ITEMS ARE TO BE INSTALLED BASED UPON SPECIFICATION SECTION 01 14 40 - CONSTRUCTION AND SCHEDULE RESTRAINTS WITH A SINGLE SHUTDOWN OF THE JA.



PLAN
SCALE: 3/8" = 1'-0"



BOWEN COLLINS & ASSOCIATES

<p>JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT</p>	<p>DESIGN: L. MINICK DRAWN: J. BLACK</p>
<p>MECHANICAL 12600 SOUTH JA-2 MAINLINE VALVE VAULT MODIFICATIONS - 1</p>	<p>REVIEW: C. NELSON CHECKED: J. LUTTINGER APPROVED: J. LUTTINGER</p>
<p>DATE: JANUARY 2025 PROJECT NUMBER: 010-23-02</p>	<p>VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING</p>
<p>DRAWING NO. M-04</p>	<p>NO. DATE REV. BY DESCRIPTION</p>
<p>SHEET 73 OF 99</p>	<p>REVISIONS</p>

NO.	DATE	REV. BY	DESCRIPTION

VERIFY SCALE
 BAR IS ONE INCH ON ORIGINAL DRAWING

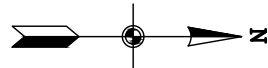
REVIEW
 CHECKED: C. NELSON
 APPROVED: J. LUETTINGER

DESIGN
 DESIGN: L. MINKO
 DRAWN: J. BLACK

MECHANICAL
 12600 SOUTH
 JA-2 MAINLINE VALVE
 VAULT MODIFICATION - 2

DATE: JANUARY 2025
 PROJECT NUMBER: 010-23-02

DRAWING NO.
M-05
 SHEET 74 OF 99



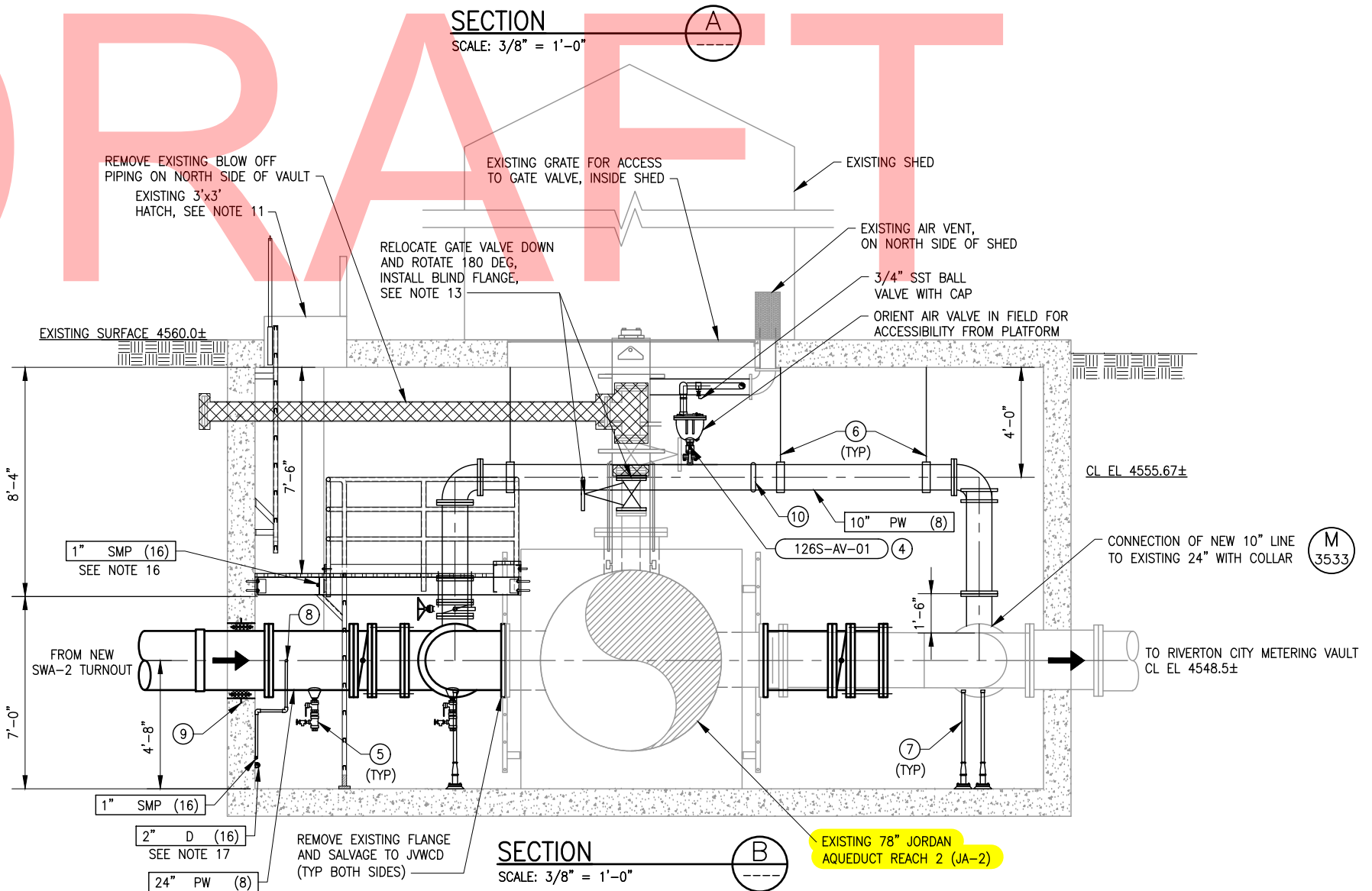
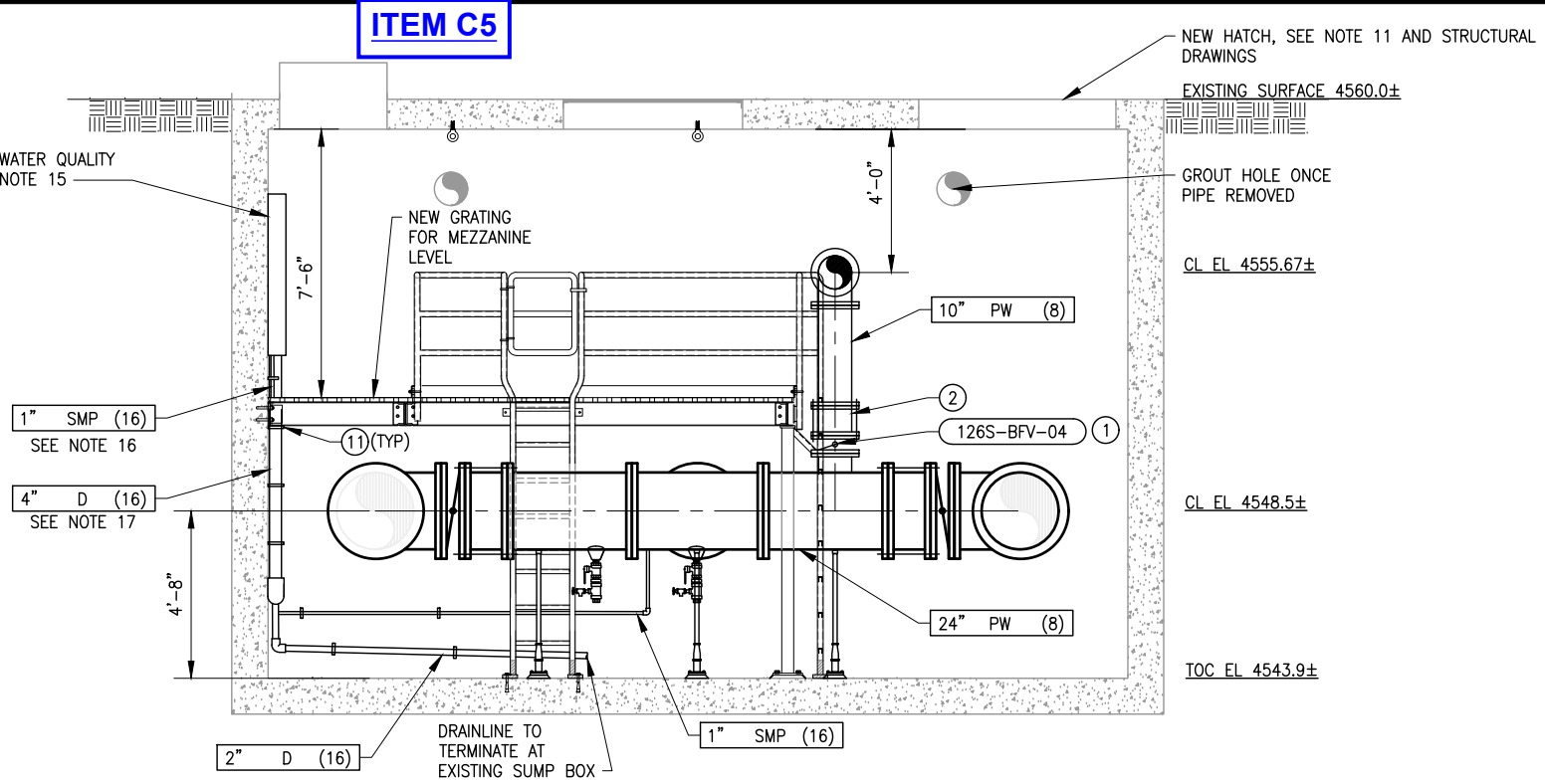
MATERIAL SCHEDULE

- ① BUTTERFLY VALVE
- ② RESTRAINED DISMANTLING JOINT COUPLING
- ③ 24" SHORT RADIUS ELBOW
- ④ COMBINATION AIR VALVE, SEE AIR VALVE SCHEDULE (M 3146)
- ⑤ 2" DRAIN WITH BALL VALVE (M 3135)
- ⑥ PIPE HANGER, TYP (M 3353)
- ⑦ X DENOTES ADJUSTABLE PIPE SUPPORT WITH U BOLT (M 3389)
- ⑧ 1" SAMPLING LINE CONNECTION (M 3167)
- ⑨ SLEEVED PIPE OPENING, TYPE 'A' (M 3307)
- ⑩ GROOVED MECHANICAL COUPLING
- ⑪ PIPE SUPPORT (M 3367)

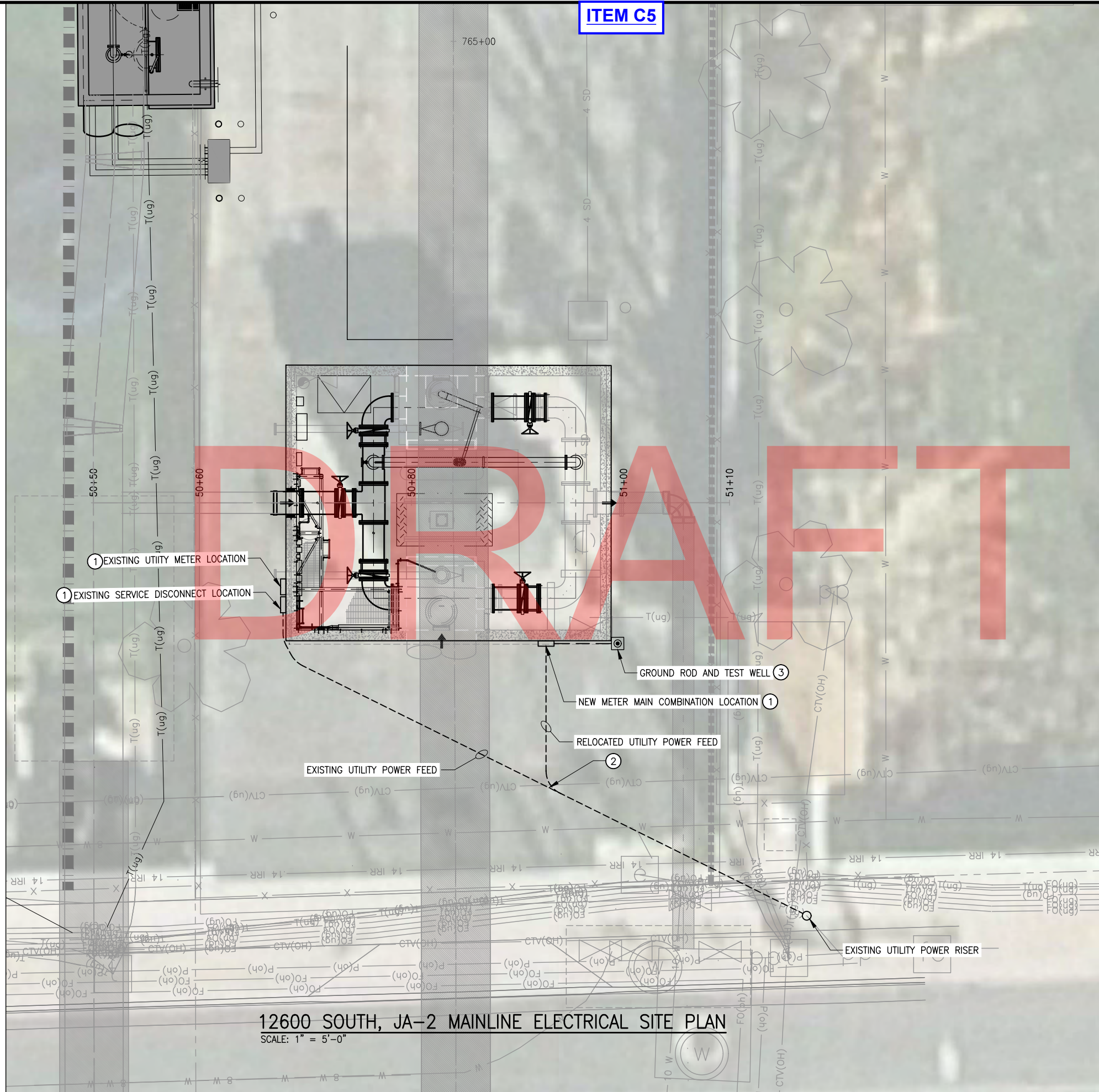
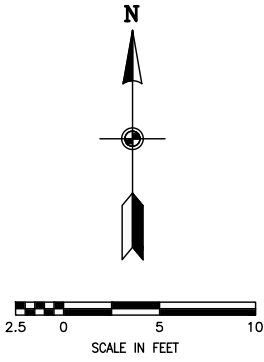
NOTES:

- XX-XX-XX DENOTES EQUIPMENT TAG FOR MECHANICAL EQUIPMENT SCHEDULE, SEE DRAWING M-03.
- PROVIDE MINIMUM OF 1'-0" CLEARANCE SPACE BETWEEN ALL FLANGES AND PIPE SUPPORTS, WALLS, FITTINGS, ETC. TO ALLOW UNRESTRICTED REMOVAL OF FLANGE BOLTS. NOTIFY ENGINEER OF POTENTIAL CONFLICTS TO ALLOW FOR FIELD ADJUSTMENT PRIOR TO FABRICATION.
- COORDINATE ORIENTATION OF VALVE ACTUATORS PRIOR TO MANUFACTURING. ACTUATORS ORIENTED INCORRECTLY WILL BE ROTATED IN THE FIELD AT NO EXPENSE TO THE OWNER.
- REMOVE EXISTING SPOOL AND BURIED WOODEN BULKHEAD. SALVAGE BULKHEAD TO OWNER. REMOVE SPOOL AND EXPAND OPENING, GRIND SMOOTH FOR INSTALLATION OF NEW PIPE AND PIPE OPENING FITTINGS. ENSURE VAULT METAL REINFORCEMENT IS NOT TOUCHING NEW PIPE.
- EPOXY LINE ALL PIPE IN VAULT WITH SYSTEM NO. 1 AND COAT ALL EXPOSED PIPE AFTER INSTALLATION WITH SYSTEM NO. 4. COAT BURIED AND CONCRETE ENCASED STEEL PIPES IN ACCORDANCE WITH SPECIFICATIONS.
- ALL PIPING, NUTS, BOLTS AND HARDWARE TO BE CARBON STEEL, ZINC PLATED AND FIELD COATED TO MATCH STEEL PIPE AFTER INSTALLATION, UNLESS OTHERWISE NOTED.
- ALL PIPING AND VALVES TO HAVE 150 PSI PRESSURE CLASS, BE NSF 61 CERTIFIED AND BE FULLY LINED AND COATED PER SPECIFICATIONS.
- ALL STEEL SHALL BE STANDARD WEIGHT WITH FITTING REINFORCEMENT PER AWWA M-11 MANUAL, FOR TEST PRESSURE.
- REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL RELOCATIONS.
- REFER TO STRUCTURAL DRAWINGS FOR DETAILS RELATED TO MISCELLANEOUS METALS FABRICATION AND STRUCTURAL WORK.
- EXISTING HATCH AND NEW LARGER HATCH ON THE NORTH SIDE TO BE USED AS ACCESS LOCATION FOR INSTALLATION OF NEW EQUIPMENT INTO THE EXISTING VAULT, SEE STRUCTURAL DRAWINGS FOR NEW HATCH, COORDINATE ALL SHOP DRAWINGS WITH HATCH OPENINGS.
- BACKGROUND DRAWINGS DEPICTING EXISTING VAULT ARE BASED ON RECORD DRAWINGS. CONTRACTOR TO VERIFY ALL DIMENSIONS, CONFIGURATIONS, ORIENTATIONS AND ELEVATIONS PRIOR TO ORDERING EQUIPMENT AND COMMENCING WORK. NOTIFY ENGINEER OF ANY DISCREPANCIES OR UNDISCLOSED CONDITIONS BEFORE BEGINNING WORK.
- CONTRACTOR TO REPAIR DAMAGE CAUSED BY CONSTRUCTION TO THE EXISTING LININGS AND COATINGS OF THE EXISTING PIPE AND APPURTENANCES PER SPECIFICATIONS DIVISION 09.
- ALL ITEMS NOT IDENTIFIED FOR REMOVAL ARE TO BE PROTECTED IN PLACE.
- EXISTING JA-2 WATER QUALITY MONITORING INSTRUMENTATION TO BE RELOCATED TO MEZZANINE LEVEL WITH NEW SWA-2 INSTRUMENTATION.
- EXISTING JA-2 SAMPLING LINE TO BE REMOVED AND REPLACED WITH NEW 1" SAMPLING LINE, SECURE NEW SAMPLING LINE TO MEZZANINE LEVEL GRATING WITH SST BANDS AND ROUTE TO RELOCATED INSTRUMENTATION ON MEZZANINE LEVEL.
- DRAIN PIPING FROM WATER QUALITY MONITORING INSTRUMENTATION TO BE ROUTED TO EXISTING SUMP ON WEST SIDE OF VAULT. ROUTE BELOW ALL EXISTING WALL MOUNTED ELECTRICAL EQUIPMENT, SLOPE AT 2% MIN AND NOTIFY ENGINEER OF ANY CONFLICTS IMMEDIATELY.
- SALVAGE BLIND FLANGES, EXISTING LADDERS AND OTHER EQUIPMENT TO JWCD.

① M-07 RELOCATED JA-2 AND NEW SWA-2 WATER QUALITY MONITORING INSTRUMENTATION, SEE NOTE 15



DRAFT



12600 SOUTH, JA-2 MAINLINE ELECTRICAL SITE PLAN
 SCALE: 1" = 5'-0"

GENERAL NOTES:

A. CONTRACTOR TO COORDINATE SERVICE CONDUIT AND TRENCHING WITH ROCKY MOUNTAIN POWER.

KEY NOTES: #

1. REMOVE AND DISPOSE OF EXISTING METER, EXISTING SERVICE DISCONNECT, AND EXISTING MOUNTING RACK. RELOCATE UTILITY POWER FEED TO NEW METER MAIN COMBINATION LOCATION. PRESERVE AND PROTECT ANY GROUND ELECTRODE CONDUCTORS FOR RECONNECTION. FURNISH AND INSTALL NEW UNISTRUT RACK FOR NEW METER MAIN COMBINATION MOUNTING.
2. APPROXIMATE LOCATION OF SERVICE CONDUIT INTERCEPT, SEE ONE-LINE DIAGRAM ON E-06.
3. FURNISH AND INSTALL GROUND ROD AND TEST WELL. SEE SHEET E-06 FOR MORE INFORMATION.

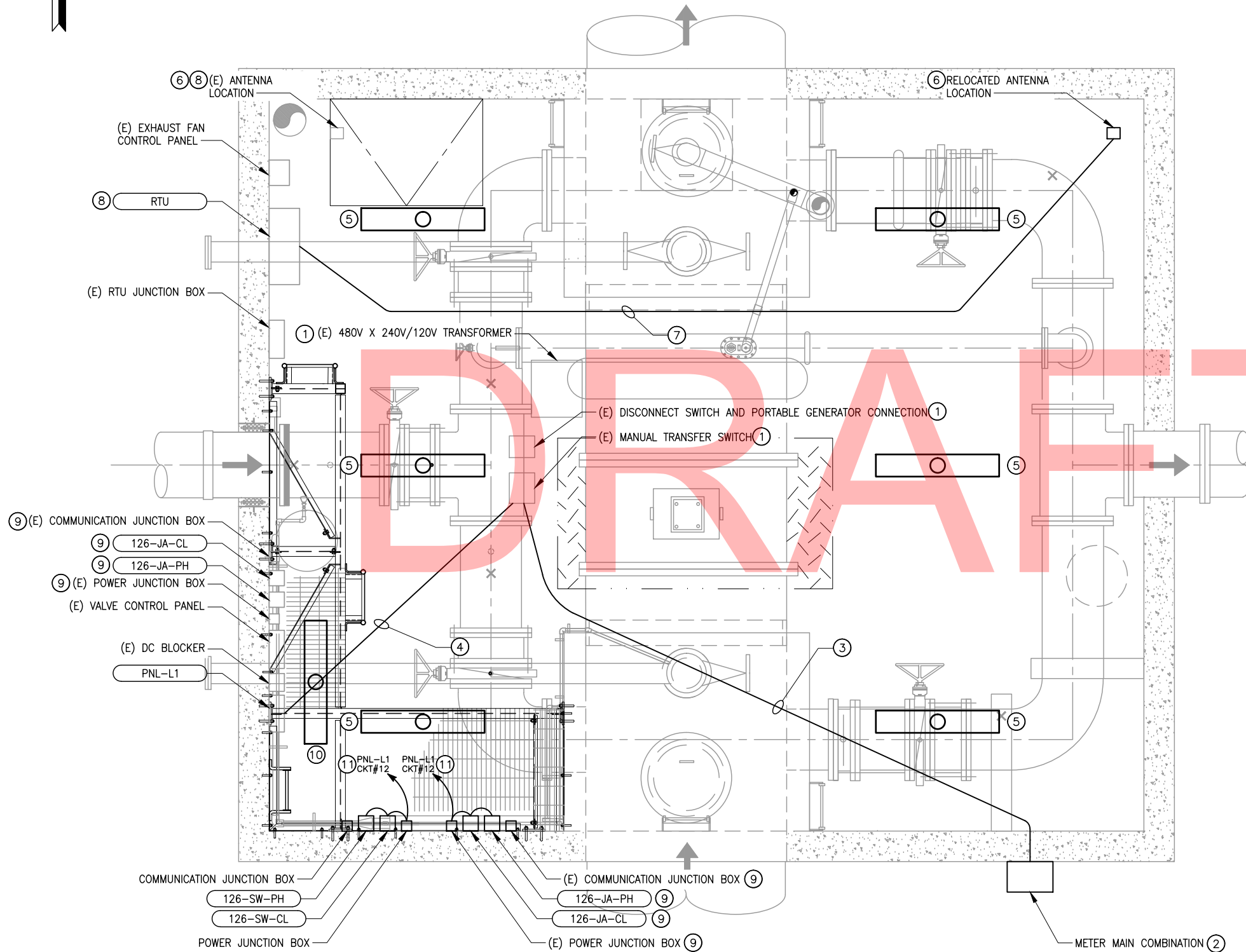
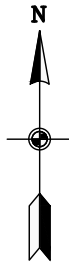


NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT		VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN C. WASEN	REVIEW S. CAVANAUGH	CHECKED S. CAVANAUGH
DRAWN C. WASEN	APPROVED S. CAVANAUGH	

ELECTRICAL 12600 SOUTH, JA-2 MAINLINE, ELECTRICAL SITE PLAN	PROJECT NUMBER 010-23-02
DATE: JANUARY 2025	

ITEM C5



GENERAL NOTES:

- A. SUPPORT ELECTRICAL CONDUITS INDEPENDENT OF PIPING. SUPPORTING THE ELECTRICAL CONDUIT OFF PIPING WILL NO BE ALLOWED.
- B. ALL EXPOSED CONDUIT, BOXES, AND FITTINGS IN THE VAULT SHALL BE GALVANIZED RIGID STEEL SUPPORTED ON ZINC COATED STRUT. SEALTITE (NOT TO EXCEED 24") MAY BE USED WHERE REQUIRED.
- C. GROUT ALL CONDUIT PENETRATIONS THROUGH VAULT WALL AND CEILING. E 5012
- D. REFER TO POWER ONE-LINE DIAGRAM AND CONTROL BLOCK DIAGRAM ON DRAWING E-06 FOR CONDUIT AND CONDUCTOR SIZES AND QUANTITIES.
- E. ELEVATION VIEWS OF EXISTING AND NEW EQUIPMENT ARE SHOWN FOR THE WEST WALL ON SHEET E-04 AND FOR THE SOUTH WALL ON SHEET E-05.

KEY NOTES: (#)

- 1. EQUIPMENT LOCATED IN SHED ABOVE VAULT.
- 2. LOCATION OF NEW METER MAIN COMBINATION, SEE SITE PLAN ON E-02.
- 3. ROUTE NEW CONDUIT ALONG VAULT WALL UNDERGROUND AND CORE VAULT WALL AT CEILING USING A PVC COATED RIGID CONDUIT AND LB FITTING. ROUTE CONDUIT ALONG CEILING TO BELOW MANUAL TRANSFER SWITCH. CORE THROUGH CEILING AND ROUTE CONDUIT TO MANUAL TRANSFER SWITCH.
- 4. CORE THROUGH VAULT CEILING BELOW MANUAL TRANSFER SWITCH. ROUTE NEW CONDUIT ALONG CEILING TO WALL AND APPROXIMATELY 8' DOWN WALL AND CONNECT TO EXISTING GRS CONDUIT TO PANELBOARD.
- 5. EXISTING CEILING MOUNTED FIXTURE TO BE REMOVED AND REPLACED. REPLACE WITH SURFACE MOUNTED FIXTURE LITHONIA CSVT L48 5000LM MVOLT 40K 80CRI OR EQUAL. CONTRACTOR TO UTILIZE EXISTING WIRING.
- 6. RELOCATE EXISTING ANTENNA AND ANTENNA MAST. ANCHOR TO VAULT CONCRETE LID. PATCH AND REPAIR HOLE IN LID AT EXISTING ANTENNA LOCATION.
- 7. CORE THROUGH VAULT TO CEILING FOR NEW ANTENNA CONDUIT, ROUTE NEW 1" CONDUIT FROM EXISTING RTU TO NEW ANTENNA LOCATION. NO CONDUIT BODIES OR JUNCTION BOXES PERMITTED IN CONDUIT RUN FOR ANTENNA. NEW ANTENNA CABLING FURNISHED AND INSTALLED BY OWNER.
- 8. REMOVE AND DISPOSE OF EXISTING ANTENNA CONDUIT BETWEEN RTU AND EXISTING ANTENNA LOCATION.
- 9. RELOCATE EXISTING WATER QUALITY INSTRUMENTATION FROM VAULT WEST WALL TO LOCATION SHOWN ON SOUTH WALL. SEE CONTROL BLOCK DIAGRAM ON SHEET E-06 FOR ADDITIONAL INFORMATION REGARDING CONDUIT AND CONDUCTORS AND SHEET E-05 FOR ELEVATION VIEW.
- 10. FURNISH AND INSTALL NEW LIGHT FIXTURE MOUNTED UNDERNEATH METAL GRATING. FIXTURE SHALL BE LITHONIA CSVT L48 3000LM MVOLT 40K 80CRI OR EQUAL. FIXTURE SHALL BE CONNECTED TO EXISTING OVERHEAD LIGHTING CIRCUIT. FURNISH AND INSTALL 2#12 CONDUCTORS WITH 1#12G AND 3/4" GRS CONDUIT AS REQUIRED.
- 11. FURNISH AND INSTALL 2#12 CONDUCTORS WITH 1#12G IN 3/4" GRS CONDUIT BETWEEN PNL-L1 AND WATER QUALITY INSTRUMENTATION.

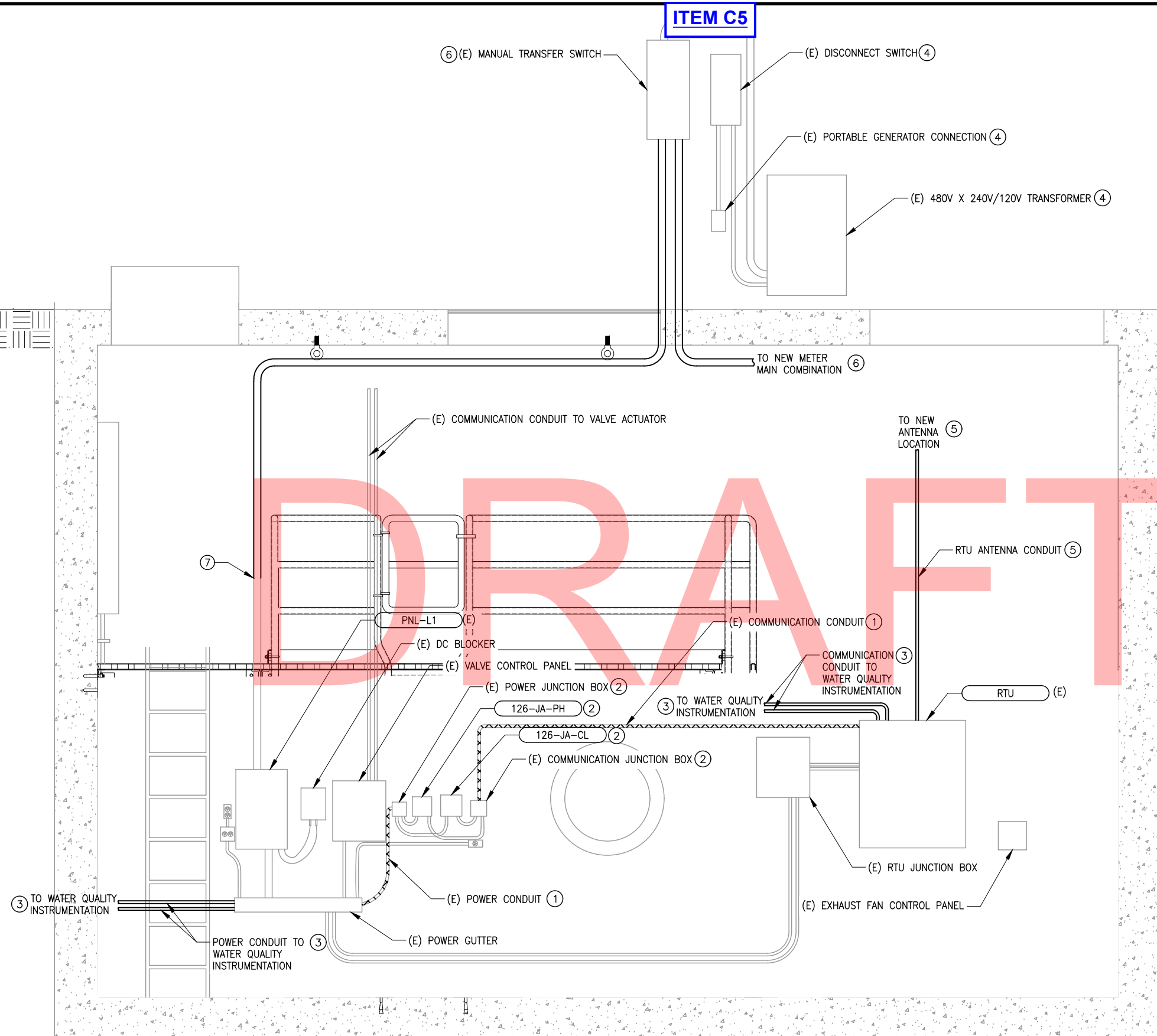
12600 SOUTH, JA-2 MAINLINE, VALVE VAULT ELECTRICAL PLAN
 SCALE: 1/2" = 1'-0"



NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN: C. WARDEN DRAWN: C. WARDEN	REVIEW: S. CAVANAUGH CHECKED: S. CAVANAUGH APPROVED: S. CAVANAUGH

ELECTRICAL 12600 SOUTH, JA-2 MAINLINE, VALVE VAULT ELECTRICAL PLAN	PROJECT NUMBER: 010-23-02 DATE: JANUARY 2025
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GENERAL NOTES:

- A. SUPPORT ELECTRICAL CONDUITS INDEPENDENT OF PIPING. SUPPORTING THE ELECTRICAL CONDUIT OFF PIPING WILL NOT BE ALLOWED.
- B. ALL EXPOSED CONDUIT, BOXES, AND FITTINGS IN THE VAULT SHALL BE GALVANIZED RIGID STEEL SUPPORTED ON ZINC COATED STRUT OR BACKSTRAP CLAMPS. SEALTITE (NOT TO EXCEED 24") MAY BE USED WHERE REQUIRED.
- C. REFER TO POWER ONE-LINE DIAGRAM AND CONTROL BLOCK DIAGRAM ON DRAWING E-06 FOR CONDUIT AND CONDUCTOR SIZES AND QUANTITIES.

KEY NOTES: #

- 1. DEMOLISH AND DISPOSE OF EXISTING POWER CONDUIT AND CONDUCTORS FEEDING EXISTING POWER JUNCTION BOX AS WELL AS CONDUIT AND CONDUCTORS BETWEEN EXISTING COMMUNICATION JUNCTION BOX AND RTU. PATCH HOLES IN RTU AND GUTTER.
- 2. RELOCATE EXISTING POWER JUNCTION BOX, PH ANALYZER, CHLORINE ANALYZER, AND COMMUNICATIONS JUNCTION BOX TO LOCATION SHOWN ON SHEET E-03.
- 3. CONDUIT AND CONDUCTORS TO NEW AND RELOCATED WATER QUALITY INSTRUMENTATION. SEE SHEETS E-03 AND E-05 FOR EQUIPMENT LOCATION. INSTRUMENTATION INFORMATION, AND CONDUIT AND CONDUCTOR INFORMATION CAN BE FOUND ON THE MECHANICAL SHEETS AND ON SHEET E-06.
- 4. TRANSFORMER, MANUAL TRANSFER SWITCH, DISCONNECT, AND PORTABLE GENERATOR CONNECTION ARE LOCATED IN SHED ABOVE VAULT. SEE POWER ONE-LINE DIAGRAM ON SHEET E-06 FOR MORE INFORMATION.
- 5. SEE SHEET E-03 FOR INFORMATION REGARDING NEW AND EXISTING RTU ANTENNA AND CONDUIT.
- 6. FOR NEW METER MAIN LOCATION, AS WELL AS CONDUIT AND CONDUCTOR INFORMATION, SEE SHEETS E-02, E-03, AND E-06.
- 7. INTERCEPT EXISTING CONDUIT.

NO.	DATE	REV. BY	DESCRIPTION

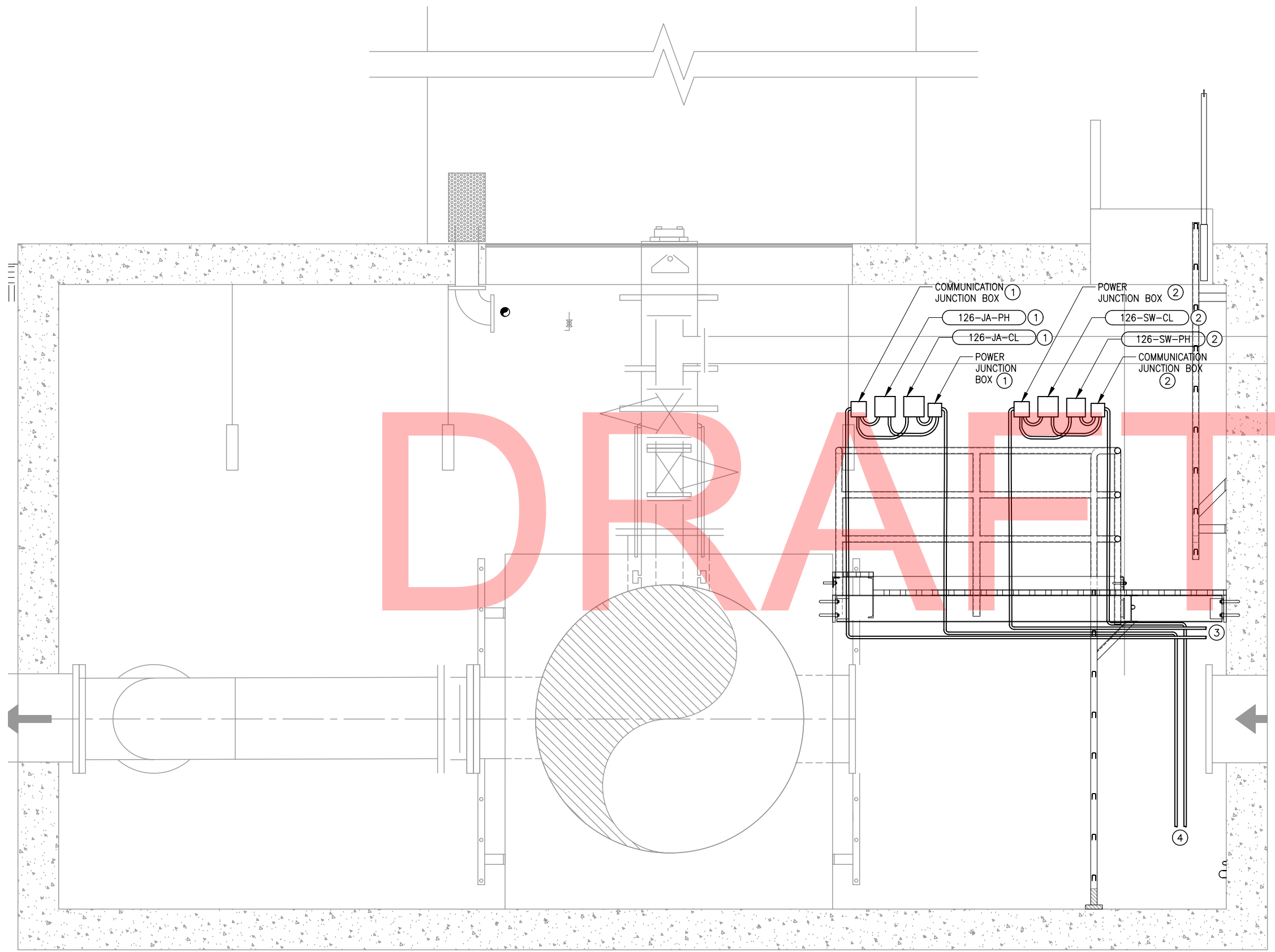
JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT		VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN C. WASEN	CHECKED S. CAVANAUGH	REVIEW S. CAVANAUGH
DRAWN C. WASEN	APPROVED S. CAVANAUGH	

ELECTRICAL	12600 SOUTH, JA-2 MAINLINE, VALVE VAULT WEST WALL ELEVATION	PROJECT NUMBER 010-23-02
DATE: JANUARY 2025		

12600 SOUTH, JA-2 MAINLINE, VALVE VAULT WEST WALL ELEVATION
SCALE: 3/4" = 1'-0"

LEGEND
[Symbol] DEMOLISH

ITEM C5



GENERAL NOTES:

- A. SUPPORT ELECTRICAL CONDUITS INDEPENDENT OF PIPING. SUPPORTING THE ELECTRICAL CONDUIT OFF PIPING WILL NOT BE ALLOWED.
- B. ALL EXPOSED CONDUIT, BOXES, AND FITTINGS IN THE VAULT SHALL BE GALVANIZED RIGID STEEL SUPPORTED ON ZINC COATED STRUT OR BACKSTRAP CLAMPS. SEALTITE (NOT TO EXCEED 24") MAY BE USED WHERE REQUIRED.
- C. REFER TO POWER ONE-LINE DIAGRAM AND CONTROL BLOCK DIAGRAM ON DRAWING E-06 FOR CONDUIT AND CONDUCTOR SIZES AND QUANTITIES.

KEY NOTES: #

- 1. RELOCATED WATER QUALITY INSTRUMENTATION. SEE MECHANICAL SHEETS AND CONTROL ONE-LINE DIAGRAM ON SHEET E-06 FOR ADDITIONAL INFORMATION REGARDING COMPONENTS AND CONDUIT AND CONDUCTOR INFORMATION. SEE ELECTRICAL PLAN ON E-03 AND WEST WALL ELEVATION ON E-04 FOR LOCATION INFORMATION.
- 2. NEW WATER QUALITY INSTRUMENTATION. SEE MECHANICAL SHEETS AND CONTROL BLOCK DIAGRAM ON SHEET E-06 FOR ADDITIONAL INFORMATION REGARDING COMPONENTS AND CONDUIT AND CONDUCTOR INFORMATION. SEE ELECTRICAL PLAN ON E-03 FOR ADDITIONAL LOCATION INFORMATION.
- 3. INSTRUMENTATION CONDUIT TO RTU. SEE DRAWING E-04.
- 4. POWER CONDUIT TO PNL-L1. SEE DRAWING E-04.



NO.	DATE	REV. BY	DESCRIPTION

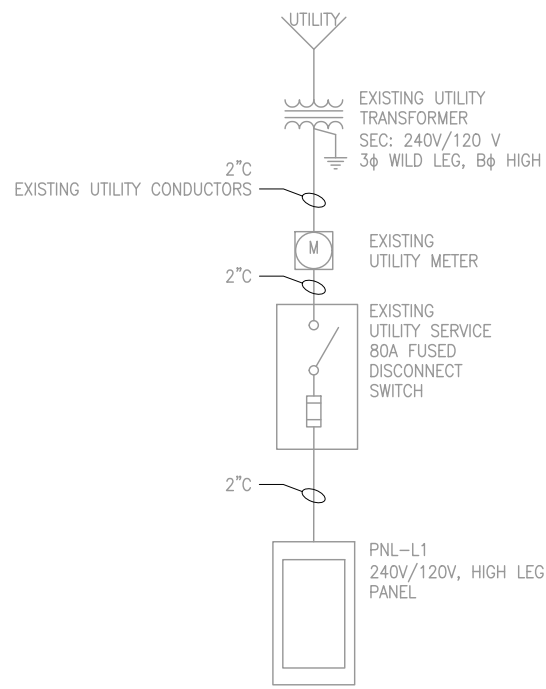
JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT		VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN	CHECKED	REVIEW
DESIGN: C. WAsDEN	CHECKED: S. CAVANAUGH	REVIEW: S. CAVANAUGH
DRAWN: C. WAsDEN	APPROVED: S. CAVANAUGH	

ELECTRICAL 12600 SOUTH, JA-2 MAINLINE, VALVE VAULT SOUTH WALL ELEVATION	PROJECT NUMBER 010-23-02
DATE: JANUARY 2025	PROJECT NUMBER 010-23-02

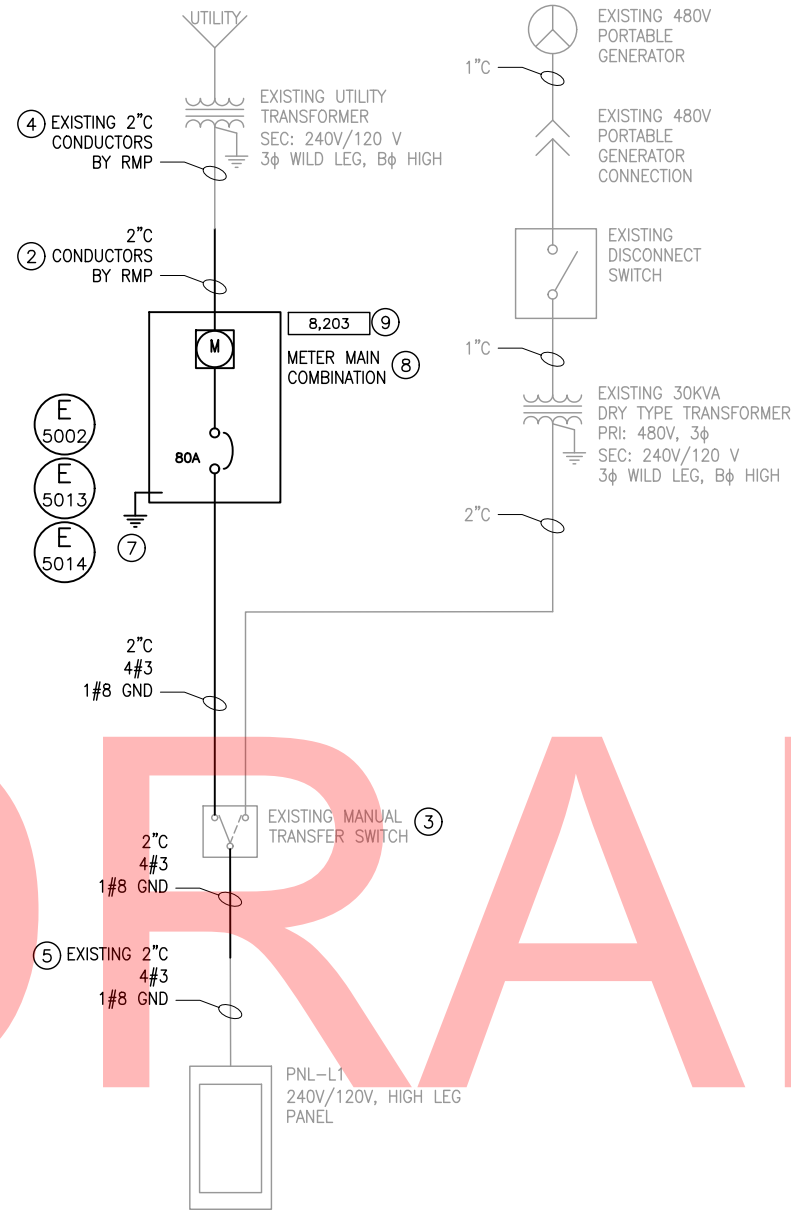
12600 SOUTH, JA-2 MAINLINE, VALVE VAULT SOUTH WALL ELEVATION
 SCALE: 3/4" = 1'-0"

P:\JORDAN VALLEY WCD\010-23-02 SOUTHWEST AQUEDUCT REACH 2 - 13400 S TO 11800 S\2.0 DESIGN PHASE\2.9 DRAWINGS\SH1E-05.dwg Plotted: 1/10/2025 3:43 PM By: Jeremy Black

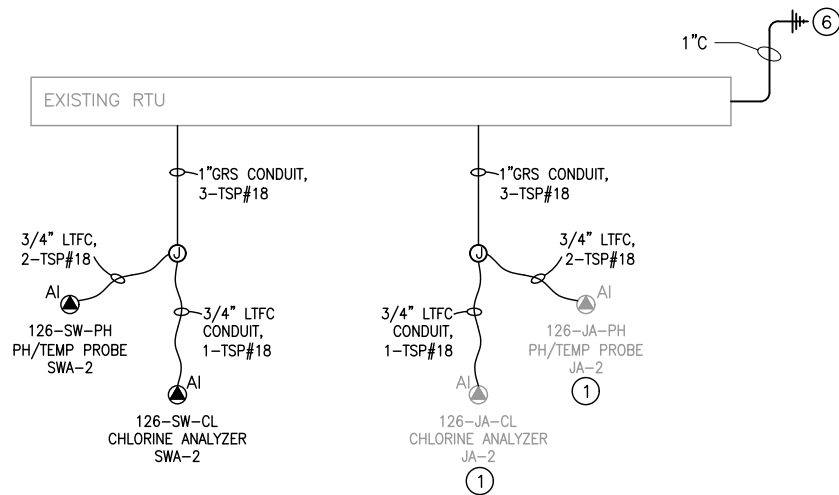
ITEM C5



EXISTING POWER ONE-LINE DIAGRAM



NEW POWER ONE-LINE DIAGRAM



CONTROL ONE-LINE DIAGRAM

GENERAL NOTES:

- CONTRACTOR SHALL PROVIDE AND INSTALL ALL JUNCTION BOXES, CONDUIT, AND CONDUCTORS FOR NEW EQUIPMENT (DARK). LIGHT COLORED EQUIPMENT IS EXISTING EQUIPMENT IN THE VAULT. CONTRACTOR SHALL LABEL ENDS OF ALL CONDUCTORS AND CABLING AND TERMINATE THE CONDUCTORS AT THE INSTRUMENTS AND EQUIPMENT. THE OWNER SHALL TERMINATE ALL CONDUCTORS AND CABLES IN THE RTU. OWNER WILL PROVIDE ANY REQUIRED RTU HARDWARE, PROGRAMMING, AND INTEGRATION.
- NEW ELECTRIC WORK SHALL MATCH PHASE ROTATION AND HIGH LEG LOCATION AT EXISTING PANEL.

SHEET NOTES: #

- EXISTING WATER QUALITY INSTRUMENTATION BEING RELOCATED. SEE ELECTRICAL PLAN ON SHEET E-03 FOR OLD AND NEW LOCATIONS. FURNISH AND INSTALL NEW CONDUIT AND CONDUCTOR BETWEEN RELOCATED DEVICE AND PLC.
- CONTRACTOR TO LOCATE EXISTING UNDERGROUND SERVICE CONDUIT AND INTERCEPT FOR CONNECTION TO NEW METER LOCATION. EXTEND CONDUIT AS REQUIRED. DEMOLISH AND DISPOSE OF EXISTING CONDUIT BETWEEN INTERCEPT LOCATION AND OLD METER LOCATION. ROCKY MOUNTAIN POWER TO PROVIDE NEW CONDUCTORS FROM UTILITY TRANSFORMER TO METER. SEE SITE PLAN ON E-02 FOR APPROXIMATE ROUTING.
- OWNER WILL CONNECT EXISTING PORTABLE GENERATOR TO CHECK GENERATOR WIRING PHASE ROTATION. MAKE ANY CORRECTIONS TO TERMINATIONS AS REQUIRED.
- EXISTING SERVICE CONDUIT TO BE INTERCEPTED, SEE SHEET E-02.
- INTERCEPT EXISTING CONDUIT, SEE SHEETS E-03 AND E-04.
- RELOCATE ANTENNA AND MAST, SEE SHEET E-03.
- CONTRACTOR TO PRESERVE AND PROTECT ANY GROUND ELECTRODE CONDUCTOR PRESENT AT VAULT. CONNECT NEW SERVICE TO EXISTING GROUND CONDUCTOR ELECTRODE. FURNISH AND INSTALL (1) 8-FOOT LONG, 3/4" DIA. COPPER CLAD STEEL GROUND ROD AND CONNECT WITH #8 BARE COPPER GROUND CABLE.
- FURNISH AND INSTALL METER MAIN COMBINATION IN ACCORDANCE WITH ROCKY MOUNTAIN POWER REQUIREMENTS. FURNISH AND INSTALL 80A SERVICE ENTRANCE RATED MAIN CIRCUIT BREAKER.
- APPROXIMATE AVAILABLE FAULT CURRENT. CONTRACTOR IS RESPONSIBLE TO PERFORM AVAILABLE FAULT CURRENT STUDY AND LABEL ENCLOSURE IN ACCORDANCE WITH NEC 110.24 (A). CONTRACTOR SHALL ALSO LABEL ENCLOSURE WITH IDENTIFICATION OF HIGH LEG IN ACCORDANCE WITH NEC 110.15.



NO.	DATE	REV. BY	DESCRIPTION

JORDAN VALLEY WATER CONSERVANCY DISTRICT SOUTHWEST AQUEDUCT REACH 2 RIVERTON AND SOUTH JORDAN, UT		VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING
DESIGN C. WARDEN	CHECKED S. CAVANAUGH	REVIEW S. CAVANAUGH
DRAWN C. WARDEN	APPROVED S. CAVANAUGH	

ELECTRICAL	12600 SOUTH, JA-2 MAINLINE, VALVE VAULT ONE-LINE DIAGRAMS	PROJECT NUMBER 010-23-02
DATE: JANUARY 2025		

SECTION 01 71 51
AQUEDUCT PROTECTION AND MONITORING

PART 1 - GENERAL

1.1 THE REQUIREMENTS

- A. The work in this section includes specific measures required to protect the Jordan Aqueduct from potential damages during construction of the Southwest Aqueduct.
- B. The Jordan Aqueduct is owned by the United States Bureau of Reclamation (BOR, USBOR, Reclamation) and operated and maintained by the Jordan Valley Water Conservancy District (JVWCD, District). Both entities may be referred to as Aqueduct Owner in these specifications.
- C. The Jordan Aqueduct is located in the BOR easement and runs parallel to the JVWCD easement for the Southwest Aqueduct. Existing Jordan Aqueduct horizontal and vertical alignment, based upon original BOR design drawings, are shown on the plans. Limits of the BOR right-of-way are shown on the plans.
- D. The existing aqueduct was constructed in the 1970's using gasketed bell and spigot style pipe. The Jordan Aqueduct consists of 78-inch diameter reinforced concrete cylinder pipe (CCP) along 3200 West (Reach 2, JA-2).
- E. The size and age of the aqueduct and lack of joint restraint requires that extreme caution be exercised when operating equipment and constructing facilities along or adjacent to the BOR right-of-way. Excessive vibration, loading, or settlement of the aqueduct may cause joints to leak and the pipeline to fail. The aqueduct must continuously convey water for a significant portion of the population of the Salt Lake Valley. The aqueduct cannot be taken out of service for maintenance and repair without significant advance planning and expense, and then only during limited (low wintertime demand) periods of the year for short and planned schedule durations.
- F. Requirements of this Section are based upon the Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, and 4, and the U.S. Department of the Interior Bureau of Reclamation Engineering and O&M Guidelines for Crossings. Copies of these documents are included in the Reference Document Attachments.
- G. Note that this Section is intended to provide a summary of the key requirements of the above documents as they relate to the Jordan Aqueduct Protection along the 3200 West Corridor for the Southwest Aqueduct Reach 2 Project. It is not intended to be a comprehensive list of BOR requirements. All requirements of these documents shall be adhered to when operating along or adjacent to the Jordan Aqueduct and United States right-of-way.

1.2 RELATED SECTIONS

- A. Section 331111S – Steel Pipe (AWWA C200, Modified)
- B. Section 099000S – Protective Coatings
- C. Section 099010S – Pipeline Coating

1.3 REFERENCES

- A. Engineering and O&M Guidelines for Crossings – Bureau of Reclamation Water Conveyance Facilities, April 2008
- B. Exhibit A Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, & 4 – Protection Criteria
- C. Standard Form 299 – Application for Transportation and Utility Systems and Facilities on Federal Lands
- D. 29 CFR 1926: OSHA Safety and Health Regulations for Construction

1.4 DEFINITIONS NOT USED

1.5 SUBMITTALS

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

1.6 QUALITY CONTROL

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

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

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 BOR ENCROACHMENT APPLICATION PROCESS

- A. The Owner has performed the work required for permitting of the pipeline as part of this project and the regulations are provided for Contractor knowledge and understanding of what is required by the BOR. Contractor shall follow all provision of SF 299 permitting obtained by JWCD.
- B. Requirements for obtaining an authorization to cross Reclamation project land are in the Code of Federal Regulations (CFR) at 43 CFR 429 and Reclamation Manual LND 08-01. Applicants must complete the Standard Form (SF) 299, "Application for Transportation and Utility Systems and Facilities on Federal Lands." The form is included in the Reference Document Attachments and can be obtained electronically at: <https://www.gsa.gov/forms-library/application-transportation-utility-systems-telecommunications-and-facilities-federal>

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

- A. All new construction shall meet requirements of the Encroachment Guidelines for Jordan Aqueduct, Reach 1, 2, 3, and 4, included in the Reference Document Attachment for reference.
- B. All new construction and utility crossings shall meet requirements of the Engineering and O&M Guidelines for Crossings by the U.S. Department of the Interior Bureau of Reclamation, included at the end of this Section for reference.
- C. All requests for encroachments on U.S Bureau of Reclamation land, facility, or water body must obtain a written land use authorization from JWCD and BOR.
- D. Storage of hazardous materials is not permitted within the BOR rights-of-way.
- E. All temporary and permanent changes in ground surfaces within the BOR rights-of-way are considered to be encroaching structures and must be handled as such.
- F. All finished grades shall provide a 4-foot minimum cover above the existing Jordan Aqueduct.
- G. Surface structures that will generally be allowed to be constructed within the BOR rights-of-way include standard concrete pavement section, asphalt pavement, non-reinforced parking areas, curbs, gutters, sidewalks, walkways and driveways, and removable barriers.

However, it is understood that all surface structures shall be analyzed and considered on an individual basis.

- H. Structures that may not be constructed in, on, or along the BOR rights-of-way include but are not limited to permanent structures such as retaining walls, street light standards, supports for large signs, power or communication poles, drainage structures, buildings, permanent foundations, permanent traffic barriers, cement or rock walls, sound walls, and longitudinal fences.
 - 1. During the SF299 permitting process, the Owner will obtain an exception from the BOR for any structures required for this project.
- I. Parallel utilities are not permitted within the BOR rights-of-way.
- J. Trees or vines are not permitted within the BOR rights-of-way.
- K. If existing drainage features are to be modified during construction, detailed drawings showing the proposed drainage replacement/restoration should be submitted with the application for review and approval.
- L. Notify the BOR Provo Area Office Field Engineering Division Manager at (801) 379-1000 and the Jordan Valley Water Conservancy District (District) at (801) 565-4300 at least forty-eight (48) hours in advance of commencing construction to permit inspection by the BOR and/or District.
- M. Notify JWCD immediately upon any evidence of suspected damage to the Jordan Aqueduct so that emergency inspection or response efforts can be initiated as determined necessary. The JWCD 24-hour contact is 801-256-4401. Always maintain this 24-hour emergency contact information available to on-site crews and provide contractor's 24-hour contact information to JWCD's on-call staff.

3.3 UTILITY CROSSINGS

- A. Any non-metallic encroaching structure below ground level shall be accompanied with a metallic strip within the BOR rights-of-way.
- B. The points where proposed crossing utilities enter and exit the BOR rights-of-way should be plainly and permanently marked by signposts. Signposts should contain the name of the owner/operator, contents of the pipeline, utility identification, and emergency contact phone number.
- C. Utilities including electrical and communication lines, and pipelines containing sewage, oil, gasoline, natural gas, contaminated waters, non-potable waters, or hazardous materials should only **cross perpendicular (between 70 and 90 degrees)** to the Jordan Aqueduct.
- D. Utilities crossing above or under the Jordan Aqueduct should maintain a vertical clearance between the utility and aqueduct of **at least of 12 inches**.
- E. Sanitary sewer crossings shall be contained within steel pipe casings within the BOR right-of-way.

- F. No vertical or horizontal bends will be permitted on utilities within the BOR right-of-way.
- G. Overhead wires across BOR rights-of-way should be at least 32 feet above all ground levels. For electrical power lines of 69 kilovolts (kV) or higher voltage, the minimum clearance should be 40 feet plus 0.25 inch per kV of line-to-line voltage above 450 kV. Poles or towers are not allowed within the BOR rights-of-way.
- H. High voltage, direct current powerlines are generally not permitted to encroach on the BOR rights-of-way for the Jordan Aqueduct, except in unusual circumstances and with proper cathodic protection considerations.
- I. Refer to the Engineering and O&M Guidelines for Crossings for specific cathodic protection requirements within the BOR rights-of-way.

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

- A. Load restrictions must be carefully observed to protect the Jordan Aqueduct from damages that could be caused by excessive live or dead loading or vibrations during construction. The Load Restricted Area surrounding the Jordan Aqueduct is defined as a zone within 12-feet of both sides of the centerline of the pipeline (24-feet total width).
- B. Limit equipment, operation, procedures, and methods of construction within the Load Restricted Area to ensure that any combination of either live loads or dead loads does not exceed the design capabilities of the aqueduct. Comply with the following constraints, procedures, and load restrictions which apply to all construction activities and operations located within this zone.
- C. The largest equipment loading (live load) which shall be permitted within the Load Restricted Area is HL-93 and there must be a temporary minimum soil cover of 3-feet or greater.
- D. Prevent heavy equipment (exceeding an HL-93 loading) from encroaching within the Load Restricted Area. Dynamic loading of equipment, including soil compaction equipment, shall not exceed HL-93 loading. In all cases there shall be a temporary minimum of 3 feet of cover within the Load Restricted Area.
- E. Operation of backhoes, augers, excavation or lifting equipment which may impose point loads from outriggers, wheels, or jacks is not permitted within the Load Restricted Area.
- F. The allowable soil loading (dead load) or depth of cover over the aqueduct is restricted to a minimum of 4 feet for all pipe classes, and a maximum of 5 feet for Class A pipe, maximum of 10 feet for Class B, maximum of 15 feet for Class C, and maximum of 20 feet for Class D. Note that the aqueduct changes pipe class frequently along its alignment. Class changes are based upon the original design depth of cover that was present along the aqueduct. Pipe classes are shown in Table 1 below, and BOR reference plans.

**Table 1
Jordan Aqueduct Reach 2 at 3200 West
78-inch Concrete Cylinder Pipe (CCP) Classifications**

Location – Segment¹	Begin JA Stationing	End JA Stationing	Approximate Distance from SWA-2 Centerline (ft)	Pipe Class	Max Cover (ft)
13400 S to 13290 S	710+00	718+00	30	B	10
13290 S to 13140 S	718+00	728+60	24	A	5
13140 S to 13074 S	728+60	732+10	26	B	10
13074 S to 12950 S	732+10	740+00	26	A	5
12950 S to 12780 S	740+00	751+15	46	B	10
12780 S to 12615 S	751+15	762+42	46	A	5
12615 S to 12555 S	762+42	766+00	34	B	10
12555 S to 12350 S	766+00	780+00	35	A	5
12350 S to 12330 S	780+00	781+80	39	B	10
12330 S to 12290 S	781+80	784+82	39	A	5
12290 S to 12280 S	784+82	785+32	39	B	10
12280 S to 12210 S	785+32	789+12	38	A	5
12210 S to 12095 S	789+12	796+80	33	B	10
12095 S to 12055 S	796+80	799+54	29	A	5
12055 S to 11690 S	799+54	824+00	30	B	10

1. *Location or Segment is based on residential addresses to identify the approximate location where the pipe class changes. Exact location of class change is based on BOR Reference Plans and requires additional investigation.*

- G. All backfill material within the BOR rights-of-way shall be compacted to a minimum of 95-percent maximum density specified by ASTM Part 19, D-698, method A; unless otherwise shown.
 - H. Backfilling of any excavation or around any structure within the BOR rights-of-way shall be compacted in layers not exceeding 6-inches thick if hand compacted or 8-inches thick if power compacted to the following requirements:
 - 1. cohesive soils to 95 percent maximum density specified by ASTM Part 19, D-698, method A; or
 - 2. noncohesive soils to 95 percent relative compaction specified by ASTM D 7382-08.
 - I. Maintain existing ground cover over the aqueduct unless special exceptions are approved which allow for modifications during construction.
 - J. Do not place fill or temporarily stockpile construction materials in the Load Restricted Area - within 12-feet either side of the centerline of the aqueduct.
- 3.5 SPECIAL PROTECTIONS FOR TEMPORARY LOW COVER CONDITIONS WITHIN THE BOR EASEMENT FOR THE JORDAN AQUEDUCT – (BELOW 3 FEET OF COVER)
- A. Special protections are required for the aqueduct during interim conditions when there is a temporary low cover over the Jordan Aqueduct, such as when replacement of the existing

roadway requires the pavement section and subgrade to be removed and replaced for development of the new roadway section over the aqueduct.

- B. Temporary low cover conditions are present any time there is less than the allowable minimum 3 feet depth of soil over the aqueduct that is required for any equipment loading. Note that permanent finish grade cover over the existing aqueduct requires 4 feet of minimum cover.
- C. Coordinate planned subgrade elevations with Jordan Aqueduct pothole depths. Submit cross sections in low cover areas illustrating the identified depth of cover and proposed subgrade elevation at 25-foot intervals.
- D. Excavation over the aqueduct shall take place from the adjacent existing pavement to allow removal of excavated material while maintaining the minimum cover or sufficient offset distance between the top of aqueduct and construction equipment and not directly loading construction equipment on the aqueduct during low cover conditions.
- E. For placement of granular borrow materials, utilize the adjacent existing pavement for material delivery and place import material using one of the following methods:
 - 1. Side dump trucks, placing material directly on grade.
 - 2. Belly dump trucks, placing material on the existing pavement and blading off of pavement onto grade.
- F. Backfill within 18-inches of the aqueduct shall be compacted using light, hand operated compactors and rollers. Mechanical compaction shall not be allowed within 6-inches of the aqueduct.
- G. Once a working platform has been established, a low ground pressure Dozer/Grader (less than 7 psi ground pressure) shall be used to spread material across the sub grade while maintaining a minimum of 18-inches of cover over the aqueduct.
- H. Utilize static rolling compaction methods with light weight equipment (less than 8,000 lbs.) within the low cover zone between 18-inches and 36-inches cover. Vibratory compaction shall not be used within the Load Restricted Area when cover over the existing Jordan Aqueduct is less than 36-inches.

3.6 SPECIAL PROTECTIONS FOR POTENTIAL GROUND SETTLEMENT

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

3.7 SPECIAL PROTECTIONS FOR VIBRATION CONTROL DURING CONSTRUCTION

- A. Vibration monitoring will be completed by JWCD and the Engineer during construction activities in the BOR easement that may cause vibration to the JA-2. Provide 3 days' notice to Engineer of schedule of activities that may vibrate the JA-2 to allow for monitoring equipment to be set up prior.
- B. Do not exceed the following special vibration limits for the Jordan Aqueduct:
 - 1. 0.1 in/sec for both steady state and impact vibrations along the centerline of the existing aqueduct.
- C. For purposes of these special aqueduct vibration limits, steady state vibrations will be considered as all continuous and frequent intermittent sources including pogo stick compactors, vibratory pile drivers, and vibration compaction equipment.
- D. For purposes of these special aqueduct vibration limits, impact vibrations will be considered as all transient sources which create a single isolated event such as impact pile driving, blasting, jack and boring, or other non-recurring heavy drop impact.

END OF SECTION

DRAFT