

CLIFTON WATER DISTRICT

**Desert Road Pump Station
Project Number 2024-02**

August 2026

**Clifton Water District
510 34 Road
Clifton, Colorado 81520**

(970) 434-7328

**Clifton Water District
Project Number 2024-02**

Bid Submittal Checklist

BID

_____	Signed Bid Form
_____	Signed Bid Bond
_____	CONTRACTOR Qualifications (If applicable)

AWARD

_____	Notice of Award
_____	Agreement
_____	Agreement
_____	Performance Bond
_____	Payment Bond
_____	Certificate of Tax Exemption
_____	Insurance Certificates
_____	Notice to Proceed

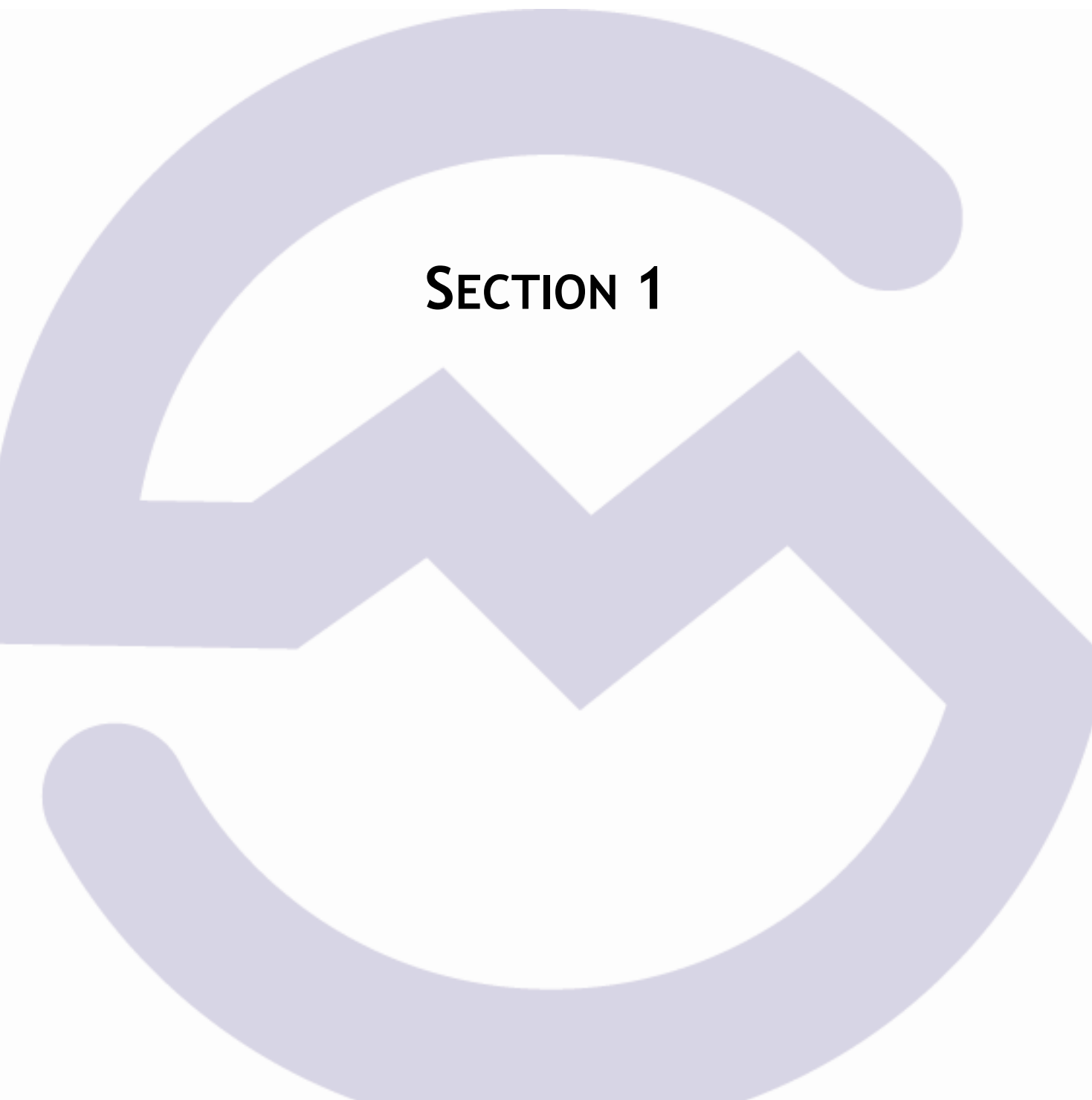
TABLE OF CONTENTS

<u>Title</u>	<u>Section</u>
Contract Documents.....	1
Special Conditions and Provisions.....	2
General Conditions	3
Clifton Water District Design and Construction Standard Specifications.....	4
Project Technical Specifications.....	5

APPENDIX

Design Drawings

Geotech Report

A large, stylized purple logo is centered on the page. It consists of a thick, curved line that forms a semi-circle at the top, a horizontal line in the middle, and a thick, curved line that forms a semi-circle at the bottom. The horizontal line is composed of several segments, creating a zigzag or stepped appearance. The entire logo is rendered in a solid purple color.

SECTION 1

SECTION 1
CONTRACT DOCUMENTS
(Index)

Advertisement for Bids	1-1
Information for Bidders	1-2 to 1-4
Bid Proposal.....	1-5 to 1-7
Bid Schedule	1-8
Bid Schedule Summary.....	1-9 to 1-10
Bid Bond	1-11
Notice of Award.....	1-12
Contract.....	1-13 to 1-15
Performance Bond	1-16 to 1-17
Payment Bond.....	1-18 to 1-19
Certificate of Insurance.....	1-20
Certificate of Tax Exemption.....	1-21
Notice to Proceed.....	1-22
Clifton Water District Partial Payment Estimate	1-23 to 1-24
Change Order	1-25
Notice of Substantial Completion.....	1-26
Notice of Final Completion Inspection.....	1-27

ADVERTISEMENT FOR BIDS

CLIFTON WATER DISTRICT
510 34 Road
Clifton, Colorado 81520

The Clifton Water District, Acting By And Through Its Water Activity Enterprise, will receive separate sealed BIDS for the Clifton Water District **Desert Road Pump Station, Project Number 2024-02**, at 510 34 Road, Clifton, Colorado 81520 until 1:00 p.m., MDT on Wednesday, August, 26th, 2026 at which time and place the BIDS will be publicly opened and read aloud.

This project includes supplying all labor, material, and equipment to install approximately 250 square foot pump station, including booster pump skid, yard piping/interconnections to the distribution system, standby generator, electrical, HVAC and other miscellaneous work as described in the Contract Documents.

For parties interested in bidding the project, please contact the District's Project Representative, Jacob Lenihan at 510 34 Road, Clifton, Colorado 81520 (970-434-7328) or email jacobl@cliftonwaterdistrict.org for the CONTRACT DOCUMENTS. The CONTRACT DOCUMENTS are also available on the following web address:

<https://cliftonwater.specialdistrict.org/desert-road-pump-station-project-2024-02-7db5b16>

All BIDS must be accompanied by a BID BOND in the amount of five percent (5%) of the total bid. No BID shall be withdrawn after the opening of BIDS without the consent of the Clifton Water District for a period of Sixty (60) calendar days after the scheduled time of the opening of BIDS. The successful BIDDER must also provide a one hundred percent (100%) PAYMENT BOND and a one hundred percent (100%) PERFORMANCE BOND.

All BIDS must be submitted in writing on the forms provided and signed by the BIDDER or a duly authorized agent.

The OWNER (Clifton Water District) reserves the right to reject any or all BIDS and to waive any informalities in BIDDING and to make the award in such a manner as they may deem right and proper for the best interests of the Public.

There will be a mandatory pre-bid tour for this project at 2:30 pm on Wednesday, August 12th, 2026 commencing at the District offices, located at 510 34 Road, Clifton, CO.

July 29, 2025

BY: Ty Jones
District Manager

INFORMATION FOR BIDDERS

The Clifton Water District, (District) Acting By And Through Its Water Activity Enterprise (“DISTRICT”), will receive separate sealed BIDS for the **Desert Road Pump Station, Project Number 2024-02**, at the District office at 510 34 Road, Clifton, Colorado 81520 until 1:00 p.m., MDT on Wednesday, August, 26th, 2026 at which time and place the BIDS will be publicly opened and read aloud.

Each BID must be submitted in a sealed envelope, addressed to the Clifton Water District, 510 34 Road, Clifton, Colorado 81520. The outside of the envelope must bear the name of the BIDDER, address, and labeled “**Bid for Desert Road Pump Station, Project 2024-01**”. If forwarded by mail, a sealed envelope containing the BID must be enclosed in another envelope addressed to the Clifton Water District, 510 34 Road, Clifton, CO 81520.

ALL BIDS must be accompanied by a BID BOND in the amount of five percent (5%) of the total bid. ALL BIDS must be made on the required BID form. BIDDERS are cautioned that the actual bid form contains the following pages, the BID, the BID SCHEDULE, and the BID SUMMARY. Total material cost within the BID is required to be presented on the BID SUMMARY. All blank spaces for BID prices must be filled in, in ink or typewritten.

The DISTRICT may waive any informalities or minor defects or reject any or all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified for the bid opening shall not be considered. No BIDDER may withdraw a BID within sixty (60) calendar days after the actual date of the opening thereof. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the DISTRICT and the BIDDER.

Submission of a bid shall be conclusive assurance and warranty the bidder has examined the plans, specifications, contract documents, and site and understands all requirements for the performance of work. The bidder will be responsible for all errors in the proposal resulting from failure or neglect to conduct an in-depth examination. The District will in no case be responsible for any costs, expenses, losses or changes in anticipated profits resulting from such failure or neglect of the bidder.

Materials or quantities stated as unit price items in the Bid are supplied only to give an indication of the general scope of the Work, and are, as such, estimates only. The DISTRICT does not expressly or by implication agree that the actual amount of Work or material will correspond therewith and reserves the right after award to increase or decrease the quantity of any unit item of the Work without a change in the unit price.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the DISTRICT or any other person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve the CONTRACTOR from fulfilling any of the conditions of the Contract.

The party to whom the Contract is awarded will be required to execute the Contract and obtain and furnish a one hundred percent (100%) Payment Bond, a one hundred percent (100%) Performance

Bond and Certificates of Insurance as requested in the Paragraph V of the General Conditions within ten (10) calendar days from the date when NOTICE OF AWARD is delivered to the BIDDER. The NOTICE OF AWARD shall be accompanied by the necessary Contract, Payment Bond, and Performance Bond forms. In case of failure of the BIDDER to execute the Contract, the DISTRICT may at its option consider another BID and make the award in such a manner as it may deem right and proper for the best interests of the DISTRICT.

The DISTRICT, within ten (10) days of receipt of the Contract signed by the party to whom the Contract was awarded, shall sign the Contract, and return to such party an executed duplicate of the Contract. Should the DISTRICT not execute the Contract within such period, the BIDDER may, by WRITTEN NOTICE withdraw his signed Contract. Such notice of withdrawal shall be effective upon receipt of the notice by the DISTRICT.

The NOTICE TO PROCEED shall be issued within ten (10) days of the execution of the Contract by the DISTRICT. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period, the time will be extended by mutual agreement between the DISTRICT and the CONTRACTOR. If the NOTICE TO PROCEED has not been issued within a ten (10) day period, or within the period mutually agreed upon, the CONTRACTOR may terminate the Contract without further liability on the part of either party.

The DISTRICT may make such investigations as it deems necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the DISTRICT all such information and data for this purpose as the DISTRICT may request. The DISTRICT reserves the right to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy the DISTRICT that such BIDDER is properly qualified to carry out the obligations of the Contract and to complete the WORK contemplated therein.

A conditional or qualified BID will not be accepted unless as otherwise provided for in the "INFORMATION FOR BIDDERS". The Board of Directors of the DISTRICT may reject any and all BIDS.

All applicable laws, ordinances, and the rules and regulations of the PROJECT shall apply to the Contract throughout. Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to his BID. A BIDDER shall supply the names and addresses of major material suppliers and SUBCONTRACTORS when requested to do so by the DISTRICT.

The following materials for this project will be provided by the DISTRICT:

- Not Applicable

Within 10 days after the execution of the CONTRACT, the CONTRACTOR must submit to the ENGINEER in duplicate an acceptable breakdown of the lump sums and unit prices bid for items of the CONTRACT, showing the various operations to be performed under the CONTRACT, and the value of each of such operations, the total of such items to equal the total price bid. The CONTRACTOR shall also submit such other information relating to the bid prices as may be required and shall revise the bid breakdown as directed. Thereafter, the breakdown may be used

for checking the CONTRACTOR's applications for partial payments hereunder but shall not be binding upon the OWNER or the ENGINEER for any purpose whatsoever.

There will be a mandatory pre-bid tour for this PROJECT. The PROJECT is described in these documents. Prospective BIDDERS should familiarize themselves with the PROJECT. Should prospective BIDDERS have any concerns, the Manager, or his designee, will be available at the DISTRICT Office at 510 34 Road, Clifton, Colorado [970) 434-7328] to answer any questions. All Bid Package Clarification Questions must be received at the DISTRICT office by Close of Business (5:00 pm), Thursday, August 20, 2026, to be considered for formal response to all plan holders. The DISTRICT REPRESENTATIVE is Jacob Lenihan, Assistant Manager of the DISTRICT.

BID PROPOSAL

To: The Clifton Water District (District) Acting By and Through Its Water Activity Enterprise.

1. Proposal of _____
for the improvement known as the **Desert Road Pump Station, Project Number 2024-02.**

2. In submitting this proposal, the undersigned declares that the only persons or parties interested in the proposal as principals are those named herein, and that the proposal is made without collusion with any person, firm, or corporation.

3. The undersigned further declares that he has carefully examined the proposals, Plans, specifications, form of contract, bonds, and special provisions, if any, and that he has inspected in detail the site of the proposed work and that he has familiarized himself with all of the local conditions affecting the contract and detailed requirements of construction, and understands that in making this proposal he waives all right to plead any misunderstanding regarding the same.

4. The undersigned further understands and agrees that if the proposal is accepted, he is to furnish and provide all necessary machinery, tools, apparatus and other means of construction and to do all the work and to furnish all the materials and labor required.

5. The undersigned declares that he understands that the quantities mentioned are approximate only, and that they are subject to increase or decrease; that he will take in full payment therefore the amount of the summation of the actual quantities installed, as finally determined, and multiplied by the unit prices shown in the schedule of prices contained herein.

6. The undersigned agrees that the unit prices submitted herewith are for the purpose of obtaining a gross sum and for use in computing the value of extras and deductions; that if there is a discrepancy between the gross sum bid and that resulting from the summation of the quantities multiplied by their respective unit prices, the latter shall apply.

7. The undersigned agrees that if the District decides to extend or shorten the improvement, or otherwise alter it by extras or deductions, including the elimination of any one or more of the items, as provided in the specifications, he will perform the work as altered, increased or decreased, at the contract unit prices without claim for profits lost as a result of any work or items eliminated by the District.

8. The undersigned agrees that the District may, at any time during the progress of the work covered by this contract, order other work or materials incidental thereto, and that all such work and materials as do not appear in the proposal or contract as a specific item accompanied by a unit price, and which are not included under the bid price for other items in this contract, shall be performed as extra work and paid for in accordance with the General Conditions.

9. The undersigned further agrees to execute a contract, a payment bond and performance bond satisfactory to and in the form prescribed by the District in the penal sum of the full amount of the contract, guaranteeing the faithful performance of the work in accordance with the terms of the contract within **ten (10)** days after receiving the notice of award of the contract.

10. The undersigned further agrees to begin work not later than **ten (10)** calendar days after the execution or by the date stated within the contract documents and approval of the contract, payment bond, and performance bond, unless otherwise provided, and to prosecute the work in such a manner and with sufficient materials, equipment, and labor as will ensure its completion within the time limit specified herein, it being understood and agreed that the completion within the time limit is an essential part of the contract.

11. The undersigned agrees to complete the work within the time stipulated in the Special Provisions.

12. All work shall be completed to the satisfaction of the District by the above dates unless the District in accordance with the specifications, grants additional time. In case of failure to complete the work within the time named herein, or within such extra time as may have been allowed by extensions, the undersigned agrees that the District shall withhold from such sums as may be due him under the terms of the contract the liquidated damages as set forth in the Special Provisions, which costs shall be considered and treated not as a penalty, but as damages due the District from the undersigned by reason of inconvenience to the public, added cost of engineering and supervision, and other items which have caused an expenditure of public funds resulting from the failure of the undersigned to complete the work within the time specified in the contract.

13. If this proposal is accepted and the undersigned shall fail to execute a contract and bonds as required herein, it is hereby agreed that the amount of the bid bond shall become the property of the District and shall be considered not as a penalty but as payment of liquidated damages due to delay and other causes suffered by the District because of the failure to execute said contract and bonds, otherwise said bid bond shall be returned to the undersigned.

14. Accompanying this proposal is a **5% Bid Bond**, using the form provided.

15. The undersigned submits herewith his schedule of prices covering the work to be performed under this contract, he understands that he must show in the schedule the unit prices for which he proposes to perform each item of work, that the extensions must be made by him, and that if not so done, his proposal may be rejected as irregular or non-responsive.

16. The District reserves the right to reject any or all of the bids and to waive any and all irregularities and technicalities. The District shall either award the project or reject the bids within Sixty (60) calendar days after the bid opening. This time frame may be extended upon mutual agreement of the District and the Bidder.

17. The undersigned of this proposal agrees that he has examined all sections of this Proposal, Specifications, and Bidding Documents and hereby understands and accepts the provisions for access, or the lack of access, to the construction site and shall claim no compensation other than the prices as bid for this condition of accessibility.

18. The undersigned further agrees that the unit prices submitted herewith are for the complete item constructed, including all labor, equipment, material and other necessary incidental work.

19. The undersigned agrees to indemnifying and saving harmless the District, its officers, agents, employees, and servants in accordance with the General Conditions.

20. The undersigned shall be properly insured prior to execution of the contract by filing with the District, prior to the execution of the contract, copies of completed Certificates of Insurance satisfactory to the District, with the District named as co-insured; automobile liability insurance covering owned, non-owned, and hired vehicles with limits of liability as stated in the District's General Conditions.

21. No bid shall be considered unless the party offering it shall furnish evidence satisfactory to the District that he has been previously engaged in the quality construction of improvements of the same character as the one herein specified, and that he has the necessary facilities, equipment, experience, and ability and pecuniary resources to fulfill the conditions of the contract

22. In submitting this Offer, the Bidder acknowledges that:

All bid documents have been examined: Instructions to bidders, Specifications and the following addenda:

No. _____, No. _____, No. _____, No. _____, No. _____ (Bidder to acknowledge addenda here).

23. The undersigned submits herewith this **Schedule of Prices** covering the work to be performed under this contract:

BID SCHEDULE

Schedule of Values Table

Bid Item	Description	Quantity	Unit	Unit Cost	Cost
1	Mobilization & Demobilization	1	LS	\$	\$
2	Erosion Control	1	LS	\$	\$
3	Site Grading and Improvements	1	LS	\$	\$
4	Shallow Utility Installation	1	LS	\$	\$
5	Yard Piping	1	LS	\$	\$
6	Pump Station Concrete	1	LS	\$	\$
7	Pump Station Building	1	LS	\$	\$
8	Pump Skid	1	LS	\$	\$
9	Process Piping	1	LS	\$	\$
10	Pump Station Mechanical/HVAC	1	LS	\$	\$
11	Pump Station Electrical	1	LS	\$	\$
12	Generator and ATS	1	LS	\$	\$
13	Site Restoration	1	LS	\$	\$
Total Bid					\$

BID SCHEDULE SUMMARY

Total \$ _____

Total Price Bid _____

_____ Dollars

Signature Line

By:

CONTRACTOR:

RETURN WITH BID

Signatures

(If an individual)

Signature of Bidder _____

Business Address _____

(If a partnership)

Firm Name _____

Signed by _____

Business Address _____

Insert
Names and
Addresses of
All Partners

(If a corporation)

Corporate Name _____

Signed By _____

President

Business Address _____

President _____

Secretary _____

Treasurer _____

Attest: _____
Secretary

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____

_____ firmly bound unto the CLIFTON WATER DISTRICT Acting By and Through Its Water Activity Enterprise, Clifton, Colorado, ("DISTRICT") in the penal sum of five percent (5%) of the total amount of the BID for payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed this ____ day of _____, 2026.

The condition of the above obligation is such that whereas the Principal has submitted to the CLIFTON WATER DISTRICT, Clifton, Colorado, a certain BID, attached hereto and hereby made a part thereof, to enter into a Contract in writing, for the **Desert Road Pump Station 2024-02**.

NOW, THEREFORE,

(a) If said BID shall be rejected, or

(b) If said BID shall be accepted and the principal shall execute and deliver a Contract in the form of Contract attached hereto (properly completed in accordance with said BID) and shall furnish a BOND for his faithful performance of said Contract, and for payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the Contract created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of the obligation as herein stated.

The Surety, for value received, hereby stipulates, and agrees that the obligation of said Surety and its BOND shall be in no way impaired or affected by any extension of time within which the DISTRICT may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate officers, the day and year first set forth above.

Principal _____ ATTEST: _____

By: _____

BY: _____

Surety

Witness:

By: _____

IMPORTANT: Surety companies executing BOND must appear on the Treasury Department's most current list (Circular 570, as amended) and be authorized to transact business in Colorado.

NOTICE OF AWARD

Date:

Contractor:

PROJECT DESCRIPTION: Project 2024-02 – Desert Road Pump Station

The DISTRICT has considered the BID submitted by the Contractor for the above-described Project in response to the Advertisement for Bids dated **month/day/year**.

The Contractor is hereby notified that the BID received from the Contractor for the Project in the amount of **\$XXXXXX** has been accepted for the Clifton Water District Board of Directors on **XX/XX/XXXX**.

The Contractor is required by the Information for Bidders and Bid Proposal to execute the Contract and provide all required Bonds and Certificates of Insurance within ten (10) calendar days from the date of this Notice of Award.

If the Contractor fails to execute said Contract and to furnish the Bonds and Certificates of Insurance within ten (10) calendar days from the date of this Notice of Award, the DISTRICT shall be entitled to forfeiture of the Bid Bond to the District. The DISTRICT shall also be entitled to such other rights as may be granted by law or the Contract Documents.

The Contractor is required to return an acknowledged copy of this Notice of Award to the CLIFTON WATER DISTRICT.

CLIFTON WATER DISTRICT
Acting By and Through Its Water
Activity Enterprise

510 34 Road
Clifton, Colorado 81520

By: _____
Ty Jones
Title: Manager

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged.

Contractor: _____

By: _____

Date: _____

Title: _____

CONTRACT

THIS CONTRACT made this ____ day of _____ 20XX, by and between the Clifton Water District, Acting By and Through Its Water Activity Enterprise ("DISTRICT") and _____ doing business as a contractor, ("CONTRACTOR").

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The CONTRACTOR agrees to perform all of the WORK described in the CONTRACT DOCUMENTS and comply with the terms therein for the sum of _____ Dollars and _____ Cents (\$_____) or as shown on the Bid Schedule (payment shall be paid by the unit price bid for each item). The CONTRACTOR will commence and complete the Clifton Water District Project 2024-01, in accordance with the CONTRACT DOCUMENTS.

2. The CONTRACTOR will furnish all the supplies, tools, equipment, labor and other services necessary for the construction and completion of the PROJECT described herein ("WORK").

3. The CONTRACTOR will commence the WORK required by the CONTRACT DOCUMENTS within (10) calendar days after the date of the NOTICE TO PROCEED and shall complete same within one hundred fifty (150) calendar days of the date on the NOTICE TO PROCEED unless the period for completion is extended otherwise by the CONTRACT DOCUMENTS.

4. This Contract includes and incorporates by reference all the CONTRACT DOCUMENTS. The term CONTRACT DOCUMENTS means and includes the following:

- (a) Advertisement for Bids
- (b) Information for Bidders
- (c) Bid Proposal
- (d) Bid Bond
- (e) Contract
- (f) General Conditions
- (g) Special Conditions and Special Provisions
- (h) Payment Bond
- (i) Performance Bond
- (j) Notice of Award
- (k) Notice to Proceed
- (l) Change Orders
- (m) The Clifton Water District Design and Construction Standard Specifications latest revision.
- (n) Project Drawings/Plans
- (o) Addenda
- (p) Mesa County Work in Right of Way Permit and associated Stipulations if applicable.
- (q) State of Colorado Department of Transportation Work in Right of Way Permit and associated Special Conditions if applicable.

5. The DISTRICT will pay the CONTRACTOR in the manner and at such times as

set forth in the General Conditions such amounts as required by the CONTRACT DOCUMENTS and in accordance with C.R.S. § 38-26-107 if applicable.

6. The amount of money appropriated by the DISTRICT is equal to or in excess of the Contract amount shown above at Paragraph 1. The DISTRICT is precluded from issuing any Contract modification or directive requiring additional compensable work to be performed, which work causes the aggregate amount payable under the Contract to exceed the amount appropriated for the original Contract unless the CONTRACTOR is given written assurance by the DISTRICT that lawful appropriations to cover the costs of the additional work have been made and the appropriations are available prior to the performance of the additional work unless the work is covered under a remedy-granting provision in the Contract.

7. Notwithstanding any provisions of this Contract to the contrary, no term or condition of this Contract shall be construed or interpreted as a waiver, either expressed or implied, of the monetary limitations on liability or any of the immunities, rights, benefits or protections provided to the DISTRICT under the Colorado Governmental Immunity Act, § 24-10-101, et seq. C.R.S., as amended or as may be amended. The parties understand and agree liability for claims for injuries to persons or property arising out of the alleged negligence of the DISTRICT, its officials and employees may be controlled or limited by said Act, as amended or as may be amended. Any provision of this Contract, whether or not incorporated herein by reference, shall not be interpreted to control, limit or otherwise modify so as to limit any liability protection of the DISTRICT pursuant to the above cited laws.

8. This Contract shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

9. This Contract is intended be the full, complete and integrated expression of the parties' agreements relating to the subject matter hereof, with all prior agreements, negotiations and discussions being merged herein. Neither this Contract nor the rights and obligations under it may be changed, modified, or waived except by an instrument in writing that is signed by the parties.

10. Waiver of strict performance or the breach of any provision of this Contract shall not be deemed a waiver nor shall it prejudice the waving party's right to require strict performance of the same provision, or any provision in the future, unless waiver has rendered future performance impossible.

11. If any provision of this Contract is determined to be unenforceable or invalid for any reason, the remainder of the Contract shall remain in effect, unless otherwise terminated in accordance with the terms contained herein.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Contract in three (3) copies, each of which shall be deemed an original on the date first above written.

DISTRICT

CLIFTON WATER DISTRICT
Acting By and Through Its Water Activity Enterprise Fund
510 34 Road
Clifton, Colorado 81520

By: _____
Board President

(SEAL)

ATTEST: By: _____
Board Secretary

CONTRACTOR:

By: _____

Name: _____

Title: _____

(SEAL)

ATTEST:

Name: _____

Title: _____

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

BOND NO. _____

CONTRACTOR:

A (An) _____, hereinafter called Principal, and
(Corporation, Partnership, Limited Liability Company or Individual)

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto the Clifton Water District Acting By and Through Its Water Activity Enterprise, 510 34 Road, Clifton, Colorado 81520; hereinafter called DISTRICT, in the penal sum of _____ Dollars (\$ _____) in lawful money of the United States, for the payment in which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the DISTRICT, dated the ____ day of _____ 20XX a copy of which is hereto attached and made a part hereof for the Desert Road Pump Station 2024-02.

NOW, THEREFORE, if the principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term thereof, and any extensions thereof which may be granted by the DISTRICT, with or without notice to the Surety and during the eighteen month warranty and guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the DISTRICT from all; costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the DISTRICT all outlay and expense which the DISTRICT may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the DISTRICT and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in three (3) counterparts, each of which shall be deemed an original, the ____ day of ____ 20XX.

ATTEST:

_____ Secretary (Principal)	_____ Principal
--------------------------------	--------------------

By: _____

Witness as to Principal

Address

ATTEST:

_____ Secretary (Surety)	_____ Surety
-----------------------------	-----------------

By: _____

Witness as to Surety

Address

NOTE: Date of BOND must not be prior to the date of the Contract. If CONTRACTOR is a Partnership, all Partners should execute the BOND.

IMPORTANT: Surety Companies executing the BOND must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in Colorado.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: **that**

BOND NO. _____

CONTRACTOR:

a (an) _____, hereinafter called Principal, and
(Corporation, Partnership, or Individual)

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto the Clifton Water District Acting By and Through Its Water Activity Enterprise, 510 34 Road, Clifton, Colorado 81520: hereinafter called DISTRICT, in the penal sum of _____ Dollars (\$ _____) in lawful money of the United States, for the payment in which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain Contract with the DISTRICT, dated the ____ day of ____ 20XX, a copy of which is hereto attached and made a part hereof for the Desert Road Pump Station 2024-02.

NOW, THEREFORE, if the Principal shall promptly make all payments to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such Contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, fuel, repairs in machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in any work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the WORK to be performed thereunder or to the SPECIFICATIONS accompanying the same shall in any way affect its obligations on this BOND, and does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the WORK or to the SPECIFICATIONS.

PROVIDE, FURTHER, that no final settlement between the DISTRICT and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in three (3) counterparts, each of which shall be deemed an original, this ____ day of _____ 20XX.

ATTEST:

_____ Secretary (Principal)	_____ Principal
	By: _____

Witness as to Principal

Address

ATTEST:

_____ Secretary (Surety)	_____ Surety
	By: _____

	_____ Address

Witness as to Surety

Address

NOTE: Date of BOND must not be prior to the date of the Contract. If CONTRACTOR is a Partnership, all Partners should execute the BOND.

IMPORTANT: Surety Companies executing the BOND must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in Colorado.

CERTIFICATE OF INSURANCE

A certificate of insurance will be inserted here. Insurance will be in accordance with the General Conditions.

**Please review the insurance specifications in the SPECIAL CONDITIONS (Section SC-V).
The SPECIAL CONDITIONS will prevail over the GENERAL CONDITIONS.**

CERTIFICATE OF TAX EXEMPTION

A certificate of sales tax exemption will be inserted here. In accordance with Paragraph FF, Section 3 and Paragraph SC-FF, Section 2, of the CONTRACT DOCUMENTS, the CONTRACTOR will obtain a certificate of sales tax exemption if applicable for this PROJECT.

NOTICE TO PROCEED

TO:

DATE:

PROJECT DESCRIPTION: **Desert Road Pump Station**

Project 2024-02

You are hereby notified to commence WORK in accordance with the Contract dated the ____ day of _____, 20XX, on or before _____, 20XX, and you are to complete the WORK in a diligent manner within the time frame as specified on the BID.

The date of completion of all WORK is therefore _____, 20XX.

Reasonable time extensions due to the delays of material, delivery, weather conditions or delays approved in accordance with the applicable paragraphs in both the Special Conditions and the General Conditions of this document, may be made if the DISTRICT determines it is necessary and that the delays were not the fault of the CONTRACTOR.

CLIFTON WATER DISTRICT

Acting By and Through Its Water Activity Enterprise

By: _____

Title: District Manager

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by: _____

—

this ____ day of _____, 20XX

By: _____

Title: _____

CONTRACTOR: _____

Date of Completion	Amount of Contract	Date of Estimate
Original _____	Original \$ _____	From _____
Revised <u>n/a</u> _____	Revised <u>n/a</u> _____	To _____

Description of PROJECT: **Desert Road Pump Station**
Project 2024-02

Contract Items						This	Total to Date
Item	Quantity	Unit	Unit Price	Quantity	Amount	Period Quantity	Amount
_____	_____	_____	\$ _____	_____	\$ _____	_____	\$ _____
---See Attached----							

-							
TOTAL*					\$ _____	\$ _____	

* This total does not represent the total to be paid in this partial payment estimate. The total to be paid on this partial payment estimate is shown on page 2 in the "BALANCE DUE THIS PAYMENT" line.

CONTRACTOR: _____

Date of CompletionAmount of ContractDate of Estimate

Original _____

Original \$ _____

From _____

Revised n/aRevised n/a

To _____

Description of PROJECT: **Desert Road Pump Station – 2024-02**ANALYSIS OF WORK PERFORMEDThis PeriodTotal to Date

(a) Cost of original contract work performed

\$ _____

\$ _____

(b) Approved CHANGE ORDER(S)

\$ _____

\$ _____

(c) Total cost of work performed

\$ _____

\$ _____

(d) Add materials stored at close of this period

\$ _____

\$ _____

(e) Less amount retained in accordance with contract terms

(Show both percent and dollar amount)

5%

\$ _____

\$ _____

(f) Subtotal

\$ _____

\$ _____

(g) Less amount of previous payments

\$ _____

\$ _____

(h) BALANCE DUE THIS PAYMENT

\$ _____

\$ _____

CERTIFICATION OF CONTRACTOR

According to the best of my knowledge and belief, I certify that all items and amounts shown on page 1 of this Partial Payment Estimate are correct; that all WORK has been performed and/or material supplied in full accordance with the requirements of the referenced Contract, and/or duly authorized deviations, substitutions, alterations, and/or additions; that the foregoing is a true and correct statement of the Contract account up to and including the last day of the period covered by this Partial Payment Estimate; that no part of the "Balance Due This Payment" has been received, and that the undersigned and his subcontractors have - (check applicable line)

a. ☐ Compiled with all the labor provisions of said Contract

b. ☐ Compiled with all the labor provisions of said Contract except in those instances where an honest dispute exists with respect to sold labor provisions. (If (b) is checked, describe briefly nature of dispute) _____

(Contractor)By: _____
(Signature of Authorized Representative)20XX

Title _____

CHANGE ORDER

Order Number One (1)

Date:

Agreement Date:

NAME OF PROJECT: **Desert Road Pump Station – Project 2024-02**

DISTRICT: Clifton Water District, Acting By and Through Its Water Activity
Enterprise

CONTRACTOR:

The following changes are hereby made to the CONTRACT DOCUMENTS:

Justification:

Change of Contract Price:

Change to Contract Time:

Approvals Required

Recommended by:

Date Clifton Water District Field Representative

Accepted by:

Date Contractor

Approved by:

Date Clifton Water District, Acting By and Through Its Water Activity
Enterprise

NOTICE OF SUBSTANTIAL COMPLETION
Clifton Water District
Acting By and Through Its Water Activity Enterprise
510 34 Road, Clifton, CO 81520

Project Name: XXXXXXXXXXXX
Contractor: XXXXXXXXXXXX
Date: XXXXXX/XXXXXXX

The Clifton Water District conducted has found the above referenced Project to be Substantially Complete. The outstanding items on the attached Punch List must be completed prior to the Contractor's application for Final Acceptance of the Project.

Clifton Water District, Acting By and Through Its Water Activity Enterprise

Title

Date: _____

NOTICE OF FINAL COMPLETION INSPECTION
Clifton Water District
Acting By and Through Its Water Activity Enterprise
510 34 Road, Clifton, CO 81520

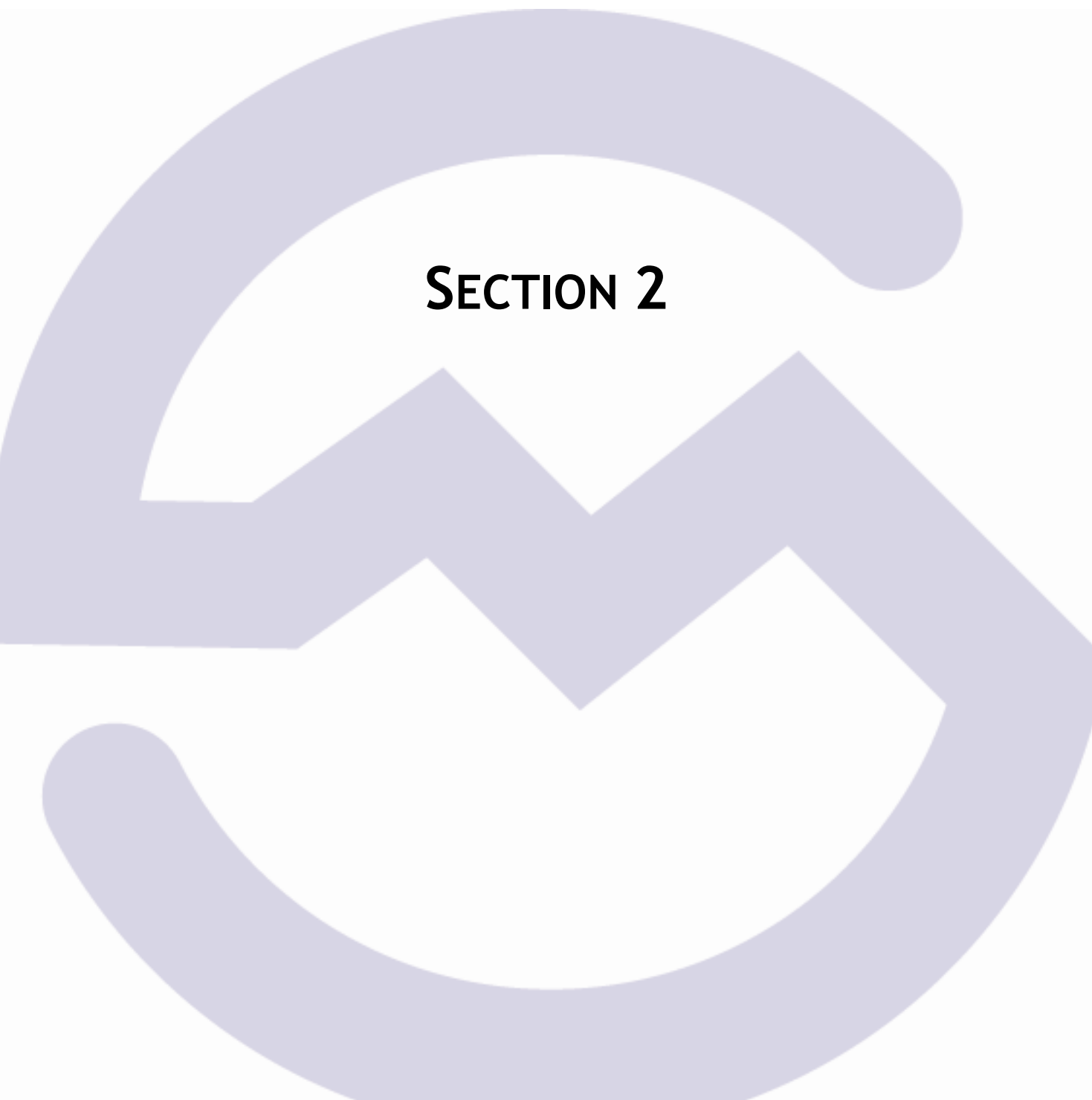
Project Name: XXXXXXXXXXXX
Contractor: XXXXXXXXXXXX
Date of final Completion: XXXXXX/XXXXXXX
End of warranty period: XXXXXXXXXXXXXXXX

The Contractor is hereby notified that the above referenced Project is complete and has been accepted by the Clifton Water District. The Contractor shall warrant all work for the Project for 180 days after the date of Final Completion.

Clifton Water District, Acting By and Through Its Water Activity Enterprise

Title

Date: _____

A large, light purple stylized logo is centered on the page. It features a thick, curved line at the top that forms an arch, a central zigzag line, and a thick, curved line at the bottom that forms a wide, open U-shape.

SECTION 2

SECTION 2

SPECIAL CONDITIONS & PROVISIONS

- A. **SPECIAL CONDITIONS** The following Special Conditions modify the General Conditions provided in Section 3.

SPECIAL CONDITIONS INDEX			
Section 3 General Condition Paragraph Modified	Section 2 Special Condition Paragraph	Description	Page
D	SC-D1	Hours of Work	2-2
D	SC-D2	Timely Demand for Instructions	2-2
E	SC-E	Contract Documents at the Jobsite	2-2
G	SC-G1	Staging Area/Construction Phasing	2-2
G	SC-G2	Flushing & Disinfection	2-3
H	SC-H	Testing Services	2-3
K	SC-K	Mesa County	2-3
L	SC-L1	Traffic Control	2-3
L	SC-L2	Safety	2-3
P	SC-P1	Time of Completion	2-4
P	SC-P2	Liquidated Damages	2-4
S	SC-S	Inadequate Progress	2-4
T	SC-T	Payment Requests	2-5
V	SC-V	Insurance Limits and Indemnification	2-5
BB	SC-BB	Authorized Representatives	2-5
CC	SC-CC	Acquisition of Easements	2-6
FF	SC-FF	Sales or Use Taxes	2-6

This project includes supplying all labor, material, and equipment to install approximately 250 square foot pump station, including booster pump skid, yard piping/interconnections to the distribution system, standby generator, electrical, HVAC and other miscellaneous work as described in the Contract Documents.

These Special Conditions pertain to the WORK that will be performed by the CONTRACTOR.

The performance of the WORK for this PROJECT shall conform to General Conditions presented in Section 3, except that these General Conditions are specifically modified or supplemented by these Special Conditions.

SC-D1 **Hours of Work:** Unless otherwise approved in advance, all hours of work will be accomplished within the normal working hours of 8:00 a.m. to 5:00 p.m. on regular working days. No work shall be authorized on a Saturday, Sunday, or DISTRICT- recognized Holidays, or after normal working hours without prior approval from the DISTRICT. Any WORK that is accomplished during non-working hours without an inspector being present will be done at the direct responsibility of the CONTRACTOR and the DISTRICT may require the WORK to be uncovered for inspection. WORK not meeting these specifications will be redone by the CONTRACTOR. No extra compensation will be allowed to the CONTRACTOR for opening up for inspection, even if this WORK is found to be accomplished in accordance with these specifications.

SC-D2 **Timely Demand for Instructions:** The CONTRACTOR, when deemed necessary, shall request instructions in a timely manner from the DISTRICT. The CONTRACTOR shall not proceed with the PROJECT until he has received instructions as may be necessary as the WORK progresses.

SC-E **Contract Documents:** The CONTRACTOR'S superintendent shall have at the jobsite while work is in progress the PROJECT Special Conditions and Provisions, the Construction Drawings, and the General Contract Conditions.

SC-G1 **Staging Area:** A staging area has not been identified within or outside of the PROJECT work area. Any materials, equipment or construction vehicles stored or used onsite shall be placed in locations that do not interfere with normal traffic or off-road accesses. If staging is to occur on private property, the DISTRICT shall receive from the CONTRACTOR a copy of a signed agreement between the

CONTRACTOR and DISTRICT of property where staging is to occur prior to staging on private property.

- SC-G2** **Flushing & Disinfection:** DISTRICT personnel in conjunction with the CONTRACTOR will flush and disinfect the new line. The DISTRICT will furnish the water for flushing and disinfection. The CONTRACTOR shall disinfect and flush the new line in accordance with the SPECIFICATIONS and take care to control the dispersal of flushing water.
- SC-H** **Testing:** All testing as required by the Standard Technical Specifications shall be arranged, scheduled, and paid for by the CONTRACTOR. The tester shall immediately notify the DISTRICT and CONTRACTOR's supervisor of any failing tests, and a written hard copy of test results shall be provided to the DISTRICT within three working days from when the test was taken. CONTRACTOR responsible for all retesting costs and scheduling.
- SC-K** **Mesa County:** A Mesa County utility permit is required for the work in the various street rights-of-way. The permits have been obtained by the DISTRICT, copies of which will be provided to the CONTRACTOR. The inability to work because of conformance with the requirements of the permits will not be counted as time against the Working Days or partial days allowed for the Time of Completion.
- SC-L1** **Traffic Control:** According to the utility permits issued for this PROJECT, the CONTRACTOR must submit a traffic control plan to the DISTRICT prior to issuance of the NOTICE TO PROCEED. These traffic control plans shall be filed by the DISTRICT with Mesa County and CDOT. The CONTRACTOR must include costs for traffic control in their bid. If additional traffic control is needed due to a change in work or methods, the CONTRACTOR shall immediately notify the DISTRICT'S REPRESENTATIVE and proceed to have modified Traffic Control Plans prepared and presented to DISTRICT for approval. Additionally, the CONTRACTOR shall secure adequate traffic control support for construction activities performed within the privately owned parking and vehicle travel routes.
- SC-L2** **Safety:** The CONTRACTOR shall be responsible for complying with all applicable laws and regulations of the State of Colorado and the requirements of the Occupational Safety and Health Administration. The CONTRACTOR shall furnish the following information prior to PROJECT

start-up:

1. Identification and qualification of the PROJECT Safety Officer
2. Emergency Contact Numbers for PROJECT Safety Officer (Office/Home/Cell)
3. Brief statement describing CONTRACTOR'S Safety Policy and methods for assuring compliance by SUBCONTRACTORS and delivery vendors (May include, but not limited to general housekeeping, equipment maintenance and repair, fuel storage, and equipment operational requirements)
4. Statement describing what arrangements are in place for emergency response to first-aid injuries (Trained personnel, emergency routes, nearest medical facilities, and other pertinent emergency requirements)
5. Proposed safety meeting schedules and topics
6. Statement describing what personal protective equipment (hard hats, safety boots, goggles, glasses, hearing protection, etc.) will be required on this PROJECT and who is responsible for providing it and assuring compliance
7. Sanitary facilities will need to be provided by the CONTRACTOR.
8. Informational signboard identifying jobsite safety requirements, emergency medical requirements, and any other pertinent data the CONTRACTOR feels is necessary to maintain a safe work environment to CONTRACTOR employees and subcontractors, DISTRICT staff personnel and other individuals accessing the site on official business.

SC-P1 **Time of Completion:** The time of completion for the PROJECT will be **150 Calendar Days** from the starting date specified in the NOTICE TO PROCEED.

SC-P2 **Liquidated Damages:** The CONTRACTOR agrees that as a part of the consideration for the DISTRICT'S awarding of this Contract, liquidated damages in the daily amount of **\$2,500.00** is reasonable and necessary to pay for the damages resulting from CONTRACTOR'S failure to complete the WORK within the CONTRACT TIME or approved extension of time. See Section 3, General Conditions, Paragraph P for further discussion of liquidated damages.

SC-S **Inadequate Progress:** The CONTRACTOR will be responsible to proceed with the WORK in a diligent manner in order that all WORK may be accomplished by the assigned time. In the event, that in the opinion of the DISTRICT, the CONTRACTOR is not pursuing the WORK with due diligence, the CONTRACT will be terminated, and the CONTRACTOR will forfeit all rights to

complete the WORK. The DISTRICT will have the right to enter into a contract with any other CONTRACTOR of its choice in order to see that the WORK is accomplished in a timely manner.

SC-T **Payment Requests:** Authorized payments to the CONTRACTOR will be made on the first Thursday of each month at the regular meeting of the Board of Directors of the DISTRICT. All requests for payment must be in the DISTRICT'S office at 510 34 Road, Clifton, CO by Close of Business (COB) the third Friday of each calendar month the PROJECT is underway. The payment will be considered for payment at the next scheduled Regular District Board Meeting (typically the first Thursday of the month).

SC-V **Insurance Limits:** The CONTRACTOR shall purchase and maintain insurance as described in Paragraph V, Section 3. The CONTRACTOR shall also abide by Subparagraph 2 of Paragraph V, Section 3.

The CONTRACTOR shall procure and maintain, at his own expense, during the contract time, liability insurance as hereinafter specified:

Proof of Worker's Compensation with scope and limits as required by the laws in the State of Colorado.

Business and auto liability insurance with coverage no less than one million dollars (\$1,000,000) combined single limit per accident for bodily injury and property damage.

Commercial general liability insurance in the amount of one million dollars (\$1,000,000), combined single limit, per occurrence per bodily injury, personal injury and property damage.

SC-BB **Authorized Representatives of Clifton Water:** Those authorized to represent the DISTRICT on this PROJECT shall include personnel employed by the DISTRICT. All notices, letters, submittals, and other communications directed to the DISTRICT shall be addressed and mailed or delivered to:

Clifton Water
Attn: Jacob Lenihan
510 34 Road
Clifton, CO 81520

SC-CC **Acquisition of Easements:** All WORK will be conducted within Mesa County Rights-of Way and/or exclusive waterline easements

secured by the DISTRICT.

SC-FF

Sales or Use Taxes: The DISTRICT is a Special District within the meaning of the Special District Act C.R.S. § 32-1-101 et seq. and is sales tax exempt. The CONTRACTOR (and all SUBCONTRACTORS) will be required to make application to the State Department of Revenue for Certificates of Exemption for sales tax for materials used in this PROJECT.

End Special Conditions

- B. SPECIAL PROVISIONS** The following Special Provisions modify the Standard Technical Specifications that are provided in Section 4.

SPECIAL PROVISIONS INDEX		
Section 2 Special Provisions Paragraph	Description	Page
SP-1	General	2-7
SP-2	Modifications and Amendments to Clifton Water Standard Specifications	2-8
SP-3	Stormwater Management	2-8
SP-4	Measurement and Payment Descriptions: 105.1 -105.13	2-8 to 2-13
SP-5	Asphalt Patching/Temporary Trench Surface Maintenance	2-13
SP-6	Cutoff Walls	2-13
SP-7	Erosion Control	2-13
SP-8	Watering and Dust Palliatives	2-14
SP-9	Construction Surveying	2-14
SP-10	Traffic Control	2-14

SP-1 General Work for this PROJECT shall conform to Project Specifications, which are as follows:

- The DISTRICT'S Standard Technical Specifications shall be considered as Supplemental Specifications that modify, amend, or revise the DISTRICT'S "Design and Construction Standard Specifications" revised April 9, 2025, as presented in Section 4.
- These Standard and Supplemental Specifications are specifically modified or amended by these Special Provisions and may also be modified by specifications on the Project Construction Drawings.
- CONTRACTOR to coordinate with both the Grand Valley Drainage District and Mesa County when crossing storm drainage facilities.
- CONTRACTOR is responsible for pressure testing of installed water mains. The testing shall be observed by DISTRICT personnel as well as the DISTRICT'S REPRESENTATIVE.

The descriptions of the pay items listed in the Bid Schedule for the PROJECT may not agree with those listed in the Standard Specifications. Payment for all WORK performed, as required in the CONTRACT DOCUMENTS, will be in accordance with the items and units listed in the Bid Schedule.

SP-2 Modifications and Amendments to Clifton Water Standard Specifications

CONNECTION TO EXISTING DISTRIBUTION SYSTEM

Connections of new PVC main lines shall be completed by DISTRICT staff with assistance from the CONTRACTOR. CONTRACTOR shall provide all materials (excepting pipe and fittings) needed as per the design documents with the physical installation of new to existing infrastructure performed by DISTRICT personnel. Where connections are made to existing AC main lines, HYMAX GRIP couplings and thrust blocks shall be used.

SP-3 Stormwater Management

A Stormwater Management Plan (SWMP) has not been developed for this PROJECT based on the calculations showing less than one acre of surface disturbance is expected. The CONTRACTOR is however required to utilize best management practices (BMP) in dealing with runoff from this construction site.

SP-4 Measurement and Payment Descriptions – Section 105

Description

The complete and accepted pipeline will be paid for in accordance with the items listed in the Bid Schedule, approved CHANGE ORDERS, and these specifications.

BASIS OF PAYMENT

1. Progress payments will be made on the basis of Engineer's opinion of completed work of individual project components, plus suitably stored materials on-hand, per the approved Schedule of Values and in accordance with the terms of the General Conditions and Agreement.
2. LUMP SUM PRICES
 - a. Where lump sum prices are given for a described portion of the work, that price shall cover all materials, equipment and labor necessary to acquire, deliver, store and install that portion of the work, complete and in place, as shown and indicated in the drawings and as described in the Project Manual.
 - b. Quantities given in the Bid Form are estimates for the purpose of evaluating Bids. Consequently, some differences may arise in actual and bid quantities.
 - c. Quantities given for lump sum items, including earthwork, are estimates only. The Contractor should satisfy itself as to the actual quantities required to complete the work described in the Drawings and Specifications. Unit costs for earthwork will not be employed to determine payment.
3. UNIT PRICE BID ITEMS

- a. Payment for work included in unit price bid items shall be based on the completed value of each unit in such quantity actually installed as measured and determined by Engineer unless the approved Schedule of Values provides sufficient detail for measurement and payment of partial progress of work.
- b. Unit pricing shall include all materials, equipment and labor necessary to complete the bid item as shown and indicated in the project documents.
- c. Quantities given in the Bid Form are estimates for the purpose of evaluating Bids. Consequently, some differences may arise in actual and bid quantities.
- d. Contractor or Owner may request re-negotiation of Unit Price for an item if the actual field measured work done for that item differs from the estimated quantity by more than 50% under the following terms:
 - i. Contractor shall not make any claim for damages for any work item for which the actual field measurement does not differ from the estimated quantity by more than fifty percent (50%), higher or lower.
 - ii. Re-negotiated Unit Prices shall be based on actual costs to Contractor for the specific work item plus a reasonable allowance for overhead and profit.
 - iii. Re-negotiating the Unit Price shall not increase or decrease the Unit Price by more than ten percent (10%).
 - iv. Contractor shall submit to Owner satisfactory data substantiating the actual costs and overhead rate to perform the Work covered by the Unit Price being re-negotiated.
 - e. No payment will be made if the entire bid item is unused.

4. MINOR CONTRACT REVISIONS

- a. If provided on the Bid Schedule, the Minor Contract Revisions line item is for the sole use of Owner at Owner's discretion for Owner-authorized changes to the project.
- b. The Contractor shall include the dollar amount provided by the Owner for Minor Contract Revisions in its base Bid total.
- c. The intent of this line item is to provide the Owner's designated representative a mechanism to approve minor changes to the Work, originating either from Contractor requests or Owner modifications, without unnecessary project delay and without further approval by the Owner.
- d. The Owner shall retain all unused monies in this line item.
- e. The Owner shall direct Contractor in writing when this line item is to be used along with the amount to be included in the Application for Payment.

5. ALLOWANCES

- a. If provided on the Bid Schedule, an Allowance line item is for the sole use of Owner at Owner's discretion for changes to the project.
- b. Allowance line items shall be administered per conditions of paragraph 13.02 of the Standard General Conditions.

- c. The Owner shall direct Contractor in writing when this line item is to be used along with the all pertinent specifying information for purchase by Contractor.
 - d. Contractor shall submit purchase receipts documenting the cost of Owner-requested materials with Application for Payment for reimbursement.
- 6. **STORED MATERIALS**
 - a. If separate payment is requested for materials suitably stored but not installed, paid invoices for the materials shall be submitted.
 - b. Stored materials will be paid at invoice cost plus a maximum of ten percent (10%) markup to cover submittals, delivery and handling.
 - c. Requests for materials stored offsite must be approved by Engineer. Request must contain name and address of storage location, property owner, insurance summary covering equipment, description of measures to protect equipment from physical and environmental damage, photo documentation of protection in place and identification of material (Owner, project and equipment), and letter granting Owner legal right to entry and retrieval of materials.

105.1 Mobilization & Demobilization

- 1. Description
 - a. This line item is for the costs associated with mobilizing and demobilizing from the project site.
 - b. Item shall also include any item that is required for the project but does not have a specific bid item.
- 2. Specific inclusions, exclusions or special considerations
 - a. Construction fencing
 - b. Site preparation
 - c. Contractor overhead, profit, insurance, bonds, etc.
- 3. Payment Basis
 - a. Lump Sum

105.2 Erosion Control

- 1. Description
 - a. This line item is for the erosion control throughout the project site.
- 2. Specific inclusions, exclusions or special considerations
 - a. All labor, material and equipment required for the installation of erosion control best management practices (BMPs).
- 3. Payment Basis
 - a. Lump Sum

105.3 Site Grading and Improvements

- 1. Description
 - a. This line item is for the site grading and improvements throughout the project site.
- 2. Specific inclusions, exclusions or special considerations
 - a. Includes general site grading.
 - b. Site grading includes generator pad.

- c. Includes fencing
- 3. Payment Basis
 - a. Lump Sum

105.4 Shallow Utility Installation

- 1. Description
 - a. This line item is for shallow utility installation required to facilitate pump station construction.
- 2. Specific inclusions, exclusions or special considerations
 - a. This line shall include all labor, materials, and equipment involved with trenching, pipe embedment, and backfill.
- 3. Payment Basis
 - a. Lump Sum

105.5 Yard Piping

- 1. Description
 - a. This line item is for all yard piping and appurtenances.
- 2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment required to connect the 6" water line to the existing distribution system.
 - b. Includes 6" C900 PVC including excavation and backfill, bedding, compaction, and testing as described in the project documents.
 - c. Includes 6" Gate Valves.
 - d. Includes 6" DIP fittings.
 - e. Includes installation of concrete thrust blocks and other pipe restraints as detailed in project documents.
 - f. Includes tracer wire.
- 3. Payment Basis
 - a. Lump Sum

105.6 Pump Station Concrete

- 1. Description
 - a. This line item is for pump station concrete.
- 2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment required for all the structural concrete for the pump station as described in the project documents.
- 3. Payment Basis
 - a. Lump Sum

105.7 Pump Station Building

- 1. Description
 - a. This line item is for pump station building.
- 2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment required for all the structural building for the pump station, including framing, access and overhead doors, siding, and roofing as described in the project documents.

3. Payment Basis
 - a. Lump Sum

105.8 Pump Skid

1. Description
 - a. This line item is for the pump skid and appurtenances.
2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment required to furnish and install the pump skid as described in the project documents.
3. Payment Basis
 - a. Lump Sum

105.9 Process Piping

1. Description
 - a. This line item is for the all the process piping and appurtenances within the pump station.
2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment, and other associated costs for the installation of the process piping including valves, magmeter, pressure gauges, etc as described in the project documents.
3. Payment Basis
 - a. Lump Sum

105.10 Pump Station Mechanical/HVAC

1. Description
 - a. This line item is for the mechanical/HVAC work for the pump station.
2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment, and other associated costs for the mechanical/HVAC work for the pump station as described in the project documents.
3. Payment Basis
 - a. Lump Sum

105.11 Pump Station Electrical

1. Description
 - a. This line item is for the electrical work for the pump station.
2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment, and other associated costs for the electrical work for the pump station as described in the project documents.
3. Payment Basis
 - a. Lump Sum

105.12 Generator and ATS

1. Description
 - a. This line item is for generator and ATS.

2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment, and other associated costs for the generator and ATS work as described in the project documents.
3. Payment Basis
 - a. Lump Sum

105.13 Site Restoration

1. Description
 - a. This line item is for the site restoration.
2. Specific inclusions, exclusions or special considerations
 - a. Includes all labor, materials and equipment, and other associated costs for the site restoration as described in the project documents.
 - b. Includes re-seeding.
 - c. Includes gravel driveway
 - d. Includes general site cleanup.
3. Payment Basis
 - a. Lump Sum

SP-5 Asphalt Patching / Temporary Trench Surface Maintenance

The CONTRACTOR shall be responsible for maintenance of the temporary trench surface prior to paving. Asphalt millings may be placed, treated with Magnesium Chloride, and compacted to create a durable temporary surface. The temporary surface shall be maintained to provide a uniform smooth surface, free of potholes. Maintenance of the temporary surface shall be incidental to the CONTRACT cost and carried out until the PROJECT is complete with final paving. This work shall be incidental to the CONTRACT price and is not paid for separately.

SP-6 Cutoff Walls

Cutoff walls shall be installed along every utility line to inhibit the movement of ground water through the screened rock bedding. Cutoff walls shall be 5 to 10 feet long and consist of native material or imported material free of organics, and with a maximum stone size of 1-inch, that has a permeability rate the same or less than that of the native material. Cutoff walls shall be constructed by discontinuing the installation of bedding and haunch backfill material and installing approved native or imported material. Cutoff walls shall be installed at intervals not exceeding 200 feet on pressurized lines.

SP-7 Erosion Control

Storm drain inlet protection shall be provided where runoff from construction sites enters conveyance system structures such as drain inlets, drop inlets and curb inlets. Inlet protection devices are for drainage areas of one acre or less. Runoff from areas larger than one acre shall be routed through approved sediment trapping or settling facilities upstream of the inlet.

Storm drain inlet protection devices shall be installed before the contributing drainage area is disturbed. The devices shall remain in place and be maintained until the disturbed area is stabilized.

Inlet protection shall be inspected weekly and within 24 hours after every precipitation event by the Contractor's Erosion Control Supervisor. Sediment deposits shall be removed, and the inlet protection device restored to its original condition when sediment has accumulated to ½ of the capacity of the device, or when the device is no longer functioning as designed. The method of depositing and stabilizing, or disposal of removed sediment shall be approved by the District.

Inlet protection devices shall be removed once the contributing area is stabilized with appropriate vegetation or impervious surface.

SP-8 Watering and Dust Palliatives

The Contractor shall furnish and apply a dust palliative on portions of the roadway, haul roads and other locations as necessary or as directed to prevent air borne dust. This shall include prevention of dust generated from the Contractors operations and from windy weather conditions. Dust abatement shall be provided, as needed, throughout the construction period included nights, weekends and holidays.

Dust palliative may consist of water, magnesium chloride or approved substance. Application of dust palliative shall be done with acceptable sprinkling equipment at an appropriate rate as approved by the District.

SP-9 Construction Surveying

The Contractor shall be responsible for all construction surveying, calculating, layout and staking necessary for construction of all elements of the project. As the work progresses and throughout the duration of the Project, the Contractor and/or its Surveyor shall prepare and maintain current a set of As-Built Construction Drawings showing all changes and deviations from the drawings that were made in the constructed improvements. This shall include all changes in horizontal location and vertical elevation of all constructed improvements, both underground and on the surface. The As-Built drawings shall be available to the Construction Inspector and the District at the job site during working hours. Traffic control for construction surveying will not be measured or paid for separately but shall be included in the work.

SP-10 Traffic Control

- a. No street, alley, sidewalk, trail or other public way shall be closed, blocked or obstructed without first obtaining permission from the District and from the proper authority having jurisdiction over the

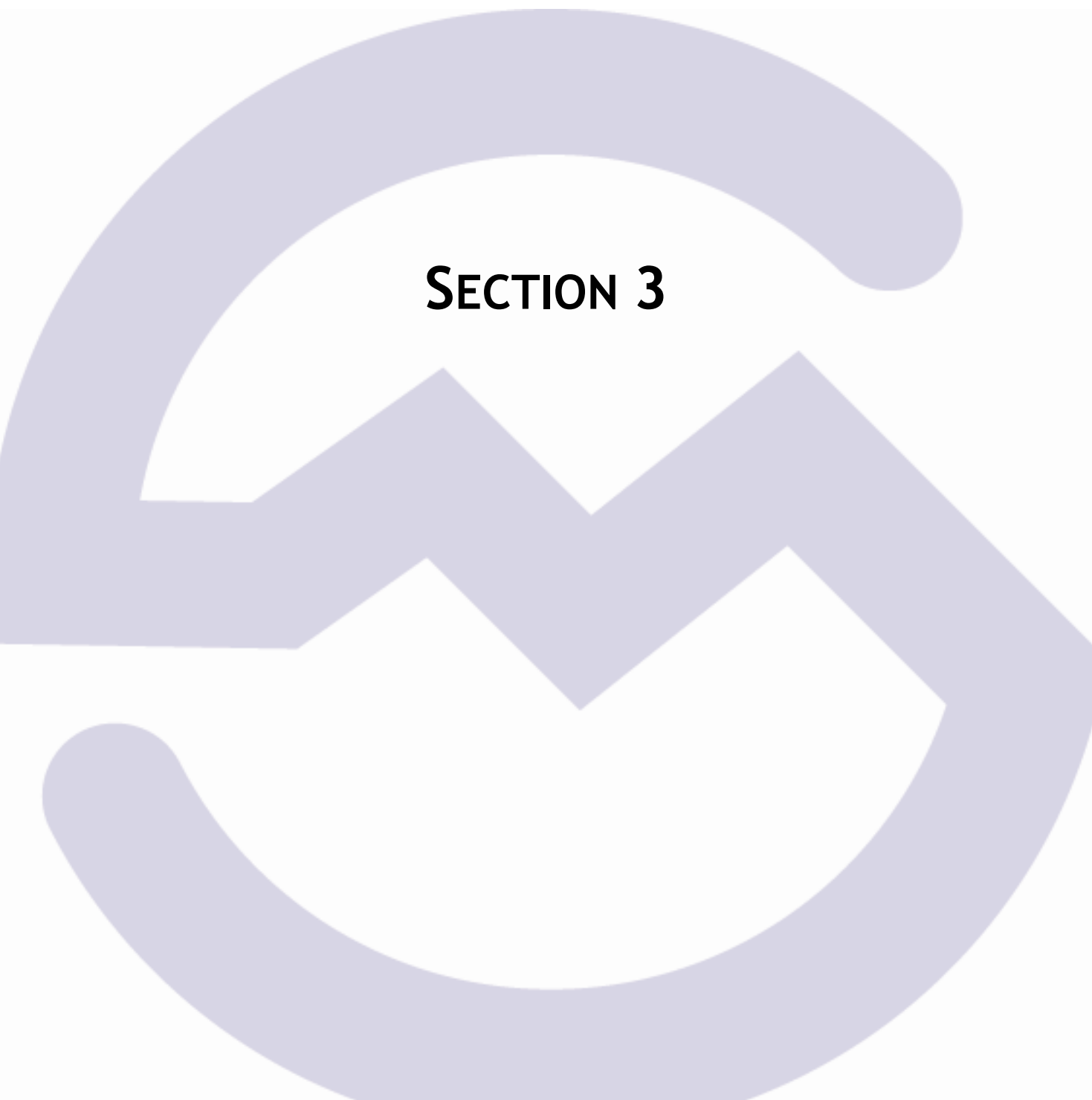
affected right of way. All road closures, lane closures and other traffic controls shall be set up and maintained in accordance with an approved traffic control plan (TCP). The Contractor shall provide all traffic controls as needed for the safe movement of vehicular traffic and pedestrians through or around the construction work zone and for the protection and safety of all persons and property in and around the work zone. All traffic control devices used shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and the approved TCP. All warning signs and barricades shall be constructed and displayed according to standards set forth in the MUTCD.

- b. At least five (5) Working Days before preconstruction meeting, the Contractor shall submit to the District a detailed TCP for review. This plan shall consist of a sketch or drawing showing the information outlined below:
 - i. The vicinity, street names and specific area within which the project is going to occur, as well as all curbs, gutters, sidewalks, driveways, traffic lanes, cross streets, etc. in the vicinity of the Work.
 - ii. Details of all street, sidewalk and lane closures including proposed detour routes. Include the number of days and hours per day that the closures and detours shall be in effect.
 - iii. The type, location and spacing of all barricades, warning signs, detour signs, cones, and other traffic control devices.
 - iv. The locations and schedules of all flaggers who shall be used.
 - v. The name and phone number of the Contractor's designated Traffic Control Supervisor (TCS) and phone numbers of persons who can be reached after working hours, and on holidays and weekends for traffic control needs.
 - vi. Any special notes of information on how the traffic control operation is to be handled.
- c. During progress of the Project, if significant adjustments on the TCP are necessary or desirable, the Contractor shall submit pertinent proposed revisions in writing to the District for approval at least 3 Working Days prior to proposed implementation of the changed plan.
- d. In addition to other required notices (such as newsletters), at least 72 hours prior to closing any street or roadway the Contractor shall verbally notify the District's representative, School District 51, mail delivery and solid waste pick-up, including those listed (with telephone numbers) in the Special Conditions. The Contractor shall notify those referenced above whenever there is a change in a road closure or detour route.
- e. Businesses and residences whose access or parking will be restricted

by a road closure or detour shall be notified by the Contractor at least 48 hours in advance. Notification shall be in writing and may be included in the contractor's weekly newsletter or other approved method. The Contractor shall furnish all barricades, advance warning signs, flaggers, and other traffic control devices required to set up and maintain road closures, detours and lane closures as shown on the TCP or as otherwise directed or approved.

- f. The Contractor should consider subcontracting the traffic control work to a qualified company that provides such services. Should the Contractor decide to rent equipment and do the traffic control work itself, it shall designate a Traffic Control Supervisor (TCS) who shall be responsible for the set up, maintenance and removal of all traffic control devices. This supervisor shall be certified by the American Traffic Safety Services Association (ATSSA). The TCS shall have in possession at all times a copy of the MUTCD or a copy of the ATSSA Guide for Work Area Traffic Control.
- g. In any case, no work shall be done until all advance-warning signs and traffic control devices are in place. The District representative shall have the authority to require the Contractor to provide additional signs or barricades for those locations it deems to be inadequate.
- h. At times, it may be necessary for the Contractor to provide flaggers to direct traffic. All flaggers provided by the Contractor shall be certified by the Colorado Department of Transportation or ATSSA and shall be wearing the proper safety attire while performing the duties of a flagger.
- i. Public sidewalks which are under construction or otherwise obstructed shall be properly barricaded at all times in accordance with applicable regulations. Temporary walkways or pedestrian detours shall be provided around obstructed sections of sidewalk. Temporary walkways shall be structurally sound and on uniform grade. Any sidewalks left closed overnight shall be marked with Type A flashing lights mounted on approved barricades.
- j. Wherever detours are routed over areas other than established public roadways, it shall be the Contractor's responsibility to secure permission from all affected property owners prior to setting up the detours. Traffic shall not be placed on any detour route until it has been graded and delineated in such a way that it is safe for use by the traveling public. The Contractor shall maintain and provide dust control, as needed on all unpaved detour routes.

End Special Provisions

A large, light purple stylized logo is centered on the page. It features a thick, curved line at the top that forms an arch. Below this arch is a horizontal line with a zigzag pattern. At the bottom, another thick, curved line forms a wide, shallow U-shape, mirroring the top arch. The entire logo is composed of solid, light purple strokes.

SECTION 3

GENERAL CONDITIONS

Last revised 11/14/2025

SECTION 3 (Index)

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
A.	General	2
B.	Definitions	2
C.	Additional Instructions and Detail Drawings	4
D.	Schedules, Reports and Records	4
E.	Drawings and Specifications	5
F.	Shop Drawings	5
G.	Materials, Services and Facilities	6
H.	Inspection and Testing.....	6
I.	Substitutions	7
J.	Patents	8
K.	Surveys, Permits, Regulations.....	8
L.	Protection of Work, Property and Persons	8
M.	Supervision by Contractor.....	9
N.	Changes in the Work	9
O.	Changes in Contract Price	10
P.	Time for Completion and Liquidated Damages	10
Q.	Correction of Work	11
R.	Subsurface Conditions.....	11
S.	Suspension of Work, Termination and Delay	11
T.	Payments to Contractor	13
U.	Acceptance of Final Payment as Release	14
V.	Insurance	14
W.	Contract Security	17
X.	Assignments	17
Y.	Indemnification	17
Z.	Separate Contracts	18
AA.	Subcontracting.....	18
BB.	Engineer's Authority.....	19
CC.	Land and Rights-of-Way	19
DD.	Warranty	19
EE.	Arbitration	20
FF.	Taxes	20

GENERAL CONDITIONS

Last revised 11/14/2025

- A. **General**. The following Specifications are general in scope and may refer to conditions which will not be encountered in performance of the work included in this Contract, and which are not applicable thereto. Any requirement, provision, specification, or other stipulation of these General Conditions which refers to a non-existent condition and is not applicable to the work to be performed under this Contract, shall be considered null and void and shall have no meaning in this Contract.

In case of conflict between the General Conditions and the Special Provisions or Technical Specifications, the Special Provisions or Technical Specifications shall govern.

- B. **Definitions**. Wherever used in the Contract Documents, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

1. **"Addenda"**. Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, Drawings and Specifications, by additions, deletions, clarifications or corrections.

2. **"Bid"**. The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

3. **"Bidder"**. Any person, firm or corporation submitting a Bid for the Work.

4. **"Bonds"**. Bid, Performance, and Payment Bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.

5. **"Change Order"**. A written order to the Contractor authorizing an addition, deletion or revision in the Work within the general scope of the Contract Documents or authorizing an adjustment in the Contract Price or Contract Time.

6. **"Contract Documents"**. The Contract, including Advertisement for Bids (sometimes referred to as "Invitation to Bid"), Information for Bidders (sometimes referred to as "Instructions for Bidders"), Bid, Bid Bond, Agreement, Payment Bond, Performance Bond, Notice of Award, Notice to Proceed, Change Order, Drawings, Specifications, Addenda, and in State or Federally funded documents there may be additional requirements such as, but not necessarily limited to, Equal Opportunity Act, Clean Air Act, Clean Water Act, or documents of a similar nature.

7. **"Contract Price"**. The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

8. **"Contract Time"**. The number of calendar days stated in the Contract Documents for the completion of the Work or calendar days changed by a "Change Order" or by other means consistent with these General Conditions.

GENERAL CONDITIONS

Last revised 11/14/2025

9. **"Contractor"**. The person, firm or corporation with whom the Owner has executed the Agreement.

10. **"District"**. The Clifton Water District Acting By and Through Its Water Activity Enterprise.

11. **"Drawings"**. The part of the Contract Documents which show the characteristics and scope of the Work to be performed and which have been prepared or approved by the Engineer. In these Contract Documents, the words "Drawings" and "Plans" are synonymous in all aspects.

12. **"Engineer"**. The Clifton Water District Engineer or person, firm or corporation named as such in the Contract Documents, if applicable, and may include the Owner's Representative within this Contract.

13. **"Field Order"**. A written order affecting a change in the Work not involving an adjustment in the Contract Price or an extension of the Contract Time, issued by the Engineer, to the Contractor during construction.

14. **"Notice of Award"**. The written notice of the acceptance of the Bid from the Owner to the successful Bidder.

15. **"Notice to Proceed"**. Written communication issued by the Owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work.

16. **"Owner"**. The Clifton Water District Acting By and Through Its Water Activity Enterprise.

17. **"Project"**. The undertaking to be performed as provided in the Contract Documents

18. **"Owner's Representative"**. The authorized representative of the Owner who is assigned to the Project site or any part thereof normally referred to in the body of the Specifications or Contract Documents as "OWNER'S REPRESENTATIVE". The Owner's Representative may include the Engineer as defined above.

19. **"Shop Drawings"**. All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, Supplier or distributor, which illustrate how specific portions of the Work shall be fabricated or installed, or specific items incorporated in the Work will be manufactured, or the function of items incorporated in the Work.

20. **"Specifications"**. A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

GENERAL CONDITIONS

Last revised 11/14/2025

21. "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.

22. "Substantial Completion". That date as certified by the Engineer, when the construction of the Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.

23. "Supplemental General Conditions". Modifications to General Conditions required by a Federal Agency for participation in the Project and approved by the agency in writing prior to inclusion in the Contract Documents, or such requirements that may be imposed by applicable State laws.

24. "Supplier". Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not necessarily perform labor at the site.

25. "Work". All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the Project.

26. "Written Notice". Any notice to any part of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address or delivered in person to said party or his authorized representative on the Work.

C. Additional Instructions and Detail Drawings.

1. The Contractor may be furnished additional instructions and detailed drawings, by the Engineer, as necessary to carry out the Work required by the Contract Documents.

2. The additional drawings and instructions thus supplied will become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detailed drawings and instructions.

3. The additional drawings and instructions thus supplied and described in subparagraph 1. above may require additional compensation, less compensation, or the same compensation as identified in the Contract Price. Changes in Contract Price are addressed in Paragraph 0 of this Section.

D. Schedules, Reports and Records.

1. The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the Contract Documents for the Work to be performed.

GENERAL CONDITIONS

Last revised 11/14/2025

2. Prior to the first partial payment estimate the Contractor shall submit construction progress schedules showing the order in which he proposes to carry on the Work, including dates at which he will start the various parts of the Work, estimated date of completion of each part, and as applicable:

a. The dates at which special detail drawings will be required; and

b. Respective dates for submission of Shop Drawings, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

E. Drawings and Specifications.

1. The intent of the Drawings and Specifications is that the Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the Project in an acceptable manner, ready for use, occupancy or operation by the Owner.

2. In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings.

3. Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported to the Engineer, in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities and prior to notifying the Engineer of same in writing shall be done at the Contractor's risk.

4. In case of conflict between the Special Provisions or the Standard Specifications for Design and Construction (Standard Specifications), the Special Provisions shall govern unless a clause in the Special Provisions specifically states that the Standard Specifications shall govern.

F. Shop Drawings.

1. The Contractor shall provide Shop Drawings as may be necessary for the prosecution of the Work as required by the Contract Documents. The Engineer shall promptly review all Shop Drawings. The Engineer's acceptance of any Shop Drawing shall not release the Contractor from responsibility for deviations from the Contract Documents or any errors or omissions in the Shop Drawings. The acceptance of any Shop Drawing which substantially deviates from the requirement of the Contract Documents shall be evidenced by a Change Order.

2. When submitted for review, Shop Drawings shall bear the Contractor's certification that he has reviewed, checked and approved of the Shop Drawings and that they are in conformance with the requirements of the Contract Documents.

GENERAL CONDITIONS

Last revised 11/14/2025

3. Portions of the Work requiring a Shop Drawing or sample submission shall not begin until the Shop Drawing or submission has been accepted by the Engineer. A copy of each accepted Shop Drawing and each accepted sample shall be kept in good order by the Contractor at the site and shall be available for review at the site upon request.

G. Materials, Services and Facilities.

1. It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the Work within the specified time.

2. Materials and equipment shall be stored to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located to facilitate prompt inspection.

3. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

4. Materials, supplies and equipment shall be in accordance with samples submitted by the Contractor and accepted by the Engineer.

5. Materials, supplies or equipment to be incorporated into the Work shall not be purchased by the Contractor or the Subcontractor subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

H. Inspection and Testing.

1. All materials and equipment used in the construction of all the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards and as required and defined in the Contract Documents.

2. The Owner shall provide all inspection and testing services not required by the Contract Documents.

3. The Contractor shall provide at his expense the testing and inspection services required by the Contract Documents.

4. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer the required certificates of inspection, testing or approval.

GENERAL CONDITIONS

Last revised 11/14/2025

5. Inspections, tests or approvals by the Engineer or others shall not relieve the Contractor of his obligations to perform the Work in accordance with the requirements of the Contract Documents.

6. The Engineer and his representatives will always have access to the Work. In addition, authorized representatives and agents of any participating Federal, State, or Agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and for any inspection or testing thereof.

7. If any Work is covered contrary to the written instruction of the Engineer it must, if requested by the Engineer, be uncovered for his observation and replaced at the Contractor's expense.

8. If the Engineer considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor, at the Engineer's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, materials, tools, and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, however, such Work is not found to be defective, the Contractor will be allowed an increase in the Contract price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate Change Order shall be issued.

I. Substitutions.

1. Whenever a material, article or piece of equipment is identified on the Drawings or Specifications by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The Contractor may recommend the substitution of a material, article or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalogue number, and if, in the opinion of the Engineer, such material, article or piece of equipment is of equal substance and function to that specified, the Engineer may approve its substitution and use by the Contractor. Any cost differential shall be deductible from the Contract price and the Contract Documents shall be appropriately modified by Change Order. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the Project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time.

2. Throughout the whole industry of Contractors, Suppliers, Engineers, Architects, Owners, etc., certain standards have been developed for Specification purposes. In many instances the developed standards are minimum specifications that will provide the purchaser with a product manufactured to perform a certain function. Some suppliers construct or fabricate the product to this minimum standard; other suppliers construct their product to a much higher quality within the minimum standards and other suppliers fall in between. In these

GENERAL CONDITIONS

Last revised 11/14/2025

Specifications the clause "or approved equal" is used after referring to a Suppliers name, brand, or product. The "or approved equal" clause is intended to describe not only the material required in this project but also the quality of material required. It is not the intention of these Specifications to provide proprietary specifications for any certain Supplier but to provide a product of known quality, performance, serviceability, and other values not covered in minimum standards. All products, other than those products specifically mentioned in these Specifications, will not be considered as an "approved equal" unless the drawings of the product have been submitted to the Engineer for approval at least two weeks prior to the opening of Bids, and then only after written approval of the Engineer will the product be considered as "approved equal".

J. Patents.

1. The Contractor or the Supplier shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Owner and Engineer harmless from the loss on account thereof, except that the Owner shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified, however, if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Engineer.

K. Surveys, Permits, Regulations.

1. The Contractor shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the Work together with a suitable number of benchmarks adjacent to the Work as shown in the Contract Documents. The Contractor shall develop and make all detailed surveys needed for construction such as slope stakes, batter boards, stakes for the pile locations and other working points, lines, elevations and cut sheets.

2. The Contractor shall carefully preserve benchmarks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

3. Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be secured and paid for by the Contractor unless specifically stated in the General Conditions or the Supplemental General Conditions or Special Provisions. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations relating to the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, he shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Section 0, "Changes in the Work", of this Section.

L. Protection of Work, Property and Persons.

GENERAL CONDITIONS

Last revised 11/14/2025

1. The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the Work and all other persons who may be affected thereby, including pedestrians, bicyclists, and the motoring public, all the work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designed for removal, relocation or replacement in the course of construction.

2. The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the Work may affect them. The Contractor will remedy all damage, injury or loss to any property caused directly or indirectly, in whole or in part, by the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them are liable, except damage or loss attributable to the fault of the Contract Documents or to the acts or omissions of the Owner or the Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them are liable.

3. In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. He will give the Engineer prompt Written Notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and a Change Order may thereupon be issued covering the changes and deviations involved.

M. Supervision by Contractor.

1. The Contractor will supervise and direct the Work. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor will employ and maintain on the Work a qualified Supervisor or Superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The Supervisor shall have full authority to act on behalf of the Contractor and all communications given to the Supervisor shall be as binding as if given to the Contractor. The Supervisor shall always be present on the site as required to perform adequate supervision and coordination of the Work.

N. Changes in the Work.

1. The Owner may at any time, as the need arises, order changes within the scope of the Work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the Work, an equitable adjustment may be authorized by a Change Order.

GENERAL CONDITIONS

Last revised 11/14/2025

2. The Engineer, also, may at any time, by issuing a Field Order, make changes in the details of the Work. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Engineer unless the Contractor believes that such Field Order entitles him to a change in the Contract Price or Time, or both, in which event he shall give the Engineer Written Notice thereof within seven (7) days after the receipt of the ordered change. Thereafter the Contractor shall document the basis for the change in Contract Price or Time within thirty (30) days. The Contractor shall not execute such changes pending the receipt of an executed Change Order or further instruction from the Engineer.

O. Changes in Contract Price.

1. The Contract Price may be changed only by a Change Order. The value of any Work covered by a Change Order or of any claim for increase or decrease in the Contract price shall be determined by one or both of the following methods in the order of precedence listed below:

- a. Unit prices previously approved.
- b. Additional Unit Prices
- c. An agreed Lump Sum.
- d. Time and Material.

P. Time for Completion and Liquidated Damages.

1. The date of beginning and the time for completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the Notice to Proceed.

2. The Contractor will proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and between the Contractor and the Owner, that the Contract time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work.

3. If the Contractor shall fail to complete the Work within the Contract Time, or extension of time granted by the Owner, then the Contractor will pay to the Owner the amount for liquidated damages as specified in the Special Provisions for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.

4. The Contractor shall not be charged with liquidated damages or any excess cost when the delay in the completion of the Work is due to the following, and the Contractor has promptly given Written Notice of such delay to the Owner or Engineer:

- a. To any preference, priority or allocation order duly issued by the Owner.
- b. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, or of the public enemy,

GENERAL CONDITIONS

Last revised 11/14/2025

acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

c. To any delays of Subcontractors occasioned by any of the causes specified in paragraphs P. 4.a. and P. 4.b. of this paragraph.

Q. Correction of Work.

1. The Contractor shall promptly remove from the premises all Work rejected by the Engineer for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to the Owner and shall bear the expense of making good all Work of other Contractors destroyed or damaged by such removal or replacement.

2. All removal and replacement Work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected Work within ten (10) days after receipt of Written Notice, the Owner may remove such Work and store the materials at the expense of the Contractor.

R. Subsurface Conditions.

1. The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the Owner by Written Notice of:

a. Subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents; or

b. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in Work or of the character provided for in the Contract Documents.

2. The Owner shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the Work, an equitable adjustment shall be made and the Contract Documents may be modified by a Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given the required Written Notice; provided that the Owner may, if he determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

S. Suspension of Work, Termination and Delay.

1. The Owner may suspend the Work or any portion thereof for a period of not more than ninety (90) days or such further time as agreed upon by the Contractor, by Written Notice to the Contractor and the Engineer which notice shall fix the date on which Work shall be

GENERAL CONDITIONS

Last revised 11/14/2025

resumed. The Contractor will resume that Work on the date so fixed. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension; provided that the suspension of work, termination, or delay was not anticipated during the bidding process.

2. If the Contractor is adjudged as bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of his property, or if he files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if he repeatedly fails to make prompt payments to Subcontractors or for labor, materials or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the Work or if he disregards the authority of the Engineer, or if he otherwise violates any provision of the Contract Documents, then the Owner may, without prejudice to any other right or remedy and after giving the Contractor and his surety a minimum of ten (10) days for delivery of a Written Notice, terminate the services of the Contractor and take possession of the Project and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor, and finish the Work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Project, including compensation for additional professional services, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor will pay the difference to the Owner. Such costs incurred by the Owner will be determined by the Engineer and incorporated in a Change Order.

3. Where the Contractor's services have been so terminated by the Owner, said termination shall not affect any right of the Owner against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies by the Owner due the Contractor will not release the Contractor from compliance with the Contract Documents.

4. After ten (10) days from delivery of a Written Notice to the Contractor and the Engineer, the Owner may, without cause and without prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract. In such case, the Contractor shall be paid for all Work executed and any expense sustained plus reasonable profit.

5. If, through no act or fault of the Contractor, the Work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any request for payment within forty-five (45) days after it is submitted, or the Owner fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within forty-five (45) days of its approval and presentation, then the Contractor may, after ten (10) days from delivery of a Written Notice to the Owner and the Engineer, terminate the Contract and recover from the Owner payment for all Work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for as aforesaid, the Contractor may upon ten (10) days Written Notice to the Owner and the Engineer stop the Work until he has been paid all amounts then due, in which event and upon resumption of the Work, Change

GENERAL CONDITIONS

Last revised 11/14/2025

Order shall be issued for adjusting the Contract Price or extending the Contract Time or both to compensate for the costs and delays attributable to the stoppage of the Work.

6. If the performance of all or any portion of the Work is suspended, delayed or interrupted as a result of a failure of the Owner or Engineer to act within the time specified in the Contract Documents, or if time is not specified, within a reasonable time, an adjustment in the Contract Price or an extension of the Contract Time, or both, may be made by a Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the Owner or Engineer.

T. Payments to Contractor.

1. At least ten (10) days before each progress payment falls due (but not more often than once a month), the Contractor will submit to the Engineer a partial payment estimate filed out and signed by the Contractor covering the Work performed during the period covered by the partial payment estimate and supported by such data as the Engineer may reasonably require. If payment is requested based on materials and equipment not incorporated in the Work but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the Owner, as will establish the Owner's title to the material and equipment and protect his interest therein, including applicable insurance. The Engineer will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the Owner, or return the partial payment estimate to the Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate. The Owner will, within thirty (30) days of presentation to him of an approved partial payment estimate, pay the Contractor a progress payment based on the approved partial payment estimate. The Owner shall retain up to five percent (5%) of the amount of each payment until final completion and acceptance of all Work covered by the Contract Documents and final payment procedures are followed.

2. The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.

3. Prior to the substantial completion, the Owner, with the approval of the Engineer, and with notice to the Contractor, may use any completed or substantially completed portions of the Work. Such use shall not constitute an acceptance of such portions of the Work.

4. The Owner shall have the right to enter the premises for the purpose of doing work not covered by the Contract Documents. These provisions shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the Work, or the restoration of any damaged Work except such as may be caused by agents or employees of the Owner.

5. The Contractor shall, for a period of one hundred and eighty (180) days after completion and acceptance of Work, repair at his expense any defect or failure. If the Contractor fails to make such repairs and adjustments or other similar work, the Owner may do so and charge

GENERAL CONDITIONS

Last revised 11/14/2025

the Contractor twice the cost of the same. The entire balance found to be due the Contractor, including the retained percentages, but except such sums as may be lawfully retained by the Owner, shall be paid to the Contractor after forty-five (45) days of completion and acceptance of the Work.

6. The Contractor will indemnify and save the Engineer, Owner and the Owner's officers, and agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, material men, and furnishers of machinery and parts thereof, equipment, tools, and all supplies incurred in the furtherance of the performance of the Work. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged or waived. If the Contractor fails to do so the Owner may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor, his Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the Owner shall be considered as a payment made under the Contract Documents by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

7. If the Owner fails to make payment forty-five (45) days after approval by the Engineer, in addition to other remedies available to the Contractor, there shall be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the Contractor.

U. Acceptance of Final Payment as Release.

1. The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically accepted by the Owner. Any payment, however, final or otherwise, shall not release the Contractor or his sureties from any obligations under the Contract Documents or the Performance Bond and Payment Bonds.

V. Insurance Requirements

1. The Contractor agrees to procure and maintain, at its own cost, a policy or policies of insurance sufficient to insure against all liability, claims, demands, and other obligations assumed by the Contractor pursuant to this Section. Such insurance shall be in addition to any other insurance requirements imposed by this Contract or by law. The Contractor shall not be relieved of any liability, claims, demands, or other obligation assumed pursuant to this Section by reason of its failure to procure or maintain insurance, or by reason of its failure to procure or maintain insurance in sufficient amounts durations, or types.

2. Contractor shall procure and maintain and, if applicable, shall cause any Subcontractor of the Contractor to procure and maintain insurance coverage listed below. Such coverage shall

GENERAL CONDITIONS

Last revised 11/14/2025

be procured and maintained with forms and insurers acceptable to the District. All coverage shall be continuously maintained to cover all liability, claims, demands, and other obligations assumed by the Contractor pursuant to this Section. In the case of any claims-made policy, the necessary retroactive dates and extended reporting periods shall be procured to maintain such continuous coverage. Minimum coverage limits shall be as indicated below unless specified otherwise in the Special Provisions:

a. Worker Compensation insurance to cover obligations imposed by applicable laws for any employee engaged in the performance of work under this Contract, and Employers' Liability insurance with minimum limits of:

FIVE HUNDRED THOUSAND DOLLARS (\$500,000) each accident,
FIVE HUNDRED THOUSAND DOLLARS (\$500,000) disease – policy limit, and
FIVE HUNDRED THOUSAND DOLLARS (\$500,000) disease – each employee.

b. General Liability insurance with minimum combined single limits of:

ONE MILLION DOLLARS (\$1,000,000) each occurrence and
TWO MILLION DOLLARS (\$2,000,000) per job aggregate.

The policy shall be applicable to all premises and operations. The policy shall include coverage for bodily injury, broad form property damage (including completed operations), personal injury (including coverage for contractual and employee acts), blanket contractual, products, and completed operations. The policy shall include coverage for explosion, collapse, and underground hazards. The policy shall contain a severability of interests provision.

c. Comprehensive Automobile Liability insurance with minimum combined single limits for bodily injury and property damage of not less than:

ONE MILLION DOLLARS (\$1,000,000) each occurrence and
ONE MILLION DOLLARS (\$1,000,000) aggregate

with respect to each of Contractor's owned, hired or non-owned vehicles assigned to be used in performance of the Work. The policy shall contain a severability of interests provision.

d. For contracts for construction of insurable structures, which are able to be occupied, the Contractor agrees to provide and maintain a Builder's Risk Insurance Policy with minimum limits of not less than the insurable value of the Work to be performed under this Contract at completion, less the value of the materials and equipment insured under Installation Floater Insurance. The policy shall be written in completed value form and shall protect the Contractor, Subcontractor, and the District against risks of damage to buildings, structures, materials and equipment not otherwise covered under Installation Floater Insurance, from the perils of fire and lighting, the perils included in the standard coverage endorsement, and the perils of vandalism and malicious mischief.

GENERAL CONDITIONS

Last revised 11/14/2025

e. The Contractor agrees to provide and maintain an Installation Floater Insurance Policy with minimum limits of not less than the insurable value of the Work to be performed under this Contract at completion, less the value of the materials and equipment insured under the Builder's Risk Insurance. Equipment such as pumps, engine-generators, compressors, motors, switch-gear, transformers, panelboards, control equipment, and other similar equipment shall be insured under Installation Floater Insurance when the aggregate value of the equipment exceeds \$10,000. The insurable value of the Work shall include the aggregate value of any District-furnished equipment and materials to be erected or installed by the Contractor not otherwise insured under Builder's Risk Insurance. The policy shall protect the Contractor, Subcontractor, and the District from all insurable risks of physical loss or damage to materials and equipment not otherwise covered under Builder's Risk Insurance, while in warehouses or storage areas, during installation, during testing, and after the Work under this Contract is completed. The policy shall be of the "all risks" type, with coverage designed for the circumstances which may occur in the particular Work to be performed under this Contract. The policy shall provide for losses to be payable to the Contractor and the District 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 or the District.

3. The policies required by paragraphs (a), (b), (c), (d) and (e) above shall be endorsed to include the District and the District's officers and employees as additional insurers. Every policy required above shall be primary insurance, and any insurance carried by the District, its officers, or its employees, or carried by or provided through any insurance pool of the District, shall be excess and not contributory insurance to that provided by Contractor. No additional insured endorsement to any required policy shall contain any exclusion for bodily injury or property damage arising from completed operations. The Contractor shall be solely responsible for any deductible losses under any policy required above.

4. The Contractor shall provide copies of the certificate(s) of insurance to the Engineer as evidence that policies providing the required coverage, conditions, and minimum limits are in full force and effect, which certificate(s) shall be reviewed and approved by the District prior to commencement of the Contract. The certificate(s) shall identify this Contract and shall provide that the coverage afforded under the policies shall not be canceled, terminated or materially changed until at least 30 days prior written notice has been given to the District.

5. Failure on the part of the Contractor to procure or maintain policies providing the required coverage, conditions, and minimum limits shall constitute a material breach of this Contract upon which the District may immediately terminate this Contract. At its discretion the District may also procure or renew any such policy or any extended reporting period thereto and may pay any and all premiums in connection therewith. The Contractor shall repay all monies so paid by the District to the District upon demand, or the District may offset the cost of the premiums against any monies due to Contractor from the District.

GENERAL CONDITIONS

Last revised 11/14/2025

6. The District reserves the right to request and receive, at any time(s), a certified copy of any policy and any endorsement thereto.

7. The parties hereto understand and agree that the District is relying on, and does not waive or intend to waive by any provision of this Contract, the monetary limitations or any other rights, immunities, and protection provided by the Colorado Governmental Immunity Act, § 24-10-101 et seq., C.R.S., as from time to time amended, or otherwise available to the District, its officers, or its employees.

W. Contract Security.

1. The Contractor shall provide a Performance Bond and a Payment Bond in penal sums equal to the amount of the Contract Price within the time allotted in the "information for Bidders" or "Instructions for Bidders", whichever is applicable. These Bonds shall remain in effect for the duration of the Warranty Period. The Contractor shall also furnish other Bonds that may be required by the Special Provisions. All Bonds shall be in the forms prescribed by the Contract Documents and executed by such Sureties as are:

a. licensed to conduct business in the state of Colorado and

b. named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Accounts, U.S. Treasury Department. The expense of these Bonds shall be borne by the Contractor. If at any time a surety on any such Bond is declared as bankrupt or loses its right to do business in the State in of Colorado or is removed from the list of Surety Companies accepted on Federal Bonds, the Contractor shall within ten (10) days after notice from the Owner to do so, substitute an acceptable Bond (or Bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such Bond(s) shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable Bond to the Owner.

X. Assignments.

1. Neither the Contractor nor the Owner shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the other party.

Y. Indemnification.

1. The Contractor agrees to indemnify and hold harmless the District, its officers, employees, agents, insurers, from and against all liability, claims, and demands, on account of injury, loss, or damage, including without limitation claims arising from bodily injury, personal injury, sickness, disease, death, property loss or damage, or any other loss of any kind whatsoever, which arise out of or are in any manner connected with this Contract, if such injury, loss, or damage is caused in whole or in part by, or is claimed to be caused in

GENERAL CONDITIONS

Last revised 11/14/2025

whole or in part by, the act, omission, error, professional error, mistake, negligence, or other fault of the Contractor, any Subcontractor of the Contractor, or any officer, employee, representative, or agent of the Contractor or of any Subcontractor of the Contractor, or which arise out of any workers' compensation claim of any employee of the Contractor or of any employee of any Subcontractor of the Contractor. The Contractor agrees to investigate, handle, respond to, and to provide defense for and defend against, any such liability, claims, or demands at the sole expense of the Contractor. The Contractor also agrees to bear all other costs and expenses related thereto, including court costs and attorney fees, whether or not any such liability, claims, or demands alleged are groundless, false, or fraudulent.

Z. Separate Contracts.

1. The Owner reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work and shall properly connect and coordinate his Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.
2. The Owner may perform additional Work related to the Project by himself, or he may let other contracts containing provisions similar to these. The Contractor shall afford the other Contractors who are parties to such Contracts (or the Owner, if he is Performing the additional Work himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of Work and shall properly connect and coordinate his Work with theirs.
3. If the performance of additional Work by other Contractors or the Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional Work. If the Contractor believes that the performance of such additional Work by the Owner or others involves him in additional expense or entitles him to an extension of the Contract Time, he may make a claim therefore as provided in Sections O or P.

AA. Subcontracting.

1. The Contractor may utilize the services of specialty Subcontractors on those parts of the Work which, under normal contracting practices, are performed by specialty Subcontractors.
2. The Contractor shall not award Work to Subcontractor(s), in excess of fifty percent (50%) of the Contract Price, without prior written approval of the Owner.
3. The Contractor shall be fully responsible to the Owner for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

GENERAL CONDITIONS

Last revised 11/14/2025

4. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the Work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

5. Nothing contained in this Contract shall create any contractual relation between any Subcontractor and the Owner.

BB. Engineer's (Owner's Representative) Authority.

1. The Engineer shall act as the Owner's Representative during the construction period. He shall decide questions which may arise as to quality and acceptability of materials furnished and Work performed. He shall interpret the intent of the Contract Documents in a fair and unbiased manner. The Engineer will make visits to the site and determine if the Work is proceeding in accordance with the Contract Documents.

2. The Contractor will be held strictly to the intent of the Contract Documents regarding the quality of materials, workmanship and execution of the Work. Inspections may be made at the factory or fabrication plant of the source of material supply.

3. The Engineer will not be responsible for the construction means, methods, controls, techniques, sequences, procedures, or construction safety.

4. The Engineer shall promptly make decisions relative to interpretation of the Contract Documents.

CC. Land and Rights-of-Way.

1. Prior to issuance of the Notice to Proceed, the Owner shall obtain all land and rights-of-way necessary for carrying out and for the completion of the Work to be performed pursuant to the Contract Documents, unless mutually agreed or stated differently in the Special Provisions.

2. The Owner shall provide the Contractor with information which delineates and describes the lands owned, easements and rights-of-way acquired.

3. The Contractor shall provide at his own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

DD. Warranty.

1. The Contractor shall Warranty that all materials and equipment furnished and Work performed are free from all defects due to faulty materials or workmanship for a period of eighteen (18) Months from the date of Final Completion. The Contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of

GENERAL CONDITIONS

Last revised 11/14/2025

any damage to other parts of the system resulting from such defects. The Owner shall give notice of observed defects with reasonable promptness. If the Contractor should fail to make such repairs, adjustments, or other Work that may be made necessary by such defects in a timely fashion, the Owner may do so and charge the Contractor the twice the cost thereby incurred. The Performance Bond shall remain in full force and effect through the warranty period.

EE. Contract Disputes

1. All claims, disputes and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by the making and acceptance of final payment as provided by Section U, shall be decided by non-binding arbitration. The arbitrator shall be a neutral decision maker with experience in water infrastructure construction projects. The parties shall attempt to jointly select the arbitrator from a list of proposed arbitrators generated by the parties. In the event that the parties are unable to agree on an arbitrator, the Owner shall select the arbitrator. Each party shall bear its own costs associated with presenting any disputes to the arbitrator, which costs shall not be recoverable as part of a change order or in any subsequent litigation.
2. Notice of the demand for arbitration shall be filed in writing with the other party to the Contract Documents, and a copy shall be filed with the Engineer. Demand for arbitration shall in no event be made on any claim, dispute or other matter in question which would be barred by the applicable statute of limitations.
3. The Contractor will carry on the Work and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing. The failure of the Contractor to continue expeditious performance due to a dispute arising under this Contract shall, at the option of the Owner be construed as a material breach of this Contract justifying termination or such other action as the Owner deems appropriate.
4. The submittal of disputes to non-binding arbitration shall be a condition precedent to commencing litigation by either party. If the dispute is not resolved within 30 days of the completed arbitration, either party may pursue a legal claim in Mesa County District Court.
5. No decisions or statements of the arbitrator shall be admitted as evidence in any litigation between the parties nor shall the mediator be called to testify in any litigation between the parties concerning such disputes.

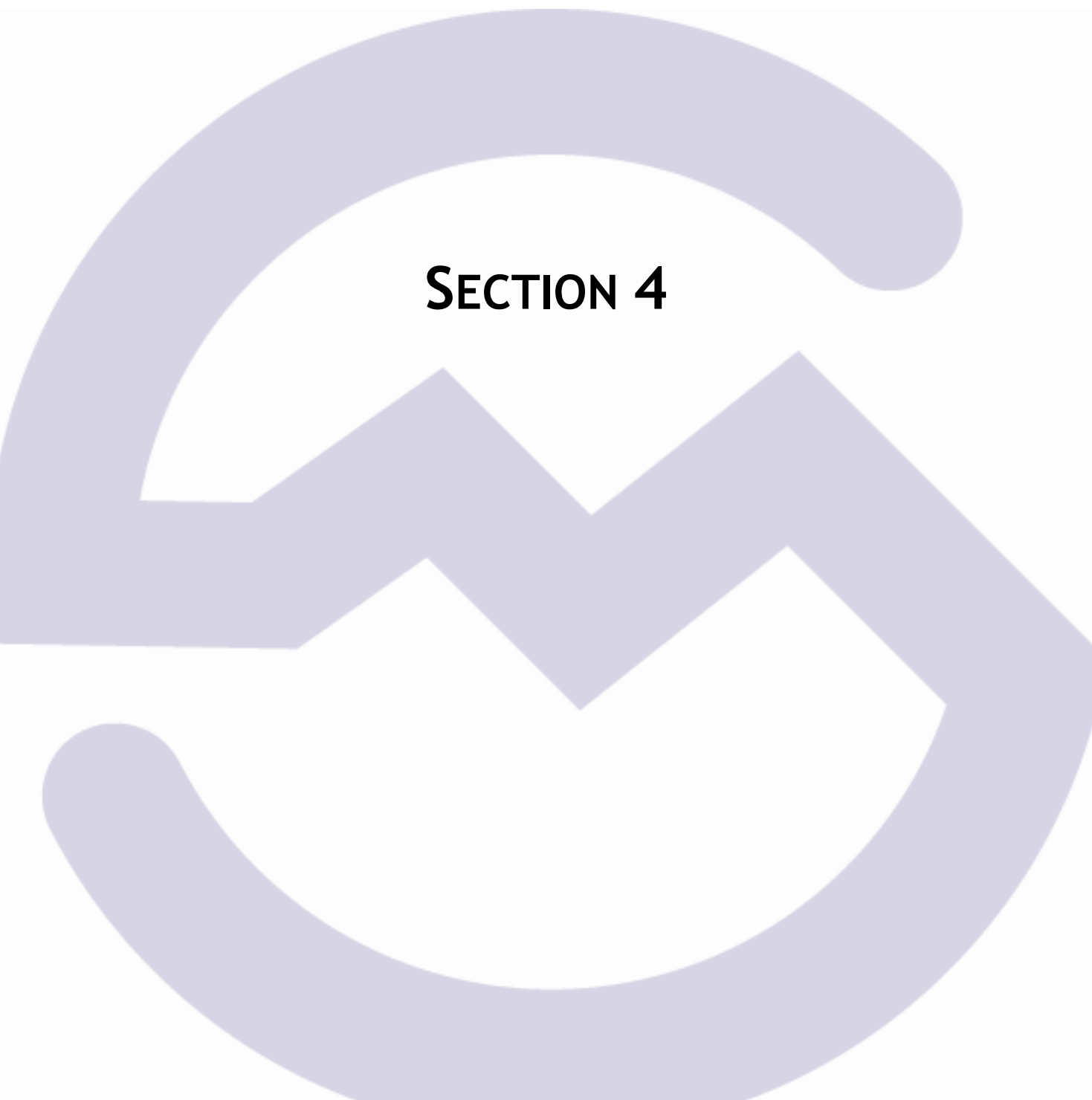
FF Taxes.

1. The Contractor will pay all sales, consumer, use and other similar taxes required by the law of the place where the Work is performed.
2. Contractors need not pay sales tax on material for Owner that are sales tax exempt. All Contractors or Subcontractors providing material for Owner that are sales tax exempt must make application to the State Department of Revenue for a Certificate of Exemption to permit the purchase of materials for the construction of the Project without payment of sales

GENERAL CONDITIONS

Last revised 11/14/2025

tax. Prior to the start of construction, the Contractor shall furnish copies of such certificates to the Engineer for insertion in the Contract Documents. Applications and Certificates must be on forms provided by the Department of Revenue.



SECTION 4

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

TABLE OF CONTENTS

Section		Page
100	GENERAL REQUIREMENTS	1
100.1	Project Approval Process	1
100.1.1	Pre-Design Meeting	3
100.1.2	Approval to Construct Water System Improvements.....	3
100.1.3	Expiration	3
100.1.4	Pre-Construction Meeting	3
100.1.5	CWD Inspections	4
100.1.6	As-Built Drawings	4
100.1.7	Initiation of Water Service	4
100.1.8	Acceptance of Improvements/Eighteen Month Warranty	5
100.1.9	Ownership of Water System Improvements	5
100.2	Applicable Codes, Standards, and Specifications	6
100.3	Legal Relations and Responsibilities	6
100.4	Severability	6
100.5	Variances	6
100.6	Construction Plans and Design Calculations	7
100.7	Easements	7
101	MATERIALS.....	8
101.1	General	8
101.2	Contractor Requirements.....	8
101.3	CWD Furnished Materials.....	8
101.4	Inspection and Testing.....	8
101.5	Handling	8
101.6	Storage.....	8
101.7	Pipe & Fittings for Water Mains and Service Connections	9
101.7.1	Ductile Iron Pipe.....	9
101.7.2	Joints.....	9
101.7.3	Polyethylene Encasement	9
101.7.4	Polyvinyl Chloride Pipe (PVC).....	9
101.7.5	Copper Service Pipe	10
101.7.6	Mechanical Restrained Pipe Joints	11
101.7.7	Fittings.....	11
101.7.8	Steel Casing.....	11
101.7.9	Casing Spacers and End Seals	12
101.8	Appurtenances for Water Distribution	13
101.8.1	Fire Hydrants	13
101.8.2	Gate Valves	13
101.8.3	Wrench Nuts	14

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

101.8.4	Tapping Valves.....	14
101.8.5	Butterfly Valves.....	14
101.8.6	Valve Boxes.....	14
101.8.7	Air Valves	14
101.8.8	Electrical Tracing Wire	14
101.8.9	Corporation Stops and Tapping Saddles	14
101.8.10	Meter Yoke Assemblies	15
101.8.11	Reduced Pressure Backflow Prevention Devices.....	15
101.8.12	Concrete and Mortar.....	15
101.8.13	Bolts and Nuts	15
101.8.14	Pipe Insulation	15
101.8.15	Sample Stations	15

102 SURFACE REMOVALS, EXCAVATION, BACKFILLING AND RESTORATION OF GROUNDS

16

102.1	Description	16
102.2	Survey Line and Grade.....	16
102.3	Surface Removals and Topsoil Preservation.....	16
102.4	Bracing and Sheet piling of Trenches.....	16
102.5	Trenches with Sloping Sides	17
102.6	Open Excavation Limits.....	17
102.7	Unauthorized Excavation and Pavement Removal	17
102.8	Unstable Trench Bottom.....	17
102.9	Bedding and Shaping Trench Bottom	17
102.10	Cutoff Walls	18
102.11	Rock Excavation	18
102.12	Blasting.....	18
102.13	Stockpiling Excavated Material	20
102.14	Dewatering Trenches	20
102.15	Backfilling Pipe and Structures	20
102.16	Granular Stabilization, Bedding and Haunching Materials.....	21
102.17	Restoration of Grounds	22
102.18	Restoration of Paved Surfaces	22
102.19	Erosion Control	22

103 INSTALLATION

23

103.1	Installation of Pipe and Appurtenances.....	23
103.2	Pipe Laying.....	23
103.3	Installation of Tracing Wire	24
103.4	Polyethylene Encasement.....	24
103.5	Thrust Restraint	24
103.4	Concrete Blocking	24

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

103.7	Installation of Valves and Valve Boxes	25
103.8	Installation of Fire Hydrants.....	25
103.9	Installation of Water Service Pipe.....	25
103.10	Service Stubouts	26
103.11	System-Protection Devices.....	26
103.12	Mainline Connections to Existing Mains	27
103.13	Installation of Sample Stations.....	27
103.14	Separation Between Water Lines and Sources of Contamination.....	27
103.14.1	Parallel Installation.....	27
103.14.2	Crossings	28
103.15	Earth Backfill Material	28
104	TESTING AND DISINFECTING PIPELINES	30
104.1	General	30
104.2	Backflow Protection	30
104.3	Disinfection of Water Lines	30
104.4	Initial Flushing of Potable Water Mains	31
104.5	Chlorine Application	31
104.6	Point of Application	31
104.7	Preventing Reverse Flow	32
104.8	Retention Period	32
104.9	Chlorinating Valves and Hydrants	32
104.10	Final Flushing and Testing	32
104.11	Bacteriological Test	32
104.12	Pressure Testing	32
104.13	Test Pressure	32
104.14	Filling	33
104.15	Pressure Test Procedure	33

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

SECTION 100 GENERAL REQUIREMENTS

These Clifton Water District (CWD) Design and Construction Standard Specifications, hereinafter referred to as the “Standards” shall apply whenever any work is performed by private Developers that will impact CWD infrastructure. The intent of these Standards is to provide the minimum criteria for the design and construction of water infrastructure within the CWD service area as well as clarify the process for completing new development and redevelopment projects that include connection to or expansion of the CWD’s water distribution system. These Standards are not intended to be applied blindly to every application and do not absolve the design engineer from the responsibility of evaluating the given situation to ensure that the application of these Standards will result in water infrastructure that safeguards the public’s life, health, and property.

100.1 PROJECT APPROVAL PROCESS

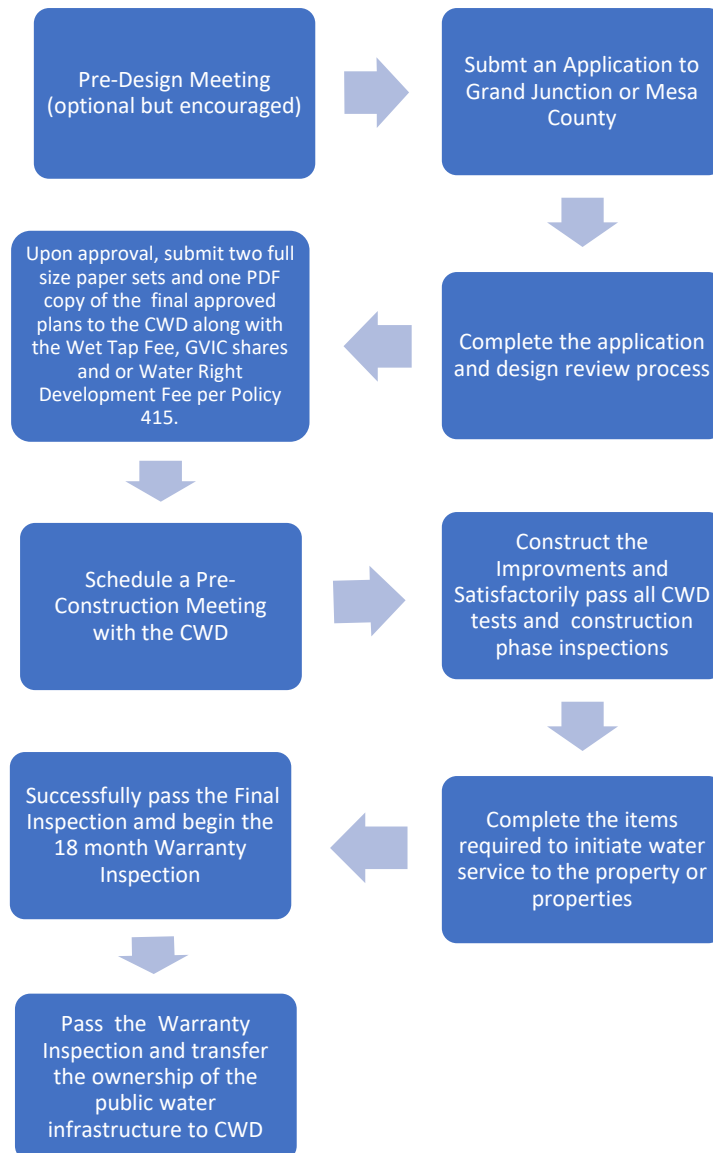
Developments that involve the CWD are typically initiated through either Mesa County or the City of Grand Junction and by following the City or County’s permit review process, the CWD will be integrated into the overall project review. Many of the steps listed below are incorporated in the development process established by Mesa County and the City of Grand Junction.

All water system improvements to the CWD’s water system from the plant up to and including the water meter shall be constructed in accordance with the latest version of the Clifton Water District Standard Specifications or Improvements and as directed by the CWD.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

Below is a flow chart showing the steps needed to take a project from the design phase to the completed product.



Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

100.1.1 PRE-DESIGN MEETING

A pre-design meeting with the CWD is recommended, but not mandatory to discuss onsite and potential offsite infrastructure improvements required to ensure adequate pressure and flow for the development. The meeting is also an opportunity for the Developer's team to gain an understanding of the requirements for designing and constructing water system improvements within the CWD.

100.1.2 APPROVAL TO CONSTRUCT WATER SYSTEM IMPROVEMENTS

Prior to the construction of any water system improvements the following must be received and approved by the CWD:

- Contact information for the Developer/Owner, Engineer, Project Coordinator, and Contractor. The contact information shall consist of mailing address, email address, and phone numbers. See New Construction Project Information Sheet.
- Two paper sets and one PDF copy of the final CWD approved construction plans and design calculations signed and sealed by a Colorado licensed Professional Engineer.
- An itemized Engineer's Opinion of Construction Costs signed and sealed by a Colorado licensed Professional Engineer, or the Contractor's itemized bid signed by both the contractor and Developer or his designee.
- Executed easement documents (if applicable). Easements shall be in accordance with CWD Standards.
- Payment of the "Wet Tap Fee – Main Line Extension".
- Transfer of GVIC shares and or payment of fee in lieu of Water Right Development Fee - see CWD Policy 415

100.1.3 EXPIRATION

If construction work has not started within 12 months of plan approval by the CWD, the project shall be considered inactive, and the approval shall expire. The Owner may submit a written request for an additional 12-month time extension. Upon receipt of such request, the CWD may extend the expiration date an additional 12 months if the plans comply with the then current CWD requirements and are consistent with any CWD planning goals. If the CWD determines that the previously approved plans do not comply with the then current requirements, the plans will need to be revised and resubmitted to the CWD for review.

Incomplete project applications shall be considered inactive and shall expire 12 months after the CWD's latest review comments. After expiration of the project application the project shall be required to comply with the then current requirements.

100.1.4 PRE-CONSTRUCTION MEETING

A pre-construction meeting is required prior to the start of construction of any water system improvements. The developer/contractor must submit a project schedule and a list of subcontractors and material suppliers at

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

least two business days prior to the pre-construction meeting. This meeting should be held in conjunction with Mesa County or the City of Grand Junction.

100.1.5 CWD INSPECTIONS

District personnel or authorized representatives must be provided access to all work being performed and must be allowed to inspect such work at its convenience. Inspection and testing shall be in accordance with the CWD Standard Specifications for Water System Improvements. Inspections must be scheduled 48 hours in advance.

100.1.6 AS-BUILT DRAWINGS

Prior to initiating water service to any properties, as-built drawings must be submitted to the CWD for approval. The as-built drawings shall consist of a marked up set of original approved construction drawings that clearly shows the original and as-built improvements. The record drawings shall include dimensions, stationing, or coordinates for all service taps, valves, fittings, and fire hydrants. All meter vaults shall be dimensioned from the nearest property corner. As constructed top of pipe elevations shall be provided for any location where the water main elevation varies from the standard 42" depth of bury.

The as-built drawing submittal shall include one full size paper copy and one PDF copy.

100.1.7 INITIATION OF WATER SERVICE

The steps that must be taken prior to initiating water service to individual parcels fall into two categories: work that must first be completed by the Developer/Owner that encompasses the entire subdivision filing; and steps that must be taken by the owner of the individual lot after the subdivision wide requirements have been met.

Requirements of the Developer/Owner of the Subdivision:

- i) Successful completion of the water system improvements including passing the required pressure and bacteriological tests.
- ii) Receipt of backfill compaction testing.
- iii) Receipt of One paper copy and one PDF copy of the approved Record Drawings signed and sealed by a Colorado licensed Professional Engineer.
- iv) Receipt of a recorded address plat with tax property identification numbers and addresses for each parcel.
- v) Receipt of an itemized final construction cost for the water system signed and dated by the Developer/Owner or contractor.
- vi) Receipt of a letter from the Developer/Owner transferring all ownership interests in the water main extension and appurtenances to the CWD.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

Requirements of the Owner/builder for the individual lot

- i) Receipt of a Mesa County building permit.
- ii) Payment of the Tap Fee.
- iii) Execution of a Clifton Water District Water Service Agreement.

The CWD shall supply all water meters. Water meters 2" and smaller shall be installed by the CWD. Meters larger than 2" shall be installed by the Owner/Developer's contractor under the direct onsite supervision of CWD staff.

100.1.8 ACCEPTANCE OF IMPROVEMENTS/EIGHTEEN (18) MONTH WARRANTY

Prior to acceptance of the completed water system improvements by the CWD, and prior to the start of the warranty period, all inspection and testing requirements as per the CWD Standard Specifications for Improvements must be met, and a final inspection performed by the CWD and the Developer/Owner or their representatives.

After the development passes the Final Inspection the 18-month warranty shall commence. The Developer/Owner shall warranty all water system related improvements for a minimum of eighteen months against defective material, workmanship, and faulty design. The Developer/Owner shall be responsible for all maintenance and repair work necessary during the warranty period.

If the Owner/Developer fails to adequately address any maintenance or repairs within an appropriate time frame per notification by the CWD, the CWD reserves the right to perform any work necessary to maintain and or correct these defects or inadequacies. The Developer/Owner shall be responsible for reimbursing the CWD double the cost incurred by the CWD while undertaking any maintenance or corrective actions that the Developer/Owner fails to complete in a timely fashion after notification by the CWD.

The Developer/Owner shall indemnify CWD for and from any claims against the CWD and any damages the CWD may suffer due to defects in materials, workmanship, and inadequate design of the water system improvements or ancillary improvements related to the water system improvements.

100.1.9 OWNERSHIP OF WATER SYSTEM IMPROVEMENTS

The CWD will operate the Water System Improvements up to and including the meter and meter vault as of the date of acceptance of the improvements except for fire services. Fire service lines shall be owned entirely by the property owner. The CWD will accept full ownership of said improvements at the end of the eighteen (18) month warranty subject to the following:

- i) Satisfactory passing of the Warranty Inspection. The Warranty Inspection is to be performed by or immediately prior to the end of the warranty period. If any portion of the Water System Improvements are found to be defective and/or inadequate in any way and for any reason during the Warranty Inspection the warranty period shall be extended until the defects and/or inadequacies are remedied by the Developer/Owner to the satisfaction of the CWD.
- ii) Water System Public Improvements Ownership Transfer signed by the Developer/Owner.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

100.2 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

All design, materials, and construction shall be in accordance with these Standards and all applicable governmental, regulatory, and testing organizations including, but not limited to the following:

- i) Colorado Department of Public Health and Environment (CDPHE)
- ii) All CWD Policies, Procedures, and Resolutions.
- iii) Colorado Department of Transportation Standard Specifications for Road and Bridge Construction
- iv) Mesa County
- v) City of Grand Junction
- vi) USEPA Recommended Standards for Water Works
- vii) Recommended Standards for Water Works – 10 State Standards
- viii) American Water Works Association (AWWA)
- ix) American Society of Testing and Materials (ASTM)
- x) American National Standards Institute (ANSI)

Whenever a provision of these Standards or any provision in any law, ordinance, resolution, rule or regulation of any kind, contains any restrictions covering any of the same subject matter, whichever standard is most stringent shall apply.

100.3 LEGAL RELATIONS AND RESPONSIBILITIES

The Developer/Contractor shall always comply with all Federal and State laws, local laws and ordinances, and any regulations which in any manner affect the project. The contractor shall release, indemnify and promise to defend and save harmless the CWD, its officers, employees and agents from and against any and all liability, loss, damage, and expense, actions and claims, including costs and reasonable attorneys' fees incurred by the CWD in defense thereof, asserting or arising directly or indirectly on account of any violation of laws, ordinances or regulations whether such violations are by the contractor, his or her subcontractors, his or her employees, or his or her agents.

100.4 SEVERABILITY

If any section or article of these Standards is found to be unconstitutional or illegal by any court, the said section or article shall have no bearing on the effectiveness of the rest of these Standards.

100.5 VARIANCES

The CWD may vary the Standards on a case-by-case basis if it is determined that such variances are in the best interest of the CWD. Any modifications that do not conform with CDPHE requirements shall not be allowed. Variance requests must include proof that compliance with the Standards cannot be accomplished and that the proposed variance will not diminish the operational or structural integrity, or maintainability of the improvements. Variance requests must be based on sound engineering principles and judgement.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

100.6 CONSTRUCTION PLANS AND DESIGN CALCULATIONS

Construction plans must be signed, sealed and dated by a Colorado licensed Professional Engineer and shall at a minimum include and or adhere to the following:

- i) All water infrastructure improvements including fire hydrants, valves, service connections meter pits and fittings.
- ii) Water main plan and profile views showing all vertical conflicts with any potential sources of contamination such as sewers, drain lines, raw water lines, and irrigation lines.
- iii) All water mains shall be a minimum of 8" diameter and shall be looped whenever possible. Dead end mains shall terminate at a fire hydrant.
- iv) All water services shall be individually tapped from a public main.
- v) Only one CWD water meter shall be connected to each water service.
- vi) Each CWD meter shall only serve a single parcel
- vii) Dimensions between the proposed watermain and sources of potential contamination.
- viii) Dimensions to the top of the proposed watermain including dimensions for areas where the watermain is proposed to be installed lower than the CWD standard.
- ix) All applicable CWD Standard Details.
- x) CWD approval block on each water related plan sheet.

Design Calculations shall be submitted for all non-residential domestic water services in accordance with AWWA M22.

100.7 EASEMENTS

Whenever water mains are not located in the public right of way or in a Mesa County or City of Grand Junction multi-purpose easement, a permanent easement shall be granted to the CWD. Watermains 12" in diameter and less shall be in the center of a minimum 20-foot-wide permanent easement. Permanent structures with fixed foundations such as houses and garages shall be set back a minimum of 15 feet from the centerline of all water mains located within easements.

Language for easements to be granted to the benefit of the CWD must be approved by the CWD.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

SECTION 101 MATERIALS

101.1 GENERAL

This section covers pipe and other materials to be used in the construction of potable water systems. All materials used shall be new and in conformance with the applicable standards.

101.2 CONTRACTOR REQUIREMENTS

All materials to be furnished by the Contractor shall conform to the requirements of these specifications. The type, size and strength class of pipe, fittings and other materials shall be as shown on individual project plans or otherwise specified in the Contract Documents.

101.3 CWD FURNISHED MATERIALS

When CWD furnishes materials that are to be incorporated into the work by the Contractor, provisions will be made in the Special Conditions as to the responsibilities of CWD and the Contractor regarding delivery, unloading, and storage of the materials.

101.4 INSPECTION AND TESTING

All pipe shall be tested in conformance with the applicable standards. Testing may be witnessed by CWD's representative, or by an approved independent testing laboratory. Upon request of CWD, the Contractor shall provide a copy of certified test reports indicating that the material conforms to the applicable specifications.

101.5 HANDLING

All materials shall be handled with equipment and methods adequate to prevent shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

If any part of the coating or lining is damaged, the Contractor shall repair or replace the material at Contractor's expense as directed by CWD. All pipe and appurtenances shall be handled in accordance with the appropriate AWWA and ASTM standards.

101.6 STORAGE

The Contractor will be held responsible for the safe storage and protection of all pipe and other materials delivered to the work site. The interiors of all pipe and fittings shall be always kept free from dirt and foreign matter. Gaskets for pipe joints shall be stored in a cool location out of direct sunlight. Any material that has been damaged shall be repaired or replaced at the Contractor's expense.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

101.7 PIPE AND FITTINGS FOR WATER MAINS AND SERVICE CONNECTIONS

101.7.1 DUCTILE IRON PIPE

Ductile iron pipe shall be single gasket, double sealing pipe per AWWA C151/ANSI A21.51 with cement mortar lining per AWWA C104/ANSI 21.4. The exterior of the ductile iron pipe shall be coated with arc-sprayed zinc at a mass to surface rate of 200 g/m². The zinc coating shall meet ISO 8179. A bituminous top-coat shall be provided over the zinc coating. The pipe shall conform to AWWA C-151, thickness-class to be determined in accordance with AWWA C-150 and shall be a minimum of Class 52.

101.7.2 JOINTS

Unless otherwise specified in the Construction Plans or Special Conditions, ductile iron pipe joints shall be mechanical or push on joints conforming to AWWA C-111/A21.11. Gaskets shall be of neoprene or other synthetic rubber material. Nitrile Rubber (Acrylonitrile Butadiene) shall be used if hydrocarbons or petroleum is present in the soil. All push-on-type joints shall be electrically connected with brass wedges or cadweld connectors and No. 12 copper wire.

101.7.3 POLYETHYLENE ENCASEMENT

Polyethylene encasement material in conformance with AWWA C600 and AWWA/ C-105/A21.5.

101.7.4 POLYVINYL CHLORIDE PIPE (PVC)

PVC pipe 4" in diameter and larger shall conform to AWWA C900. Unless otherwise specified the minimum thickness class of pipe where the operating pressure is less than or equal to 120 psi shall have a Dimension Ratio (DR) of 18. Depending on local conditions and in areas where the operating pressures are greater than 120 psi, the CWD may require the design engineer to verify the PVC Pressure Class and DR required for the specific application in accordance with AWWA M23.

Joints: Unless restraining is required joints shall be bell and spigot push on type in conformance with ASTM D3139. The bell shall consist of an integral wall section with factory installed flexible elastomeric gaskets that conform to ASTM F477. The bell shall be at least as hydrostatically strong as the pipe wall. In normal soil conditions gaskets shall be made from Styrene Butadiene Rubber. Nitrile Rubber (Acrylonitrile Butadiene) shall be used if hydrocarbons or petroleum is present in the soil.

PVC pipe for use in underground main line boring projects or when installed in casing pipes attached to bridges shall be either "*Certa-Lok*" or "*Yelomine*" as manufactured by *CertainTeed Corporation*, no substitutions allowed. "*Certa-Lok*" C900/RJ PVC pipe shall meet all the requirements of AWWA C900 "Polyvinyl Chloride (PVC) Water Distribution". The pipe shall be joined using separate couplings that have beveled edges, built-in sealing gaskets, and restraining grooves. The restraining splines shall be square and made from Nylon 101. "*Yelomine*" PVC pipe shall meet all the requirements of ASTM D2241, "Standard Specification for PVC Pressure-Rated Pipe (SDR Series)". The pipe shall be joined using separate couplings that have beveled edges, built-in sealing gaskets, and restraining grooves. The restraining splines shall be square and

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

made from Nylon 101. Each pipe and coupling shall be approved by the National Sanitation Foundation for use with potable water.

PVC plastic pipe for lines 1-1/2- inch (1-1/2") Through three-inch (3") diameter shall conform to ASTM D2241. Unless otherwise specified, the minimum thickness class of PVC 1-1/2" through 3" diameter shall conform to SDR 21 (Class 200), and shall be joined with SOLVENT WELD bushings, collars, couplings, tees, and bend fittings equal in diameter and pressure classification to the pipe.

The Contractor and/or Pipe Manufacturer shall follow the standards listed below, except as otherwise specified herein. The latest revision or edition in effect at the time plan approval shall be utilized.

A. American Society for Testing and Materials (ASTM)

1. D1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
2. D2241 – Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR PR Series)
3. D2774 – Practice for Underground Installation of Thermoplastic Pressure Piping
4. D3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
5. F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. American Water Works Association (AWWA)

1. C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
2. C651 – Disinfecting Water Mains
3. C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 60 in. (100 mm through 1500 mm), for Water Transmission and Distribution
4. M23 – PVC Pipe – Design and Installation

C. National Science Foundation (NSF)

1. 61 – Drinking Water System Components – Health Effects

D. Uni-Bell PVC Pipe Association

1. UNI-PUB-8 – Tapping Guide for PVC Pressure Pipe
2. UNI-PUB-9 – Installation of PVC Pressure Pipe
3. Handbook of PVC Pipe Design and Construction

101.7.5 COPPER SERVICE PIPE

Copper tube for water service lines 1" and smaller shall be Type K, soft temper, for underground service conforming to ASTM B-88 and B-251. The pipe shall be marked with the manufacturer's name or trademark and a mark indicating the type of pipe. The outside diameter of the pipe and minimum weight per foot shall

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

not be less than that listed in ASTM B-251, Table II. All fittings on copper service lines shall be brass compression type as manufactured by *Mueller Company, A.Y. McDonald, or Ford Company*.

101.7.6 MECHANICAL RESTRAINED PIPE JOINTS

Exterior pipe joint restraints for 4 inch through 12-inch C900 PVC pipe with bell and spigot push on joints shall be Series 1900 Split Serrated Restraint Harness as manufactured by EBAA Iron or approved equal. Exterior pipe joint restraints for 14 inch through 54-inch C900 PVC pipe with bell and spigot push on joints shall be Series 2800 Megalug Restraint Harness for new installations or Series 1100HV Split Restraint Harness for existing bell and spigot push on joints, as manufactured by EBAA Iron or approved equal.

Exterior pipe joint restraints for new installation of ductile iron pipe push on bell joints shall be Series 1700 Megalug Restraint Harness as manufactured by EBAA Iron or approved equal. Exterior pipe joint restraints for existing ductile iron pipe push on bell joints shall be Series 1100HD Split Megalug Restraint Harness as manufactured by EBAA Iron or approved equal.

101.7.7 FITTINGS

Fittings for ductile iron pipe and 4" diameter or larger PVC pipe shall be cement lined, Bituminous coated ductile iron with Megalug mechanical joints as manufactured by EBAA Iron or equal in accordance with AWWA C-111 and shall have a minimum pressure rating 250 psi, but not less than that specified for the pipe. All ductile iron pipe fittings shall be produced in accordance with all applicable terms and provisions of AWWA C104-08, AWWA/ANSI C110/A21.10, ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.11 as manufactured by Tyler Pipe, no exceptions.

101.7.8 STEEL CASING

Pipe shall be smooth-walled, welded steel pipe fabricated in conformance with ASTM A36 plate or ASTM A1011 sheet with a minimum yield point of 248 MPa (36,000 psi), conforming to AWWA C200.

Internal Coating: Coal tar epoxy coating per ANSI-A21.4 and AWWA C104 minimum 16 mils dry film thickness.

External Coating for above ground applications: Above ground steel casing shall be coated with a 3-coat epoxy/epoxy/polyurethane system in accordance with AWWA C-218, "Coating the Exterior of Aboveground Steel Water Pipelines and Fittings," Section 2.5, Coating System No. 4-91

- Prime Coat: 2-component, pigmented, catalyzed Polyamide epoxy; DFT of 3-4 mils.
- Intermediate Coat: 2-component, catalyzed Polyamide epoxy; DFT of 4-6 mils.
- Finish Coat: 2-component aliphatic polyurethane; DFT 3-4 mils. Ensure the total system has a minimum DFT of 10 mils.

External Coating for below ground applications: Coal tar epoxy coating per ANSI-A21.4 and AWWA C104 minimum 16 mils dry film thickness.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

Table 101.1 Minimum Casing Dimensions

Carrier Pipe Diameter (inches)	Minimum Casing Inside Diameter (inches)	Wall Thickness (inches)	
		Under Highways	Under Railroads
6	14	0.25	0.375
8	16	0.25	0.375
10	18	0.312	0.375
12	22	0.312	0.375
14	27	0.375	0.438
16	30	0.375	0.5
18	32	0.375	0.5
20	34	0.375	0.563
24	40	0.5	0.625
30	45	0.5	0.625

101.7.9 CASING SPACERS AND END SEALS

Casing spacer shall be a two-piece shell per carrier pipe and made from T-304 stainless steel of a minimum 14-gauge thickness. Each shell section shall be lined with a 0.090" thick, ribbed PVC extrusion with a retaining section that overlaps the edges of the shell and prevents slippage. Bearing surfaces (runners) shall be ultra-high molecular weight polyethylene (UHMW) to provide abrasion resistance and a low coefficient of friction (0.12). The runners shall be attached to support structures at appropriate positions to properly support the carrier pipe within the casing pipe and to ease installation. The runners shall be mechanically bolted to the spacer. Risers shall be made of T-304 stainless steel of a maximum 10 gauge and the bolt heads are welded to the inside of the risers for strength. When applicable, all risers shall be MIG welded to the shell. Bottom risers 6" and over in height shall be reinforced. All reinforcing plates shall be 10 ga. T-304 stainless steel and shall be MIG welded to mating parts.

The carrier pipe shall be centered & restrained within the casing pipe and the spacer shall be sized such that the height of the risers and runners are to center the carrier pipe in the casing pipe with a top clearance of three-fourths inch minimum.

Casing spacers shall be Style CSS as manufactured by Cascade Waterworks or approved equal. Casing spacers shall be placed a maximum of 2' from either end of the casing pipe and at intervals along the carrier pipe no greater than 6 feet.

End seals shall be Neoprene with T-304 stainless steel bands Style CCES Casing End Seal as manufactured by Cascade Water Works or approve equal.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

101.8 APPURTENANCES FOR WATER DISTRIBUTION

101.8.1 FIRE HYDRANTS

Fire hydrants shall be the dry bowl type and shall conform to requirements of AWWA C-502. The standard hydrant shall have a six-inch connection, a 5 ¼-inch main valve opening, two (2) 2 ½-inch hose nozzles and one (1) 4 ½-inch pumper nozzle. The hydrant barrel shall be marked with a circumferential rib to denote the intended ground line. The centers of the hose nozzles and pumper nozzle shall be 18” to 22” above finish grade.

Hydrants shall be of the “traffic” or “breakaway” design, having easily replaceable breaking devices for the grade line flange and operating stem that prevents damage to the barrel sections upon impact.

The operating nut and nozzle cap wrench nuts shall be 1 3/8-inch pentagon, measured from point to opposite flat side at the base. The height of the nut shall not be less than one inch.

The nozzle caps shall be removed and the operating nut opened by turning to the left (counter-clockwise). Nozzle caps shall be securely chained to the upper barrel section.

Fire hydrants shall be either *Mueller Model A-423 Super Centurion 250* or *Kennedy K81-D 3-way* hydrant. Hydrant shall meet the applicable requirements of ANSI/AWWA C502 Standard and UL 246 and FM 1510 specifications.

The 2 ½-inch hose nozzles shall be National Standard fire hose thread and the pumper nozzle shall be National Standard 4 ½ -inch.

PAINTING: All fire hydrants shall be painted “factory” red.

101.8.2 GATE VALVES

All valves 12” in diameter and less shall be resilient wedge gate valves and shall meet or exceed all applicable requirements of ANSI/AWWA C515 and AWWA C111, UL 262 listed and FM 1120/1130 approved and certified to ANSI/NSF 61 and 372. Mechanical joint ends shall comply with ANSAIO/AWWA C111. All 3” and larger gate valves shall be Mueller RW Series A-2361 or American Flow Control Series 2500, 350 psi working pressure, or approved equal with either MJ or flanged connections depending on the application. All 2” gate valves shall be American Flow Control Series 2500 or Mueller RW Series 2362, 250 PSI working pressure with threaded connections, or approved equal.

All gate valves shall open left (counterclockwise), be double disc, cast iron body, fully bronze mounted with non-rising stem and parallel seats. The stem and all wearing surface shall be bronze or other approved non-corrosive material. Contact surfaces shall be machine finished and all wearing surfaces shall be easily renewable. Nonferrous bushings shall be of substantial thickness, tightly fitted and pressed into machined seats. Solid wedge valves are not acceptable. Bonnet and stuffing bolts shall be stainless steel.

The valve shall be epoxy coated. The coating shall meet or exceed the requirements of ANSI/AWWA C550 standard.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

101.8.3 WRENCH NUTS

Wrench nuts shall be made of cast iron and shall be 1 5/16-inches square at the top, 2 inches square at the base and 1 3/4-inches high.

101.8.4 TAPPING VALVES

All tapping valves shall be resilient wedge with M.J. X FL ends and shall meet or exceed the applicable requirements of ANSI/AWWA C515 Standard, UL 262 listed, FM 1120/1130 approved and certified to ANSI/NSF 61 and 372. Tapping valves shall be either American Flow Control Series 2500 RW or Mueller T-2361 Resilient Wedge Tapping Valves with a minimum working pressure of 350 psi or approved equal.

101.8.5 BUTTERFLY VALVES

All valves greater than 12" shall be butterfly Valves conforming to ANSI/AWWA C-504 standard Class 250B, NSF 61/372 certified, and rated for a minimum working pressure of 350 psi. The butterfly valve shall be a Lineseal 350 as manufactured by Mueller or approved equal.

101.8.6 VALVE BOXES

All valve boxes shall be produced with Class 35 cast iron in accordance with ASTM A48 and shall be 5 1/4-inch diameter, slip type sized for the type of valve and depth of bury. The lid shall have the word "WATER" permanently cast on the top.

101.8.7 AIR VALVES

Air valves shall be of the type, class, and size specified. A separate isolation valve of the same size and pressure rating as the air valve shall be installed between the water main and the air valve. Each air valve shall be housed in a vault made of reinforced concrete pipe or manhole riser section. The vault shall be covered with a precast concrete lid and cast-iron manhole ring and perforated cover. The total area of perforations in the manhole cover shall be as detailed on the plans or specified by CWD.

101.8.8 ELECTRICAL TRACING WIRE

Electrical tracing wire shall be size No.10, solid copper, insulated wire. The insulation shall be blue.

101.8.9 CORPORATION STOPS AND TAPPING SADDLES

Corporation stops shall be made of brass and in conformance with ANSI/AWWA C800. The corporation stop shall be the same size as the service line (3/4 inch and 1 inch only) in conformance with AWWA /CC Tap Thread, the outlet of the stop shall be a compression end for use with type K copper service tubing. Saddles

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

shall be compatible with C900 PVC pipe and CC tapped. Acceptable manufacturers are Mueller Company, Ford Company, or A.Y. McDonald.

101.8.10 METER YOKE ASSEMBLIES

Meter yokes (3/4" x 5/8" or 1" size) shall be factory fabricated with compression connections to service lines, dual check, copper and brass, with stabilizers and ball valves. All meter valves shall be provided with a locking device and meter coupling attached. Yokes shall be as manufactured by Mueller Company or Ford Company. All meter yoke assemblies greater than 1" in size require CWD approval and will require a bypass and accessible vault for containment.

Meter pits shall be 20" inside diameter, 32" in height with preformed service line pipe access. Pits shall be double-walled plastic round meter box type as manufactured by *Mid-States Plastics, Inc.* Meter pit bells and lids shall be cast iron with the pentagon locking nut lid as manufactured by *Castings, Inc.* and shall be pre-drilled for AMI radio attachment.

101.8.11 REDUCED PRESSURE BACKFLOW PREVENTION DEVICES

Reduced pressure backflow prevention devices shall be the same as the service line and shall be approved by the Foundation of Cross-Connection Control and Hydraulic Research at the University of Southern California.

101.8.12 CONCRETE AND MORTAR

All concrete used in construction of manholes, inlet boxes, vaults, concrete encasement, thrust blocks, etc., shall be Colorado Division of Highways "Class B." Unless otherwise specified, all mortar shall be Type M in accordance with ASTM C 270.

101.8.13 BOLTS

All M.J. and Flange Bolts shall be *Cor-Blue Bolts* or approved equal. All packing box bolts on gate valves or butterfly valves shall be grade 304 stainless steel bolts with Grade 316 stainless steel nuts.

101.8.14 PIPE INSULATION

Acceptable pipe insulation products include two-pound spray polyurethane foam, extruded polystyrene foam, and polyurea encapsulated close-cell foam pipe insulation as manufactured by Dragon Jacket or approved equal. Pipe insulation shall have a minimum "R" value of 8.

101.8.15 SAMPLE STATIONS

The contractor installed water quality sample stations shall be as manufactured by *Kupferle Model Eclipse 88*.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

SECTION 102 SURFACE REMOVALS, EXCAVATION, BACKFILLING, AND RESTORATION OF GROUNDS

102.1 DESCRIPTION

This section covers surface removals, excavation, backfilling, compaction, disposal of surplus material, restoration of disturbed surfaces, and all other work required for the safe and proper construction of potable water systems.

102.2 SURVEY LINE AND GRADE

Unless otherwise specified, a registered Engineer or a Registered Land Surveyor registered in the State of Colorado or someone under their supervision will set line and grade control hubs or pavement markings for piping at a maximum spacing of one hundred (100) feet. A greater interval may be used in conjunction with the use of a laser instrument for maintaining line and grade. Center line location and grade for fittings, valves, fire hydrants, service connections, meter pits, and other appurtenances shall be established by setting two control hubs or pavement markings for each item.

102.3 SURFACE REMOVALS AND TOPSOIL PRESERVATION

The Contractor shall remove surface materials and obstructions only to the widths necessary for excavation of the trench. All trees, shrubbery, fences, and other plantings and structures not designated for removal shall be protected or, if moved, restored to their original condition after construction is complete.

Removal of concrete curbs, gutters, sidewalks, driveways, and asphalt pavement shall be along existing joints or neatly cut lines. All vegetation, concrete, asphalt, and other refuse removed from the construction limits shall be separated from suitable topsoil and backfill material and hauled to an authorized disposal site secured by the Contractor.

Where the trench is in an unpaved area, clean topsoil suitable for final grading shall be stripped, stockpiled separately in approved locations, and restored to the surface after the trench is backfilled.

102.4 BRACING AND SHEETING OF TRENCHES

When necessary or required, trenches shall be properly braced, sheeted or otherwise supported to provide safe working conditions and protection of the work and adjacent property.

All bracing, sheeting, trench shields, and trench boxes shall conform to the recommendations in the Occupational Safety and Health Administration Standards for Construction (OSHA). Unless otherwise approved, all trench support materials shall be removed in a manner that will prevent caving of the sides and movement or other damage to the pipe.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

102.5 TRENCHES WITH SLOPING SIDES

Where working conditions and right of way permit trenches may be excavated with sloping sides in conformance with OSHA standards with the following limitations:

- (1) In traveled streets, alleys, or narrow easements, only vertical trenches with proper bracing will be allowed.
- (2) All soils shall assumed to be OSHA Type C soil, unless otherwise classified by a qualified soils technician.
- (3) Where trenches with sloping sides are permitted, the slopes shall not extend below a point 12 inches above the top of pipe. The trench shall be excavated with the vertical sides below this point with widths not exceeding those specified on the Standard Detail Sheets.

102.6 OPEN EXCAVATION LIMITS

The length of open trench shall be kept to a minimum and shall not exceed the length necessary to accommodate pipe laying and backfilling operations unless otherwise approved by the Engineer. The Contractor shall be responsible for covering or barricading unattended trenches and excavations as necessary for protection of the public and the work. All trenches and excavations shall be backfilled at the end of each workday, unless otherwise shown on the plans or approved by the Engineer. The end of a trench may be left open overnight if the entire perimeter of the excavation is fenced, lighted and barricaded with construction equipment and/or Jersey barriers. No traffic lane shall be blocked by an open excavation, piece of equipment or other obstruction without a proper lane closure, road closure or other approved traffic control.

102.7 UNAUTHORIZED EXCAVATION AND PAVEMENT REMOVAL

Unless authorized by the Engineer, all removed pavement and excavations made beyond the lines and grades shown on the Construction Drawings or described in the Contract Documents shall be replaced at the Contractor's expense.

102.8 UNSTABLE TRENCH BOTTOM

Where the excavation is found to consist of muck, organic matter, or any other material that CWD determines to be unsuitable for supporting the pipe, the Developer/Owner's Engineer shall be required to evaluate the suitability of the native soils to support the proposed improvements and shall provide recommendations for constructing a stable base for the proposed improvements.

102.9 BEDDING AND SHAPING TRENCH BOTTOM

Unless otherwise specified in the Special Conditions, or directed by the CWD in the field, all trenches shall be excavated to at least four (4) inches below the pipe grade and brought back to grade with approved bedding material. The bedding material shall be hand shaped and graded until the trench bottom is uniform and free from

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

rocks, bumps, and depressions. A coupling or bell hole shall be dug at each pipe joint with sufficient length, width and depth to permit assembly of the joint.

102.10 CUTOFF WALLS

Cutoff walls shall be installed along every utility line to inhibit the movement of ground water through the screened rock bedding. Cutoff walls shall be 5 to 10 feet long and consist of native material or imported material that has a permeability rate the same or less than that of the native material. Cutoff walls shall be constructed by discontinuing the installation of bedding and haunch backfill material and installing approved native or imported material. Cutoff walls shall be installed at intervals not exceeding 200 feet on pressurized lines.

102.11 ROCK EXCAVATION

Rock excavation shall consist of the removal of boulders or concrete measuring one-half (1/2) cubic yard or more of hard shale, sandstone, or other bed rock which, in the opinion of the Engineer, requires for its removal the continuous use of pneumatic tools or drilling and blasting. Rock excavation shall be in accordance with Section 203 of the *CDOT Standard Specifications for Road and Bridge Construction*.

Before payment for Rock Excavation is approved, the Contractor will be required to demonstrate that the material cannot be removed by hand pick or by power operated excavator weighing no less than 45,000 pounds. No payment will be made for Rock Excavation unless authorized by the Engineer in writing prior to the work being done.

102.12 BLASTING

Whenever rock excavation is encountered, air or hydraulic hammers or some equivalent method will be used if possible. Blasting shall be used only if other methods have proven unsuccessful and only upon approval of all applicable federal, state, and local permitting authorities.

At a minimum the following conditions must be satisfied before blasting will be allowed:

1. One competent experienced person shall be specifically designated in charge of explosives and all related activities. The blaster-in-charge shall carefully supervise all work related to the use, storage, transportation, and handling of explosives. The blaster-in-charge or the Contractor shall select a blasting crew to assist with explosives activities, including transportation and area security. Only competent, qualified, experienced personnel shall be permitted to handle explosives. Anyone demonstrating carelessness, incompetence, or inexperience shall be excluded from further handling of explosives. The blaster-in-charge shall demonstrate the following minimum qualifications:
 - a. Proof of a valid Colorado Blaster's License or other license issued by an equivalent licensing body.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

- b. Written résumé showing not less than three years of active involvement as blaster- in-charge on projects similar in scope to the current project.
 - c. Five references who can testify to the known qualifications and reliability of the proposed blaster-in-charge.
2. The blasting crewmembers shall demonstrate the following minimum qualifications:
- a. Completion of at least 24 hours of explosives and blasting safety training.
 - b. Written résumés showing not less than one year of acceptable experience with explosives under a qualified licensed blaster.
3. At least 5 days prior to any blasting, the Contractor shall submit a blasting plan to the CWD or its representative and all other applicable permitting authorities. The blasting plan shall at a minimum include the following items:
- a. A description and license number of the vehicle to be used for transportation of explosives, routes to be traveled and proposed hours of travel, and qualifications of driver.
 - b. Type of explosives, initiation system, drilling system, loading plan, firing plan, pre- blast and post-blast inspection, handling of misfires, and removal and disposal of excess explosives.
 - c. Proposed signs, guard system, signal system, methods of communication, pre- blast notification of affected agencies or entities and traffic control measures during blasting.
 - d. Copies of all required permits and licenses.
4. The safety of personnel shall be the primary consideration in decisions involving the use of explosives. Protection of vehicles, utilities, and adjacent property from ground motion or fly-rock must also be provided. Use of blasting mats and other protective devices will be required. The Contractor shall retain sole responsibility for repairing or replacing any utilities or property damaged because of his blasting operations. Due to the proximity of residences and vehicular traffic, use of controlled blasting techniques is specifically required. A delayed blasting system shall be utilized that will not allow more than two holes to detonate simultaneously. Blasting will only be allowed during times of low traffic on the adjacent roads and only in conjunction with traffic

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

closure for the period during which blasting occurs. The appropriate jurisdictional authority must approve traffic closure.

102.13 STOCKPILING EXCAVATED MATERIAL

Excavated material shall be piled in locations that will not endanger the work, create traffic hazards, or obstruct sidewalks and driveways. Fire hydrants, valve boxes, manholes and other utility access points shall be left unobstructed until the work is complete. Gutters and other water courses shall not be obstructed unless other satisfactory provisions are made for runoff and street drainage.

All surplus material and excavated material unsuitable for backfilling shall be removed from the site and disposed of in areas secured by the Contractor.

102.14 DEWATERING TRENCHES

No groundwater dewatering operation shall begin until a Construction Dewatering Permit has been obtained by the Contractor from the Colorado Department of Health and Environment (CDPHE). The dewatering permit may be waived when 100 percent of the groundwater removed from the excavation is used for onsite dust control or other land application approved by the CDPHE.

In addition to a Construction Discharge Permit, no groundwater shall be discharged to a street, storm drainage system, drainage ditch, irrigation ditch, pipe or other facility without written permission from the owner of the receiving facility. Under no circumstances shall the trench water be discharged into sanitary sewers.

Trenches shall be kept free of water during pipe laying operations. The water level shall be maintained at least six (6) inches below the trench bottom throughout the placement of bedding, pipe laying, joining and backfilling operations. The dewatering shall be carried out so that it does not destroy or weaken the strength of the soil under or along the side of the trench. Watertight plugs shall be installed in the ends of all water lines when the trench is not being dewatered. Surface water from any source shall be prevented from entering the trench excavation. No additional payment will be made to the Contractor due to an unstable trench or pipe foundation conditions caused by surface water entering the trench.

102.15 BACKFILLING PIPE AND STRUCTURES

Unless otherwise specified or approved by CWD, all backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown on the Standard Detail Sheets. All approved backfill material shall be adjusted to within three (3) percent of the optimum moisture content prior to its placement in the trench. Jetting or water soaking trenches to achieve compaction of the backfill will not be permitted except when the backfill consists of gravel or other granular material having less than 20 percent of weight passing a No. 200 sieve and a geotechnical investigation has determined that expansive in-situ materials are not present. During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. Pipe haunching material shall be placed and compacted in even lifts

on both sides of the pipe to six (6) inches above the top of the pipe. Above the bedding and haunching material, earth backfill material shall be placed full width in uniform layers not more than twelve (12) inches thick. Each

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

layer shall be compacted to the required density with approved mechanical or hand tamping equipment.

All backfill shall be frequently tested to ensure that the required density is being attained. The minimum requirements for compaction testing shall be as follows:

For every 400 lineal feet of trench and each branch or section of trench less than 400 feet in length, at least one compaction test shall be performed for each two-foot vertical lift of backfill material placed. The first test shall be taken approximately two feet above the top of pipe and the last test shall be at the pavement subgrade or six inches below the ground surface in unpaved areas. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the area shall be defined by additional tests if necessary and the material in the designated area shall be removed and replaced to the required density at the Contractor's expense.

All compaction testing shall be performed by a qualified representative or an independent soil testing laboratory. The Contractor shall bear the cost of testing. It shall be the Contractor's responsibility to make necessary excavations to accommodate compaction tests at all locations designated.

A summary report of all compaction test results shall be submitted to CWD. The test results are required as a basis of acceptance of facilities. (See Section 107.)

Concrete structures shall not be backfilled until the concrete and mortar therein has attained a minimum compressive strength of 2000 psi and can sufficiently support the loads imposed by the backfill. Select backfill shall be placed simultaneously on all sides of the structure in layers approximately twelve (12) inches thick. Each layer shall be compacted to not less than ninety-five (95) percent of the maximum dry density determined in accordance with AASHTO T-99.

102.16 GRANULAR STABILIZATION, BEDDING AND HAUNCHING MATERIALS

When granular materials are required for stabilization of poor subgrade soils, bedding of pipe and structures, and haunching around pipe it shall meet the following gradation requirements.

Percent by Weight Passing Square Mesh Sieves			
Sieve Size	Pipe Bedding & Haunching Material (Class 6)	Granular Stabilization Material (Screened or Crushed Rock)	Pit Run Aggregate
8 inch	---	---	100
2 inch	---	100	---
1 inch	100	---	---
¾ inch	100		
# 4	30-65		
#8	25-55		
# 200	3-12	20 Max.	20 Max.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

102.17 RESTORATION OF GROUNDS

The cleanup and restoration of grounds shall be a continuous process from the beginning of construction to final completion of the work. The Contractor shall keep the work site free from accumulation of debris and waste material caused by his operation.

Immediately after the pipeline is backfilled, the area shall be cleaned and restored to the original grade and condition. All fences, utilities, culverts, ditches, structures, grassed areas and plantings shall be replaced and restored to a condition equal to or better than that at the beginning of construction.

102.18 RESTORATION OF PAVED SURFACES IN SITUATIONS WHERE EXISTING ROADWAYS ARE TO BE KEPT IN SERVICE

Immediately after any section of a completed pipeline has been tested and approved by CWD, the Contractor shall replace all paved surfaces removed or damaged by his operation. All pavement replacement shall be in accordance with the typical trench detail shown on the standard detail sheets, and in accordance with any permit requirements imposed by the City, County, or State.

Unless otherwise approved, all asphalt pavement removed shall be replaced with hot mixed bituminous pavement in accordance with Colorado Division of Highways. All road base shall be Colorado Division of Highways, Class 6, Aggregate Base Course. Paved surfaces shall be restored to their original line and grade and finished to match adjacent undisturbed surfaces.

All curbs, gutters, sidewalks, gutter pans, concrete driveways, concrete pavement, and other concrete hardscape within the right of way shall be replaced by a qualified concrete contractor with a permit issued by the Office of the County Engineer. All concrete shall be Colorado Division of Highways, Class B.

102.19 EROSION CONTROL

Erosion control measures shall be constructed, installed, maintained, moved (if needed) and removed in accordance with the project Storm Water Management Plan (SWMP), the CDPHE Construction Permit (if any) and Section 208 of the CDOT Standard Specifications for Road and Bridge Construction. Erosion control measures shall be maintained during the life of the Contract to prevent or minimize erosion, sedimentation, and pollution of any state waters and wetlands.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

SECTION 103 INSTALLATION

103.1 INSTALLATION OF PIPE AND APPURTENANCES

All pipe, valves, hydrants, manholes and other pipeline appurtenances shall be installed and tested in accordance with the construction plans and specifications, applicable AWWA, ASTM, or AASHTO Standards and Manufacturer's instructions. When installation instructions or procedures differ, the CWD inspector will determine which will take precedence over the others.

103.2 PIPE LAYING

Pipe shall be laid on the alignment shown on the plans or staked. Unless otherwise specified or approved, all pipelines shall be laid to a minimum depth of fifty-four (54) inches measured from the finished grade to the top of pipe. Watermain pipe shall be installed on the north and east sides of the right of way in accordance with the CWD standard details.

The inside of the pipe and jointing surfaces shall be kept clean and free from mud, dirt, gravel, ground water, and other foreign material. When pipe laying is not in progress, the open ends of the pipeline shall be kept closed with watertight plugs.

Long radius horizontal or vertical curves may be laid with standard pipe by deflections at the joints of rigid pipe or by deflecting the entire length of flexible pipe.

Maximum deflections for PVC C900 pipe for 20' pipe lengths and diameters equal to or less than 12" shall be 0.48' feet per pipe length or 1.2 degrees with a minimum allowable radius of 820 feet.

Maximum deflections at pipe joints for diameter pipe greater than 12" or other materials shall be per the Manufacturer's recommendations or applicable AWWA Standard.

All ductile iron pipe with push on type joints shall be electrically connected with cadweld connectors and No. 10 copper wire or a minimum of two brass wedges installed at each joint. The wire ends and cadwelds shall be sealed to prevent corrosion.

When installing piping on a grade of 15% or steeper, the bells shall face uphill.

The design Engineer shall provide a pipe anchorage design and consider slope stability when piping is to be installed on a grade of 20% or steeper.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

103.3 INSTALLATION OF TRACING WIRE

All nonmetallic pipe shall be buried with a continuous electrical tracing wire to enable future location of the pipe. Tracing wire shall be taped to the top of the pipe at 10-foot intervals with 2" wide PVC tape to prevent dislocation of the wire during backfilling. At all fire hydrants, valves, and other locations shown on the plans,

the tracing wire shall be extended to the ground surface for easy access. In paved areas, the tracing wire shall be brought upon the inside of the valve box and securely fastened to the inside wall within 4 inches from the top of the lid. Splices for tracing wire shall consist of a wire nut completely encased with TBT-20 rubber tape.

103.4 POLYETHYLENE ENCASEMENT

Prior to backfilling, all cast iron and ductile iron pipe, fittings, valves, and other metal pipe and appurtenances shall be wrapped with polyethylene encasement material. The polyethylene encasement shall be a minimum thickness of 0.008 inches (8 mil). Installation of the polyethylene tube shall be in accordance with one of the methods described in AWWA C-105.

Ductile iron valves and fittings shall be fully encapsulated by the polyethylene sheeting except for the valve operating nut. The ends of the polyethylene sheeting shall be taped around the full circumference of the pipe. All splices shall overlap a minimum of 12" and the full length of the seam shall be taped.

103.5 THRUST RESTRAINT

Thrust restraint shall be provided at all pipe bends, tees, caps, valves, hydrants and other locations shown on the plans. The thrust restraint may be provided by concrete blocking or mechanical joint restraint. If mechanical joint restraint is used in lieu of concrete blocking, the minimum distance for joint restraint along the pipe away from the fitting shall be determined using the EBAA Iron Thrust Restraint calculations per the Restrain Length Calculator located at: <http://rcp.ebaa.com/>

Joints for all fittings and valves shall have mechanical connections per CWD Material Specifications.

103.6 CONCRETE BLOCKING

The size and location of blocking shall be as shown on the plans, and as directed by CWD. Thrust blocks shall be poured on firm, stable foundation material and all bearing surfaces shall be against undisturbed earth. Form work shall be provided as needed to ensure access to all bolts, nuts, and fittings for repair after placement of the concrete. Plastic sheeting shall be placed between the concrete and the fitting, valve, or piping and the concrete shall not extend around more than one-half of the circumference of the fitting or pipe at any point.

Concrete for support and thrust blocks shall be made with Type II Portland Cement and shall reach a minimum compressive strength of 3000 psi in 28 days.

Reinforcing steel and bolts used to anchor valves, fittings, etc., to thrust blocks when required shall meet tensile requirements of ASTM Grade 40. All anchorage steel not embedded in concrete shall be coated with coal tar

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

or be Cor-Ten steel.

Thrust blocking for bends or pipes greater than 12-inch in diameter or in areas where the operating pressure is greater than 125 psi are not covered by the Standard Details and require special consideration by the design Engineer.

103.7 INSTALLATION OF VALVES AND VALVE BOXES

Each valve shall be installed in a vertical position with a suitable support block as shown on the Standard Water Line Detail Sheet. An adjustable slip type valve box shall be set into position during backfilling operations. The lower section of the valve box shall be supported with brick or block so that it does not rest directly upon the body of the valve or upon the water main. The upper section of the unit shall be placed in proper alignment and adjusted so that its top will be at final grade upon completion of surfacing. The completed valve box shall be vertically centered over the valve operating nut and each valve shall be tested for proper access and operation.

103.8 INSTALLATION OF FIRE HYDRANTS

Hydrants shall be installed at the locations shown on the plans and in accordance with the standard details. They shall be plumb and the center of the pumper nozzle shall be no less than eighteen (18) inches and no more than twenty-two (22) inches above finished grade and set on precast concrete blocks. A minimum of $\frac{1}{4}$ cubic yard of washed $\frac{3}{4}$ inch gravel shall be placed around the base of the hydrant to insure proper drainage of the hydrant after use. Blocking of the hydrant shall consist of pouring a solid concrete base of not less than $\frac{1}{4}$ cubic yard extending from the hydrant base to the undisturbed soil on the bottom and sides of the trench. The thrust block shall be formed to not prohibit full access to all bolts and nuts, and to not block the barrel drain weep holes.

All pipe and fittings from the fire hydrant to the main water line shall be mechanically restrained. The mainline tee shall be mechanically restrained and a concrete thrust block poured behind it.

Weep holes which drain the hydrant shall not be covered with concrete.

103.9 INSTALLATION OF WATER SERVICE PIPE

Water service pipe shall be laid not less than ten (10) feet horizontally from any potential source of contamination (both service and collection lines). Where a 10-foot horizontal separation is not possible, the service line shall be at least eighteen (18) inches above the top of the sewer line and with a minimum cover of forty-two (42) inches. If placed in a common trench with the sewer service, the water service must be placed on a solid shelf excavated to one side of the trench. Where the 18" separation is not practical, the sewer line must be encased in a casing pipe or constructed with C-900 PVC pipe.

Connecting water services that are less than or equal to 1-1/2" diameter to distribution lines that are under pressure at the time the service connection is made shall include a double strap brass tapping saddle and CC threaded corporation stop.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

When installing water services less than or equal to 1-1/2" diameter in conjunction with the installation of the water main, and the service connections are to be made prior to pressurizing the new main, the connections shall be made through a brass corporation stop threaded into a tap tee.

The main shall be tapped at 45 degrees off the vertical (approximately 2 o'clock or 10 o'clock), and the stop must be turned so the T-handle of the corporation valve will be on top. A "gooseneck" loop shall be set vertical immediately after the corporation stop (6" to 12" in height) in the copper service line.

Water services equal to or larger than 2" shall include a gate valve and tapping sleeve if made while the main is under pressure, or gate valve and tee if the main is not under pressure.

Service lines shall be installed to the meter pit location shown on the plans or as designated by CWD. Wherever physical conditions permit, the meter pit shall be located within the adjacent road right of way. Meter pits shall not be placed under curb, gutter, sidewalk, or driveways.

Taps 1-1/2" and less shall be spaced at least 18" apart. Taps greater than 1-1/2" shall be spaced a minimum of 36" apart.

103.10 SERVICE STUBOUTS

The service line shall extend to the meter pit location shown on the plans or designated by CWD. The Contractor shall install the meter yoke and pit so that the final grade elevation will be above the final grade by 0.2 feet. Customer service line stubouts are the responsibility of the owner and not the CWD.

The service line shall extend to the back of the multipurpose or utility easement and marked either by a 4"x 4" board or steel fence post buried vertically. The board or post shall extend 3 feet above the ground surface with the exposed portion painted blue. The end of the service line shall be capped with watertight a plug.

103.11 SYSTEM-PROTECTION DEVICES

Appropriate backflow prevention devices shall be required on any connection to the system which utilizes irrigation systems, fire protection sprinkler systems or presents the possibility of backflow or siphonage. All backflow prevention devices shall be installed in accordance with the most current version of the international plumbing code and the manufacturers recommendations. Backflow prevention will be at the total expense of the customer. When backflow protection is required on a metered line the device shall be installed on the customer's side of the meter. All backflow protection devices shall be subject to testing and inspection as required by the Colorado Department of Public Health and Environment and CWD.

Backflow devices for fire services shall be FEBCO LF876W/WZ or equal. The CWD shall be responsible for supplying and installing a 5/8" leak check meter after the backflow device is installed.

Backflow protections devices for fire services less than 150 feet between the main line and the building can be installed inside the building in an accessible utility room or above ground near the right of way in a heated enclosure.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

Backflow projection devices for fire services that are greater than 150 feet from the main line to the building must be installed above ground near the right of way in a heated enclosure. Heated enclosures shall be as manufactured by AquaShield or equal and shall be sized per the manufacturers recommendations depending on the diameter of the backflow prevention device.

103.12 MAINLINE CONNECTIONS TO EXISTING MAINS

New water lines shall not be placed in service until the new lines have been tested and disinfected by the Contractor and inspected by CWD. CWD technicians shall perform bacteriological testing prior to placing the new line in normal service. If test results fail, the Contractor shall re-disinfect the lines as directed by CWD. All costs for disinfection and re-disinfection of lines shall be the responsibility of the Contractor.

Where the connection of the new work to old requires interruption of service, CWD and the Contractor shall mutually agree upon a date and time for connections which will allow ample time to assemble labor and materials. The Contractor, in conjunction with the CWD project representative, shall notify all water users affected in accordance with CWD's Specifications.

103.13 INSTALLATION OF SAMPLE STATIONS

The sample station shall be located within the Public Right of Way or Utility Easement. The setback shall be such that the station is as close to the curb and/or sidewalk as possible. The bottom of the station shall be level with the final grade of adjacent curb or sidewalk.

The sample station shall be installed with a brass tapping saddle and corporation stop at the main, similar to a standard service tap connection. The service line shall be 3/4 inch, type "K" copper tubing. In no case will the service line be more than 50 feet in total length. Just prior to the sample station, a brass curb stop shall be installed to provide a means of isolating the station for maintenance or repairs. The station shall not be located in a fenced or restricted access area, nor shall it be painted or altered in any way.

103.14 SEPERATION BETWEEN WATER LINES AND SOURCES OF CONTAMINATION

103.14.1 PARALLEL INSTALLATION

Watermains must be at least 10 feet horizontally from any existing or proposed non-potable pipe such as a gravity sanitary or storm sewer, raw surface water pipe, irrigation line, grey water, liquid petroleum, septic tanks, or subsoil treatment system. The distance is measured horizontally from inside pipe edge to inside pipe edge.

Exception

When it is impractical to maintain the 10' horizontal separation the following installation method may be used:

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

- a. Place the water line in a separate trench or on a separate shelf in the same trench with the bottom of the water line at least 18" above the top of the non-potable pipe and construct the non-potable pipe with 150 psi rated water main quality pipe meeting AWWA standards for potable pressure piping.
- b. Other solutions presented by the Colorado registered professional engineer design engineer will be considered.

103.14.2 CROSSINGS

Watermains crossing any existing or proposed non-potable pipe such as a gravity sanitary or storm sewer, raw surface water pipe, grey water, liquid petroleum, or subsoil treatment system must have a minimum of 18" of clear space between the outside of each pipe. At the crossing, one full length of watermain piping must be centered on the crossing so that the joints are as far from the non-potable pipe as possible.

Exception

When it is impractical to maintain the 1.5' vertical separation one of following installation methods may be used:

- a. Place the non-potable pipe in a watertight casing a minimum of 9' from each side of the watermain. The casing shall be 150 psi rated water main quality pipe meeting AWWA standards for potable pressure piping and shall include casing spacers and end seals.
- b. Install the non-potable pipe with 150 psi rated watermain quality pipe meeting AWWA standards for potable pressure piping for a minimum of 9' on either side of the watermain.
- c. When a watermain is installed under an reinforced concrete storm sewer (RCP), 1.5 feet of separation must be maintained AND the RCP must be constructed with gasketed joints in conformance with ASTM C443, or ASTM
- d. Encase the non-potable pipe in concrete a minimum of 10' from either side of the crossing.
- e. Other solutions presented by the Colorado registered professional engineer design engineer will be considered.

In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes. If the space between the non-potable pipe and the watermain is less than 6", rigid foam installation shall be placed between the two pipes. The foam installation must be installed so that it fits tightly between the pipes.

Crossings of sewer and water lines shall not be at an angle less than 45 degrees.

Approval from the owner of the non-potable pipe must be obtained prior to any piping modifications or encasements.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

103.15 EARTH BACKFILL MATERIAL

Under normal conditions, native material shall be used for bedding, haunching and backfilling. Earth backfill material shall consist of approved materials developed from project excavations or imported from another source. To be suitable for backfill, earth or earth and rock material shall be free from muck, frozen lumps, chunks of concrete, ashes, trash, vegetation, and other debris.

All shall have a plasticity limit of less than 7%. All excavated materials which, in the opinion of CWD, are

unsuitable for use in the backfill shall be removed from the site and disposed of by the Contractor at his expense. The maximum size of rock or clod allowed in the various backfill zones shall be as follows:

Zone of Backfill	Maximum size of rock or clod in backfill measured in greatest dimension
Trench backfill from a horizontal plane 6" above top of pipe to ground surface or subgrade of road base course	8"
Within 6" of the exterior surface of pipe or structure	1 ½"

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

SECTION 104 TESTING AND DISINFECTING PIPELINES

104.1 GENERAL

The contractor shall furnish all labor, equipment, tools, materials, water and other incidental items required to conduct all testing, flushing, disinfection required per these specifications. All pressure and leakage testing, and disinfection shall be performed by the Contractor under direct supervision of the CWD in accordance with AWWA C605-21, AWWA Manual of Practice M23, CDPHE requirements, the specifications contained herein, and as directed by the CWD.

The testing sequence shall be as follows:

1. Fill and pressurize the main to at least the static pressure of the existing system to be connected to.
2. Perform a thorough flush of the new system obtaining a minimum of 3 feet per second velocity in all pipe sections. If possible, flush in two directions.
3. Disinfect the new piping and appurtenances per these specifications.
4. Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its length has a residual free chlorine level not greater than the residual normally found in the system.
5. Perform a pressure and leakage test.
6. Conduct a bacteriological test.

104.2 BACKFLOW PROTECTION

When existing water mains are used to supply water for flushing and testing, they shall be protected from backflow contamination by temporarily installing a double check valve backflow prevention assembly between the test and supply water mains. Backflow prevention assemblies shall be tested and certified before use in accordance with CWD requirements. Before the hydrostatic testing, the temporary backflow device shall be removed and the section of piping to be tested isolated from the supply system.

104.3 DISINFECTION OF WATER LINES

After completion of pressure and leakage testing and prior to being placed into service, all new water mains and repaired portions of or extensions of existing mains shall be chlorinated by the Contractor in accordance with AWWA Standard C-651-14 and as modified herein.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

104.4 INITIAL FLUSHING OF POTABLE WATER MAINS

Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have entered the pipe. The duration of flushing shall be long enough to ensure a minimum of three changes of water pass through the new piping. If no hydrant is installed at the end of the main, then the proper size and quantity of taps or a temporary hydrant shall be installed to flush the line at a minimum velocity of 3 feet per second in accordance with the below table:

Table 104.1

Required flow and openings required to flush pipelines at 3.0 ft/sec						
Pipe Dia.	Flow required for 3.0 ft Velocity in Main	Size of Tap			Number of Hydrant Outlets	
Inches	gpm	1"	1-1/2"	2"	2-1/2"	4-1/2"
4"	120	1	—	—	1	1
6"	260	—	1	—	1	1
8"	470	—	2	—	1	1
10"	730	—	3	2	1	1
12"	1060	—	—	3	2	1
16"	1880	—	—	5	2	1

104.5 CHLORINE APPLICATION

All new water lines shall be disinfected by introducing chlorinated water into the new piping so that an initial chloring concentration of 100 ppm is obtained. A water truck or other means approved by the CWD shall be used to introduced chlorinated water into the new piping.

The disinfected shall consist of sodium hypochlorite as provided by the Clifton Water District. An adequate amount of chlorine shall be mixed with clean water to obtain a minimum chlorine residual of 100 ppm at all points within the new piping, including all branches, fire hydrants, and stubs and dead ends.

104.6 POINT OF APPLICATION

At a point as close as possible to, but no farther than 10 feet down stream of the beginning of the new pipeline chlorine shall be introduced into the pipeline via a corporation tap and copper whip. Alternate points of application may be used when approved or directed by CWD.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

104.7 PREVENTING REVERSE FLOW

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves may be used if pre-approved by CWD.

104.8 RETENTION PERIOD

Chlorinated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least ten (10) ppm.

104.9 CHLORINATING VALVES AND HYDRANTS

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.

104.10 FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its length has a residual free chlorine level not greater than the residual normally found in the system.

104.11 BACTERIOLOGICAL TEST

After the final flush, the CWD will take two consecutive sets of samples taken at least 24 hours apart for laboratory analysis. At least one sample shall be taken from each branch for each set of samples and one sample every 1000 feet along the mainline. If the test fails, the Contractor will re-chlorinate according to the Standard and retest. This sequencing shall continue until the bacteriological test passes. Only upon a successful bacteriological test will the installation of service connections and or meters be approve. All costs associated with testing, flushing, and disinfecting shall be the responsibility of the Contractor.

104.12 PRESSURE TESTING

No pressure testing shall be performed until all thrust blocks have been placed and cured for at least seven (7) days, and the pipeline backfilled adequately to prevent any movement or lifting of the pipe. Pavement or other permanent surface shall not be placed until all pressure and leakage tests are satisfactorily completed. No testing shall be considered completed unless a CWD representative is present to witness the testing.

104.13 TEST PRESSURE

Unless otherwise specified, the test pressure for all pipes shall be 1.25 times the normal operating pressure at the lowest point in the piping, or 1.5 times the normal operating pressure at the highest point in the piping, or 150 psi, whichever pressure is greatest. In no case shall the test pressure exceed the rated pressure for the piping, valves, or fittings.

Clifton Water District Design and Construction Standard Specifications

Last Revised: April 9th, 2025

104.14 FILLING

The pipeline shall be filled with potable water at least twenty-four (24) hours before being subjected to the hydrostatic pressure test. Each section of the pipeline shall be filled slowly and from the lowest point in the pipe section. All air shall be expelled by means of taps, fire hydrants, or air release valves at points of highest elevation.

104.15 PRESSURE TEST PROCEDURE

The test shall be performed only after the pipeline has been properly filled, flushed, purged of air. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to CWD. The test duration shall be a minimum of 2 hours.

The testing allowance shall be defined as the allowed quantity of makeup water supplied to the pipe section during the test to maintain a pressure within 5 psi of the required test pressure. No pipe installation will be accepted if the leakage for the section of line being tested is more than the rate calculated using the following formula:

$$Q = \frac{LD \text{ Sq. Root } P}{148,000}$$

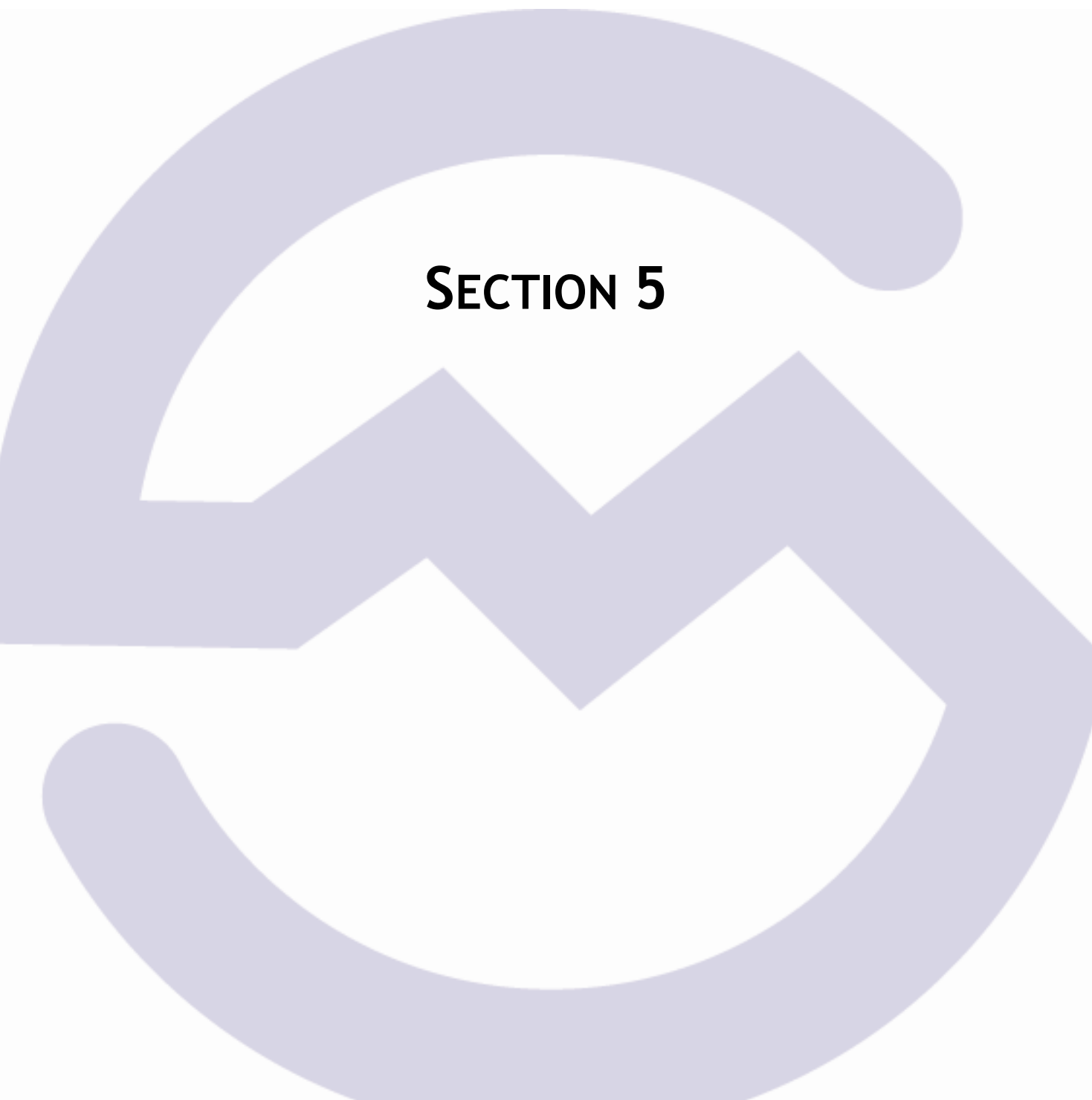
Q= Allowable leakage in gallons per hour

L= length of pipe being tested in feet.

D= Nominal diameter of pipe in inches

P= Average test pressure in psi gauge

Leakage is defined as the quantity of water to be supplied to the section of pipeline being tested, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

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SECTION 5

TABLE OF CONTENTS

DIVISION 03 - CONCRETE

03 10 00	CONCRETE FORMING AND ACCESSORIES	3
03 20 00	CONCRETE REINFORCING	2
03 30 00	CAST-IN-PLACE CONCRETE	5

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 00	ROUGH CARPENTRY	3
06 17 53	SHOP-FABRICATED WOOD TRUSSES	2

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 21 00	THERMAL INSULATION	2
07 41 13	METAL ROOF PANELS	4
07 42 13	METAL WALL PANELS	3
07 92 00	JOINT SEALANTS	3

DIVISION 08 - OPENINGS

08 11 13	HOLLOW METAL DOORS AND FRAMES	3
08 36 13	SECTIONAL DOORS	3
08 71 00	DOOR HARDWARE	4

DIVISION 09 - FINISHES

09 90 00	PAINTING AND COATING	9
09 91 13	EXTERIOR PAINTING	3
09 91 23	INTERIOR PAINTING	3

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 07 19	HVAC PIPING INSULATION	2
23 23 00	REFRIGERANT PIPING	3
23 81 26.13	SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS	4

DIVISION 26 - ELECTRICAL

26 32 13	ENGINE GENERATORS	9
26 36 00	AUTOMATIC TRANSFER SWITCHES	6

DIVISION 40 - PROCESS INTEGRATION

40 00 00	MECHANICAL BASIC MATERIALS AND METHODS	6
40 05 07	PIPE SUPPORTS AND HANGERS	3
40 05 07.01	PIPE SUPPORT AND HANGER SPACING	1
40 05 19	DUCTILE IRON PROCESS PIPE	10
40 05 51	PROCESS VALVES	4
40 70 05	METERS AND GAGES	4

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT

43 23 31.01	PACKAGED PUMP SYSTEM	9
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**SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Form accessories.
- C. Form stripping.

1.02 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials and Commentary; 2010 (Reapproved 2015).
- D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on materials and installation requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI CODE-318, ACI PRC-347, and ACI SPEC-301.

2.02 WOOD FORM MATERIALS

- A. Form Materials: At the discretion of the Contractor.

2.03 REMOVABLE PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gauge, 0.0598 inch thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2.04 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off type, galvanized metal, fixed length, free of defects that could leave holes larger than 1 inch in concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
- C. Filler Strips for Chamfered Corners: Wood strip type; 3/4 x 3/4 inch size; maximum possible lengths.

- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- E. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Coordinate this section with other sections of work that require attachment of components to formwork.

3.03 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Locate and set in place items that will be cast directly into concrete.
- B. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- C. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.05 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
 - 2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.06 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated.

3.07 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.08 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

SECTION 03 20 00 CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI MNL-66 - ACI Detailing Manual; 2020.
- C. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- F. CRSI (DA4) - Manual of Standard Practice; 2024.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI MNL-66 Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

1.04 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Deformed billet-steel bars.
 - 2. Unfinished.
- B. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI CODE-318 and CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is not permitted.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
 - 1. Review locations of splices with Engineer.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Accommodate placement of formed openings.
- C. Maintain concrete cover around reinforcing as indicated on drawings.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 40 00 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION

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

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floors and slabs on grade.
- B. Concrete foundation walls.
- C. Concrete footings.
- D. Joint devices associated with concrete work.
- E. Miscellaneous concrete elements, including equipment pads.
- F. Concrete curing.

1.02 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.
- D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- E. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- F. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- G. ACI PRC-308 - Curing of Concrete—Guide; 2026.
- H. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
- J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.
- K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.
- L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- M. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2023.
- N. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).
- P. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2021.
- Q. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.
- R. ASTM C1012/C1012M - Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution; 2024.
- S. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.
- T. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.
- U. ASTM C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method); 2023.

- V. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design prior to the start of Work, Contractor to submit a statement of the proportions for the concrete mixture signed by a registered engineer in the state in which the Project shall be performed. Statement to include:
 - 1. Location and identification of aggregate source.
 - 2. Batch quantities for one (1) cubic yard of concrete, including:
 - a. Weight of fine aggregate in a saturated surface dry condition.
 - b. Weight of coarse aggregate in a saturated surface dry condition.
 - c. Weight or number of 94-pound bags of cement.
 - d. Weight or gallons of water.
 - 3. Amount and description (including manufacturer, specific product name, and number) of all admixtures.
 - 4. Test results on trial batch concrete made from the proposed mix design, including:
 - a. Cement factor in bags per cubic yard based on yield tests.
 - b. Water-cement ratio.
 - c. Percent of entrained air.
 - d. Consistency in inches of slump.
 - e. At least three 28-day compressive strength tests.
 - 5. Brand, type, and place of manufacture of cement.
 - 6. Aggregate test results for grading, deleterious substances and physical properties using test procedures developed by ACI. Aggregate shall be free of substances that are deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete. Acceptable aggregate shall be based on satisfactory evidence furnished by the Contractor that the aggregate is free from such materials. This evidence shall include service records of concrete of comparable properties under similar conditions of exposure and certified records of tests by a testing laboratory that meets the requirements of ASTM C1077. Tests shall be made in accordance with ASTM C1260.
 - 7. Prior to approval of mixture design, the Contractor shall submit written certification that the aggregate does not have a history of alkali-aggregate reactivity and that the aggregate is approved by a state Department of Transportation. If the aggregate is not approved by a state agency, the aggregates may be approved provided the aggregate is tested in accordance with ASTM C1260 and receives an expansion index of less than 0.10% and has been shown to meet the quality requirements of ASTM C33/C33M with the last two years.
- D. Test Reports: Submit report for each test or series of tests specified.
- E. Project Record Documents: Accurately record time, date and location of each concrete placement, and actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.04 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
- B. Follow recommendations of ACI PRC-305 when concreting during hot weather.
- C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 REINFORCEMENT MATERIALS

2.02 CONCRETE MATERIALS

- A. Blended Hydraulic Cement: ASTM C595/C595M, Type IL.
 - 1. May be substituted with blended hydraulic cement and pozzolans or slags tested in accordance with ASTM C1012/C1012M.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
- C. Fly Ash: ASTM C618, .
 - 1. May be substituted for a portion of the cement. Limits on supplementary cementitious materials per ACI CODE-318.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.03 ADMIXTURES

- A. Chemical Admixture: may be used in strict accordance with manufacturer's recommendations and ASTM Specifications upon approval of the Engineer.
- B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- C. Air Entrainment Admixture: ASTM C260/C260M.
- D. Water Reducing Admixture: ASTM C494/C494M Type A.

2.04 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.

2.05 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- C. Water: Potable, not detrimental to concrete.

2.06 CONCRETE MIX DESIGN

- A. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience, as specified in ACI SPEC-301.
- B. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
- C. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: For each class of concrete as indicated on drawings..
 - 2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.
 - 3. Water-Cement Ratio: Maximum as indicated on drawings percent by weight.
 - 4. Total Air Content: as indicated on drawings, determined in accordance with ASTM C173/C173M.
 - 5. Maximum Slump: 4 inches.
 - 6. Maximum Aggregate Size: 3/4 inch.

2.07 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 PLACING CONCRETE

- A. Place concrete in accordance with ACI PRC-304.
- B. Notify Engineer not less than 48 hours prior to commencement of placement operations.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Ensure reinforcement, inserts, and embedded parts will not be disturbed during concrete placement.
- E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.02 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.03 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.04 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
- D. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:
 - 1. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.05 CURING AND PROTECTION

- A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven days.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

- D. Surfaces Not in Contact with Forms:
 - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding or saturated burlap.
 - 2. Final Curing: Begin after initial curing but before surface is dry.

3.06 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure four concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.07 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.08 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural dimension lumber framing.
- B. Sheathing.
- C. Preservative treated wood materials.
- D. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- C. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata.
- D. AWP A M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2026.
- E. AWP A U1 - Use Category System: User Specification for Treated Wood; 2025.
- F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-Bonded to Wood-Based Structural Sheathing, Used as Water-Resistive Barriers; 2008, with Editorial Revision (2021).
- H. PS 2 - Performance Standard for Wood Structural Panels; 2019.
- I. PS 20 - American Softwood Lumber Standard; 2025.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing.
- C. Product Data: Submit technical data on wood treatment.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: As indicated on drawings.
 - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER

- A. Sizes: Nominal sizes as indicated on drawings, S4S.

- B. Moisture Content: Kiln-dry or MC15.
- C. Stud Framing (2 by 2 through 2 by 12):
 - 1. Species: Hem-Fir.
 - 2. Grade: No. 2.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
 - 1. Grade: Sheathing.
 - 2. Bond Classification: Exposure 1.
 - 3. Performance Category: 5/8 PERF CAT.
 - 4. Span Rating: 40/20.
 - 5. Edges: .
- B. Wall Sheathing, Interior face: Oriented strand board wood structural panel; PS 2.
 - 1. Grade: Sheathing.
 - 2. Bond Classification: Exposure 1.
 - 3. Performance Category: 1/2 PERF CAT.
 - 4. Span Rating: 32/16.
 - 5. Edges: Square.
- C. Wall Sheathing: Oriented strand board structural wood panel with factory laminated rigid plastic insulation board, and water-resistive barrier layer.
 - 1. Sheathing Panel: PS 2, Exposure 1.
 - 2. Thickness: 1-1/2 inches.
 - 3. Thermal Resistance, R-Value: 6.6, minimum.
 - 4. Insulation Board: Polyisocyanurate (ISO) insulation board; comply with ASTM C1289, Type II, Class 2 - Faced with coated polymer-bonded glass fiber mat facers on both major surfaces of the core foam.
 - 5. Integral Water-Resistive Barrier: Sheet material qualifying as a Grade D water-resistive barrier; complying with ICC-ES AC310.
 - 6. Edge Profile: Square.
 - 7. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied, seam tape.
 - 8. Products:
 - a. Huber Engineered Woods, LLC; ZIP System R-Sheathing:
www.huberwood.com/#sle.

2.04 PRESSURE-PRESERVATIVE TREATMENT (PPT)

- A. Provide factory-treated wood members in accordance with AWPA U1 and use category indicated.
- B. Applications - Treat the Following:
 - 1. Wood framing in contact with exterior foundation walls where member is less than 8 inches from exposed earth: Use Category UC1, above ground, interior, dry.
- C. Kiln-dry wood after treatment with waterborne preservative to maximum moisture content of 19 percent for lumber and 15 percent for plywood.
- D. Fabricate to maximum extent possible before treatment.
- E. Label preservative-treated wood with marking as required by AWPA U1 and ICC (IBC). Unless otherwise permitted by standard U1 and the building code, include the following markings: AWPA U1, accredited inspection agency's mark, treating plant identification, type of preservative, preservative retention, and permitted end use.

- F. Field Treatment for Cuts and Holes in Preservative-Treated Wood: Comply with AWP A M4.

2.05 ACCESSORIES

- A. Metal and Finish of Fasteners:
 - 1. Preservative-Treated Wood:
 - a. Nails, timber rivets, wood screws, and lag screws - general use: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
 - 2. Untreated Wood: Unfinished steel.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.02 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
- E. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - 1. Nail panels to framing; staples are not permitted.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.06 CLEANING

- A. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 17 53
SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop-fabricated wood trusses.
- B. Truss bridging.

1.02 REFERENCE STANDARDS

- A. ANSI/TPI 1 - National Design Standard for Metal Plate Connected Wood Truss Construction; 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- C. SBCA (BCSI) - Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining and Bracing of Structural Building Components; 2025.
- D. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses; 1989.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
 - 1. Include identification of engineering software used for design.
 - 2. Provide shop drawings stamped or sealed by design engineer.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design by or under direct supervision of a Professional Engineer experienced in design of this Work and licensed in Colorado.
- B. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle trusses in accordance with SBCA (BCSI).
- B. Store trusses in vertical position resting on bearing ends.

PART 2 PRODUCTS

2.01 TRUSSES

- A. Wood Trusses: Design and fabricate trusses in accordance with ANSI/TPI 1 and to achieve specified design requirements indicated.
 - 1. Design and fabricate temporary bracing in accordance with TPI DSB-89.
 - 2. Connectors: Steel plate.
 - 3. Structural Design: Comply with applicable code for structural loading criteria.
 - 4. Roof Deflection: 1/240, maximum.

2.02 MATERIALS

- A. Lumber:
 - 1. Moisture Content: Between 7 and 9 percent.
 - 2. Lumber fabricated from old growth timber is not permitted.
- B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as required.
- C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.03 ACCESSORIES

- A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: As specified in Section 06 10 00.
- B. Fasteners: Plain steel, type to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that supports and openings are ready to receive trusses.

3.02 PREPARATION

- A. Coordinate placement of bearing items.

3.03 ERECTION

- A. Install trusses in accordance with manufacturer's instructions, SBCA (BCSI); maintain a copy of applicable documents on site until installation is complete.
- B. Set members level and plumb, in correct position.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field-cut or alter structural members without approval of Engineer.
- E. Install permanent bridging and bracing.

3.04 TOLERANCES

- A. Framing Members: 1/2 inch maximum, from true position.

END OF SECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2026.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.04 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- B. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.
- C. Insulation in Wood Framed Ceiling Structure: Batt insulation with separate vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
 - 5. Products:
 - a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com/#sle.
 - b. Owens Corning Corporation; FOAMULAR Type IV Extruded Polystyrene (XPS) Insulation: www.owenscorning.com/en-us/#sle.
 - c. Or Approved Equal..

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.

1. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
2. Facing: Asphalt treated mesh reinforced Kraft paper, one side.
3. Products:
 - a. Knauf Insulation; Performance+ EcoBatt Insulation: www.knaufinsulation.com/#sle.
 - b. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.owenscorning.com/en-us/#sle.
 - c. Or Approved Equal..

2.04 ACCESSORIES

- A. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- B. Protection Board for Below Grade Insulation: Cementitious, 1/4 inch thick.
- C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
 1. Butt edges and ends tightly to adjacent boards and to protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
 1. Butt boards tightly, with joints staggered from insulation joints.

3.02 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Staple or nail facing flanges in place at maximum 6 inches on center.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- H. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over face of member.
- I. Tape seal tears or cuts in vapor retarder.
- J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 41 13 METAL ROOF PANELS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.
- D. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2025.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Storage and handling requirements and recommendations.
 - 2. Installation methods.
 - 3. Specimen warranty.
- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.
- D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.
- E. Test Reports: Indicate compliance of metal roofing system to specified requirements.
- F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
- B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.05 FIELD CONDITIONS

- A. Do not install metal roof panels, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

- C. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Metal Roof Panel Manufacturers:
 - 1. Berridge Manufacturing Company: www.berridge.com/#sle.
 - 2. MBCI, a Cornerstone Building Brands Company: www.mbc.com/#sle.
 - 3. Metal Roofing Systems, Inc: www.metalroofingsystems.biz/#sle.
 - 4. Or approved equal..
- B. Metal Soffit Panels Manufacturers:
 - 1. Berridge Manufacturing Company: www.berridge.com/#sle.
 - 2. MBCI, a Cornerstone Building Brands Company: www.mbc.com/#sle.
 - 3. Metal Roofing Systems, Inc: www.metalroofingsystems.biz/#sle.
 - 4. Or approved equal..

2.02 PERFORMANCE REQUIREMENTS

- A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
 - 1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
 - 2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
 - 3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.03 METAL ROOF PANELS

- A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Metal Panels: Factory-formed panels with factory-applied finish.
 - 1. Steel Panels:
 - a. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 galvanizing.
 - b. Steel Thickness: Minimum 24 gauge, 0.024 inch.
 - 2. Profile: Standing seam, with minimum 1-inch seam height; concealed fastener system for field seaming with special tool.
 - 3. Texture: Smooth.
 - 4. Length: Full length of roof slope, without lapped horizontal joints.
 - 5. Width: Maximum panel coverage of 36 inches.
- C. Metal Soffit Panels:
 - 1. Profile: Style as indicated, with venting provided.
 - 2. Material: Precoated steel sheet, 22 gauge, 0.0299 inch minimum thickness.

2.04 ATTACHMENT SYSTEM

- A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.05 FABRICATION

- A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

2.06 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as indicated on drawings.
 - 1. Products:
 - a. Arkema, Inc; Kynar 500: www.arkema.com/#sle.
 - b. Sherwin-Williams Company; Fluoropon: www.coil.sherwin.com/#sle.
 - c. Or approved equal..

2.07 ACCESSORIES

- A. Miscellaneous Sheet Metal Items: Provide flashings, trim, moldings, closure strips, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
- B. Rib and Ridge Closures: 1 inch high, narrow batten, close-fitting cap of steel with corrosion resistant finish.
- C. Sealants:
 - 1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
 - 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
- D. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
 - 1. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
 - 2. Low Temperature Flexibility: Comply with ASTM D1970/D1970M.
 - 3. Fasteners: As specified by manufacturer and building code qualification report or approval.
 - 4. Products:
 - a. Certainteed Roofing; DiamondDeck Underlayment: www.certainteed.com/#sle.
 - b. Elevate Commercial Building Products; CLAD-GARD Mechanically Attached (MA) Metal Underlayment: www.elevatecommercialbp.com/#sle.
 - c. Or approved equal..

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.
- B. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.
- C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.
- D. Protect surrounding areas and adjacent surfaces from damage during execution of this work.
- E. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.02 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project

conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.

1. Install roofing system with concealed clips and fasteners.
 2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.
- B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, trim, closure strips, preformed crickets, caps, rib closures, ridge closures, and similar roof accessory items.
- C. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.
1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by panel manufacturer.
 2. Install sealant or sealant tape at end laps and side joints as recommended by metal roof panel manufacturer.

3.03 CLEANING

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.04 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 42 13 METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal wall panel system.

1.02 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

1.03 SUBMITTALS

- A. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
 - 1. Physical characteristics of components shown on shop drawings.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions and recommendations.
- B. Samples: Submit two samples of wall panel, 12 inches by 12 inches in size illustrating finish color, sheen, and texture.
- C. Manufacturer's qualification statement.
- D. Installer's qualification statement.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

1.06 FIELD CONDITIONS

- A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
- C. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Wall Panels - Concealed Fasteners:
 - 1. Berridge Manufacturing Company: www.berridge.com/#sle.
 - 2. MBCI, a Cornerstone Building Brands Company: www.mbc.com/#sle.
 - 3. Metal Roofing Systems, Inc: www.metalroofingsystems.biz/#sle.
 - 4. Or Approved Equal..

2.02 METAL WALL PANEL SYSTEM

- A. Performance Requirements:
 - 1. Design and size components to support assembly dead loads and withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
 - 2. Structural Performance:
 - a. Comply with ASTM E330/E330M, using test pressure 1.5 times design wind pressure, with 10-second maximum load duration.
 - 3. Movement:
 - a. Accommodate movement within system without damage to components or seal deterioration.
 - b. Accommodate movement between system and perimeter components when subject to seasonal temperature cycling, dynamic loading, load release, and support framing deflection.
 - 4. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- B. Exterior Wall Panels:
 - 1. Profile: Vertical and horizontal, as indicated; style as indicated.
 - 2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
 - 3. Material: Precoated steel sheet, 22 gauge, 0.0299 inch minimum thickness.
 - 4. Color: As indicated on drawings.
- C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- D. Expansion Joints: Same material, thickness and finish as exterior sheets; ___ gauge, ___ inch thick; manufacturer's standard brake formed type, of profile to suit system.
- E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- F. Anchors: Galvanized steel.

2.03 MATERIALS

- A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as indicated on drawings.
 - 1. Products:
 - a. Arkema, Inc; Kynar 500: www.arkema.com/#sle.
 - b. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.
 - c. Or approved equal..

2.05 ACCESSORIES

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- B. Fasteners: Manufacturer's standard type to suit application; steel, hot dip galvanized.

- C. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

3.02 INSTALLATION

- A. Install panels on walls in accordance with manufacturer's instructions.
- B. Fasten panels to structural supports; aligned, level, and plumb.
- C. Use concealed fasteners unless otherwise indicated by Engineer.
- D. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

- A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch, maximum.
- B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch, maximum.

3.04 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.05 PROTECTION

- A. Protect metal wall panels until completion of project.
- B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 92 00 JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- D. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Dow: www.dow.com/#sle.
 - 2. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
 - 3. Sika Corporation: usa.sika.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 5. Or approved equal..
- B. Self-Leveling Sealants:
 - 1. Dow: www.dow.com/#sle.
 - 2. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
 - 3. Sika Corporation: usa.sika.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 5. Or approved equal..

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints:
 - a. Seal open joints except open joints indicated on drawings as not sealed.
 - 2. Interior Joints:
 - a. Seal the following joints:
 - 1) Joints between door frames, window frames, and other frames and adjacent construction.
- B. Exterior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
- C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

2.03 JOINT SEALANTS - GENERAL

2.04 NONSAG JOINT SEALANTS

- A. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: Match adjacent finished surfaces.
 - 3. Products:

- a. Master Builders Solutions; MasterSeal NP1: www.master-builders-solutions.com/en-us/#sle.
 - b. Sika Corporation; Sikaflex-1A: usa.sika.com/#sle.
 - c. Tremco Commercial Sealants & Waterproofing; Dymonic 100: www.tremcosealants.com/#sle.
 - d. Or approved equal..
- B. Nonsag Traffic-Grade Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
- 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Hardness Range: 20 to 30, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Match adjacent finished surfaces.
 - 4. Products:
 - a. Sika Corporation; Sikaflex-1A: usa.sika.com/#sle.

2.05 SELF-LEVELING JOINT SEALANTS

- A. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
- 1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.

2.06 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.
- B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.02 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install bond breaker backing tape where backer rod cannot be used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

- F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- G. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Thermally insulated hollow metal doors with frames.

1.02 REFERENCE STANDARDS

- A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2026.
- B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- C. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2026.
- F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.
- G. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- H. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- I. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.
- J. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
- K. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- L. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2026.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: <https://steeldoor.org/sdi-certified/#sle>.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.
- C. Maintain at project site copies of reference standards relating to installation of products specified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - 3. Or Approved Equal.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 3. Door Edge Profile: Manufacturers standard for application indicated.
 - 4. Typical Door Face Sheets: Flush.
 - 5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
 - 6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - 2. Door Core Material: Vertical steel stiffeners with fiberglass batts.
 - 3. Door Thermal Resistance: R-value in conformance with code requirements.
 - 4. Door Thickness: 1-3/4 inches, nominal.
 - 5. Weatherstripping: Integral, recessed into door edge or frame.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 71 00.
- D. Touch up damaged factory finishes.

3.03 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 36 13 SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead and sliding sectional doors, manually operated.
- B. Operating hardware and supports.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2026.
- C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, and hardware locations.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Operation Data: Include normal operation, troubleshooting, and adjusting.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sectional Doors:
 - 1. Overhead Door Corporation: www.overheaddoor.com/#sle.
 - 2. Raynor Garage Doors: www.raynor.com/#sle.
 - 3. Or approved equal.

2.02 PERFORMANCE REQUIREMENTS

- A. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
- B. Air Leakage Rate: Less than 0.40 cfm/sq ft when tested in accordance with ASTM E283/E283M at test pressure difference of 1.57 psf.

2.03 STEEL DOORS

- A. Doors: Flush steel, insulated; standard lift operating style with track and hardware.
 - 1. Door Panels: Steel construction; outer steel sheet of 26 gauge, 0.016 inch minimum thickness, flush profile; inner steel sheet of 20 gauge, 0.0359 inch minimum thickness, flat profile; core reinforcement sheet steel roll formed to channel shape, rabbeted weather joints at meeting rails; polyurethane insulation.
 - 2. Door Nominal Thickness: 2 inches thick.
 - 3. Exterior Finish:

- a. Factory finished with standard factory finish; color as selected from manufacturers standard line.
- 4. Interior Finish:
 - a. Factory finished with standard factory finish; color as selected from manufacturer's standard line.
- 5. Manual Operation: Chain hoist.

2.04 COMPONENTS

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
 - 1. For Manual Operation: Requiring maximum exertion of 25 lbs force to open.
- D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- F. Head Weatherstripping: EPDM rubber seal, one piece full length.
- G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
- H. Lock: Inside side mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.
- I. Lock Cylinders: Master keyed to building keying system.

2.05 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.
- B. Insulation: Foamed-in-place polyurethane.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

3.03 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Install perimeter trim and closures.

3.04 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.

- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.06 CLEANING

- A. Clean doors and frames.
- B. Remove labels and visible markings.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 71 00 DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow metal doors.
- B. Thresholds.
- C. Weatherstripping and gasketing.

1.02 REFERENCE STANDARDS

- A. BHMA A156.1 - Standard for Butts and Hinges; 2025.
- B. BHMA A156.4 - Door Closers and Pivots; 2024.
- C. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.
- D. BHMA A156.6 - Standard for Architectural Door Trim; 2021.
- E. BHMA A156.7 - Template Hinge Dimensions; 2022.
- F. BHMA A156.13 - Mortise Locks and Latches; 2022.
- G. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.
- H. BHMA A156.18 - Standard for Materials and Finishes; 2020.
- I. BHMA A156.21 - Thresholds; 2025.
- J. BHMA A156.22 - Standard for Gasketing; 2021.
- K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 - 2. Provide complete description for each door listed.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.

- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of state and local codes.
 - 2. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
- D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See shop drawing submittal of Door Hardware Schedule.
- E. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.

2.02 HINGES

- A. Hinges: Comply with BHMA A156.1, Grade 1.
 - 1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
 - 2. Provide hinges on every swinging door.
 - 3. Provide following quantity of butt hinges for each door:
 - a. Doors From 60 inches High up to 90 inches High: Three hinges.

2.03 FLUSH BOLTS

- A. Flush Bolts: Comply with BHMA A156.16, Grade 1.
 - 1. Flush Bolt Throw: 3/4 inch, minimum.
 - 2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
 - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
 - 3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
 - 4. Manual Flush Bolts: Provide lever extensions for top bolt at over-sized doors.
 - 5. Self-Latching Flush Bolts: Automatically latch upon closing of door; manually retracted; located on inactive leaf of pair of doors.

2.04 LOCK CYLINDERS

- A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 - 1. Provide standard type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
 - 2. Provide cylinders from same manufacturer as locking device.
 - 3. Provide cams and/or tailpieces as required for locking devices.

2.05 MORTISE LOCKS

- A. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
 - 1. Latchbolt Throw: 3/4 inch, minimum.
 - 2. Deadbolt Throw: 1 inch, minimum.
 - 3. Backset: 2-3/4 inch unless otherwise indicated.
 - 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.

2.06 CLOSERS

- A. Closers: Comply with BHMA A156.4, Grade 1.
 - 1. Type: Surface mounted to door.
 - 2. Provide door closer on each exterior door.
 - 3. At outswinging exterior doors, mount closer on interior side of door.

2.07 PROTECTION PLATES

- A. Protection Plates: Comply with BHMA A156.6.
- B. Metal Properties: Stainless steel material.
 - 1. Metal, Heavy Duty: Thickness 0.062 inch, minimum.
- C. Edges: Beveled, on four sides unless otherwise indicated.
- D. Fasteners: Countersunk screw fasteners.
- E. Drip Guard: Provide at head of exterior doors unless covered by roof or canopy.

2.08 KICK PLATES

- A. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
 - 1. Size: 12 inch high by 2 inch less door width (LDW) on push side of door.

2.09 DOOR HOLDERS

- A. Door Holders: Comply with BHMA A156.16, Grade 1.
 - 1. Provide surface mounted door holders when wall or floor stop is not applicable and hold-open device is mounted on door.
 - 2. Type: Lever, or kick down stop, with rubber bumper at bottom end.
 - 3. Material: Stainless steel.

2.10 FLOOR STOPS

- A. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
 - 2. Type: Manual hold-open, with dome floor stop.
 - 3. Material: Stainless steel housing with rubber insert.

2.11 WALL STOPS

- A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Type: Bumper, convex, wall stop.
 - 2. Material: Stainless steel housing with rubber insert.

2.12 ASTRAGALS

- A. Astragals: Comply with BHMA A156.22.
 - 1. Provide recessed astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
 - 2. Type: Split, two parts, and with sealing gasket.
 - 3. Material: Stainless steel, with neoprene weatherstripping.
 - 4. Provide non-corroding fasteners at exterior locations.

2.13 THRESHOLDS

- A. Thresholds: Comply with BHMA A156.21.
 - 1. Provide threshold at each exterior door, unless otherwise indicated.
 - 2. Type: Flat surface.
 - 3. Material: Stainless steel, with rubber weatherstripping.
 - 4. Threshold Surface: Fluted horizontal grooves across full width.
 - 5. Field cut threshold to profile of frame and width of door sill for tight fit.
 - 6. Provide non-corroding fasteners at exterior locations.

2.14 WEATHERSTRIPPING AND GASKETING

- A. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 - 1. Head and Jamb Type: Adjustable.
 - 2. Door Sweep Type: Encased in retainer.
 - 3. Material: Stainless steel, with rubber weatherstripping.

4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
5. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.15 LATCH PROTECTOR

- A. Latch Protector: Provide on door to protect latch from being tampered with while in locked position.
 1. Type: Standard latch protector.
 2. Material: Stainless steel.

2.16 SILENCERS

- A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
 1. Single Door: Provide three on strike jamb of frame.
 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
 3. Material: Rubber, gray color.

2.17 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
 1. Primary Finish: 625; bright chromium plated over nickel, with brass or bronze base material (former US equivalent US26); BHMA A156.18.
 2. Exceptions:
 - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

- A. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

**SECTION 09 90 00
PAINTING AND COATING**

PART 1 GENERAL

1.01 SUMMARY

- A. Work under this Section shall include all labor, parts, materials and equipment necessary to furnish and install all painting and finish systems as specified herein and shown on the Drawings. This section shall apply to all buildings and all exposed interior and exterior materials and piping.

1.02 REFERENCES

- A. ASTM D16 – Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. AWWA C204 – Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.
- C. AWWA D102 – Painting Steel Water Storage Tanks.
- D. NACE – National Association of Corrosion Engineers-Industrial Maintenance Painting.
- E. NPCA – National Paint and Coatings Association-Guide to U.S. Government Painting Specifications
- F. NSF 61 – Drinking Water System Components-Health Effects.
- G. PDCA – Painting and Decorating Contractors of America-Painting-Architectural Specifications Manual.
- H. SSPC - Steel Structures Painting Council Specifications.
- I. ICRI - International Concrete Repair Institute.

1.03 SUBMITTALS

- A. Product Data
 - 1. Complete listing of all materials to be used including generic type, surface preparation requirements and recommended application techniques. Include material safety data sheets.
- B. Color Samples
 - 1. Furnish color chips for color selection by Owner. Selections by Owner may exceed manufacturer's standard range of colors.
- C. Field Samples
 - 1. Furnish representative samples of color and finish texture of each paint type.
- D. Manufacturer's Instructions
 - 1. Indicate special surface preparation procedures, substrate conditions requiring special attention.
- E. Painting Schedule
 - 1. Identify all surfaces to be painted.
 - 2. Identify surface preparation to be used.
 - 3. Identify type of primer coating, film thickness, shop or field applied.
 - 4. Identify type of final coating, film thickness, shop or field applied.

1.04 DELIVERY, STORAGE AND HANDLING

- A. All materials delivered to the job site shall be in original sealed and labeled containers of the paint manufacturer. Labels and directions shall be legible. Store materials in dry location, designated by Engineer, kept within temperature limits set by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers

1. Tnemec Company.
 2. Sherwin Williams.
 3. Engineer Approved Equal.
- B. Coating thicknesses stated are the minimum acceptable Dry Film Thickness (DFT) for the reference product.

2.02 METAL SURFACES

- A. All structural and miscellaneous steel surfaces, exterior, non-immersion, except galvanized and stainless steel. This includes, but is not limited to the following; doors and frames, steel handrails, pumps, motors, and other process equipment, etc.

1. System: Epoxy
2. Surface Preparation: Per representative manufacturer.
3. Coatings:

Prime Coat	Factory Primed	
Intermediate	Tnemec Series V69	2.0 – 3.0 mils
Finish Coat	Tnemec Series 73	2.0 – 5.0 mils
	Total	4.0 – 8.0 mils

4. Color: Red, Match City's Lift Station 14,000, selected by Owner from manufacture standard.

- B. All structural and miscellaneous steel surfaces, interior, non-immersion, except galvanized and stainless steel. This includes, but is not limited to the following; doors and frames, beams and roof decking, steel handrails, pumps, motors, and other process equipment, etc.

1. System: Epoxy
2. Surface Preparation: Per representative manufacturer
3. Coatings:

Prime Coat	Tnemec Series V69	3.0 – 5.0 mils
Finish Coat	Tnemec Series V69	3.0 – 5.0 mils
	Total	6.0 – 10.0 mils

4. Color: Black, selected by Owner from manufacture standard.

2.03 PIPING

- A. All ductile iron piping, interior or immersion.

1. System: Epoxy.
2. Surface Preparation: Per representative manufacturer.
3. Coatings:

Prime Coat	Tnemec Series V69	3.0 – 5.0 mils
Finish Coat	Tnemec Series V69	4.0 – 6.0 mils
	Total	7.0 – 11.0 mils

4. Color: Per process color identification requirements

- B. All exterior ductile iron piping, non-immersion.

1. System: Epoxy/Polyurethane.
2. Surface Preparation: Per representative manufacturer.
3. Coatings:

Prime Coat	Tnemec Series V69	3.0 – 5.0 mils
Finish Coat	Tnemec Series V69	4.0 – 6.0 mils
	Total	7.0 – 11.0 mils

4. Color: Per process color identification requirements.

- C. All ductile iron piping below ground.

1. System: Epoxy.

2. Surface Preparation: Per representative manufacturer.

3. Coatings:

Prime Coat	Tnemec Series 66	3.0 – 5.0 mils
Finish Coat	Tnemec Series 46H-413	16.0 – 20.0 mils
	Total	19.0 – 25.0 mils

4. Color: Black.

D. All interior plastic, PVC, and copper piping

1. System: Epoxy.

2. Surface Preparation: Per representative manufacturer.

3. Coatings:

Prime Coat	Tnemec Series V69	2.0 – 3.0 mils
Finish Coat	Tnemec Series V69	2.0 – 3.0 mils
	Total	4.0 – 6.0 mils

4. Color: Per process color identification requirements.

5. For exterior service: Top coat with Tnemec Series 73 at 2.0-3.0 mils OR SW Acrolon 218 at 3.0-6.0 mils.

2.04 CONCRETE AND MASONRY SURFACES

A. The interior masonry walls shall be coated as follows:

1. System: Epoxy

2. Surface Preparation: Per representative manufacturer.

3. Coatings:

Prime Coat	Tnemec Series V69	4.0 - 6.0 mils
Finish Coat	Tnemec Series V69	4.0 - 6.0 mils

4. Color: White

B. All exterior concrete block surfaces:

1. System: Penetrating Sealer.

2. Surface Preparation: Per representative manufacturer.

3. Coatings:

Prime Coat	Tnemec Series 633	100 – 125 sf/gal
	Total	100 – 125 sf/gal

4. Color: Transparent

C. All smooth finished interior concrete floors and walkways that will not be otherwise covered or treated shall be coated.

1. System: Concrete Sealer

2. Surface Preparation: Per representative manufacturer.

3. Coatings:

Finish Coat	Tnemec Series 629	300 - 350 sf/gal
OR		
Finish Coat	SW H&C Concrete Stain	100 – 125 sf/gal

4. Color: Transparent

2.05 PIPE MARKING SYSTEM

A. Required on any rigid potable / non-potable waterlines.

1. Type - Paint conforming to the various sections above or pressure-sensitive tape equal to VX Company or Seton Nameplate Corporation.

2. Information required - Direction of flow and name of fluid.

3. Marking requirements.

4. Color requirements.

2.06 IDENTIFICATION OF PIPING AND PROCESS SYSTEMS

- A. Scope of Work. Work under this Section covers installation of piping marking systems for permanent piping and appurtenances. Piping systems include conduits for the transport of gases, liquids, semi-liquids, and their component parts, including valves, sluice gates and slide gates and any control device, which is an operational component of the system.
- B. Reference Standards. Standards listed hereunder and referenced elsewhere in these Specifications shall become a part of this specification and are incorporated herein by reference. The latest edition, amendment or supplement thereto in effect 30 days before date of invitation shall apply.
1. Scheme for Identification of Piping Systems.
 2. Safety Color Code for Marking Physical Hazards.
- C. Submittals
1. Product Data: Submit catalog data or brochures on manufactured items specified and proposed for use.
 2. Certificates of Compliance: Furnish certification that standards specified herein are met.
 3. Samples: Furnish physical examples to illustrate materials, equipment or workmanship.
- D. Materials
1. General. Content of piping systems shall be identified according to base color of pipe supplemented by completely encircling solid color bands at least 9 inches in length (longer when necessary to accommodate full identification labels and two-inch end borders), applied to pipe or pipe covering. Stencils or labels may be used.
 2. Lettering. Paint, stencil, or use identification labels. Letter size as follows:

Outside Diameter of Pipe or Covering (Inch)	Minimum Height of Letters (Inch)
5/8 or smaller	Metal Tags 1/4
3/4 through 4	3/4
5 or larger	2

3. Identification Labels. Identification labels shall be Brady "Quik-Labels" (mastic back) as manufactured by the W. H. Brady Company or equal.
4. Metal Tags
 - a. Aluminum or stainless steel, stamped in identifying letters.
 - b. Provide on pipe 5/8 inch or smaller (including cover) outside diameter.
 - c. Color code as specified.
5. Color Classification (General)
 - a. Green or Blue: Identifying color or non-hazardous media causing no danger to person or property.
 - b. Yellow: Identifying color for materials hazardous to life or property by virtue of being explosive, flammable, or productive or poisonous gases or in themselves poisonous, corrosive or hazardous due to their physical state.
 - c. Orange: Identifying color where electrical currents in excess of 120 volts occur.
6. Pipe Identification.
 - a. Color Band and Legend Dimensions:

Outside Diameter of Pipe Or Pipe Covering	Width of Color Band	Size of Legend
3/4" to 1 1/4"	8"	1/2"
1 1/2" to 2"	8"	3/4"
2 1/2" to 6"	12"	1 1/4"
8" to 10"	24"	2 1/2"
Over 10"	32"	3 1/2"

7. Legend Information: Include the name of the fluid, and an arrow indicating direction of flow. Where pipes are too small for an application of bands or legends, install stainless steel identification tags at the specified locations.

2.07 COLOR AND IDENTIFICATION

A. Wastewater Treatment Facility

Media	Base Color	Band Color	Letter Color	Legend
Potable Water	Blue	Vista Green	White	H2O
Non-Potable Water	Purple	White	Black	Non-Potable
Chlorine Gas	Lemon Yellow	None	Black	Cl2 Gas
Chlorine Solution	Lemon Yellow	White	Black	Cl2 SOL
Sanitary Sewer	Light Gray	Lemon	Yellow White	SAN
Secondary Effluent	Light Gray	Lemon	Yellow White	SE
Raw Wastewater	Light Gray	Lemon	Yellow White	WW
Settled Sewage	Light Gray	Lemon	Yellow White	
Mixed Liquor	Light Brown	Lemon Yellow	White	ML
Return Activated Sludge	Light Brown	Lemon Yellow	White	RAS
Sludge	Light Brown	Lemon Yellow	White	
Waste Activated Sludge	Light Brown	Lemon Yellow	White	WAS
Biosolids	Light Brown	Lemon Yellow	White	BIO
Sloppy Cake Discharge	Light Brown	Lemon Yellow	White	SLC
Scum	Dark Brown	Lemon Yellow	White	SC
Grit Slurry	Dark Gray	Lemon Yellow	White	GR
Drain	Dark Gray	Lemon Yellow	White	D
Centrate	Dark Gray	Lemon Yellow	White	CEN
Centrate / Supernatant	Dark Gray	Lemon Yellow	White	CEN/SNT
Decant / Supernatant	Dark Gray	Lemon Yellow	White	SNT
Sample	Light Gray	Green	Black	
Polymer Solution	Yellow	White	Black	POLY
Refrigerant	Yellow	Blue	Black	Refrigerant
Sodium Hypochlorite	Yellow	Red	Black	NaOCl
Fire Protection	Red	None	Black	Fire
Natural Gas	Red	None	Black	NG
Compressed Air	Light Green	None	Black	Air
Low Pressure Air(aeration supply)	Light Green	None	Black	LP Air

Instrument Air	Kelly Green	None	White	
Electrical (over 120V)	Bright Orange	None	Black	Voltage (list amount)
Control		Black	Black	Control
Vent	Light Gray		Black	
Other Lines	Light Gray		Black	

Lemon yellow, orange and green colors shall conform to ANSI Z53.1.

PART 3 EXECUTION

3.01 GENERAL

- A. It is the intent of this specification to give the general coating requirements for different substrates and service conditions. Where multiple products could be used in the same general vicinity, such as a clarifier where some steel is immersed and some is exposed, the more stringent requirement shall prevail and the associated coating shall be used for the entire assembly. In the clarifier example, all immersed and exposed parts shall be coated with the product for the more stringent service application.
- B. Application. Apply base color to entire run of piping. Prior to application of bands and legend, verify suitability of proposed locations with Engineer as described hereafter. Protect painted legends from damage and concealment by foreign matter throughout the construction period. Verify total visibility of legends prior to final acceptance.
- C. Pipe Identification. Identify straight lines of pipe at intervals of approximately 20 feet. Piping shall also be identified at a point approximately two feet from all turns, valves and upstream side of distributional fittings or branches. Branch take-offs from horizontal runs to outlet cocks or valves less than 10 feet in length need not be identified if in the same room. The lettered label, besides identifying the materials, shall indicate unusual qualities of the pipe contents, such as hot (85°F or higher) or high pressure (above 30 psig). On service piping, either liquid or gas, apply black arrows of same height and with same background color as adjacent identification labels to indicate direction of flow. Legends shall be located so a person standing at ground level may read them.
- D. Shop Coatings. Verify compatibility of any shop coatings with finish field coatings and these Specifications. Provide barrier coats as required.
- E. Surface Preparation. Inspect all surfaces to be painted and perform such surface preparation as is normally required by good painting practice, as required by product manufacturer, and as specified herein. Should any surface be found unsatisfactory to produce a proper finish, the Engineer shall be notified in writing and no material shall be applied until the unsuitable surfaces have been made satisfactory. Surface preparation shall be approved prior to any paint application. Where media blasting is required, contractor shall control dust and protect adjoining areas.
- F. Material Preparation. Materials shall be mixed, thinned and applied in strict accordance with the manufacturer's printed instructions. No exceptions will be allowed without written explanation from manufacturer and prior approval by Engineer.
- G. Application. Coatings shall be applied during good painting weather. Coating shall only be applied to properly prepared surface and within manufacturer's coating windows. Air and surface temperatures shall be within limits prescribed by the coating manufacturer. The work areas shall be kept reasonably free of airborne dust at the time of application and while the coating is drying.
- H. Allow each coat to dry thoroughly before applying the next coat. Dry time shall be as recommended by manufacturer with no exceptions.
- I. All work shall be cut neatly and finish coats shall be uniform in color and texture without streaks, laps, heavy build-ups, runs, sags or missed areas. Intermediate coats shall be shaded

sufficiently to allow visual inspection of adequacy of coverage. Each coat shall be approved prior to application of subsequent coats.

- J. Contract shall protect all work to eliminate product overspray and drift. Contractor responsible for all cleanup and restoration to pre-work conditions or better.
- K. Excess Materials. All paint materials, opened, but unused, shall remain the property of the Owner for use in maintenance and touch-up. Contractor shall ensure that remaining product is clearly marked with product type, color and intended application.

3.02 FIELD QUALITY CONTROL

- A. Contractor shall complete and sign daily field reports documenting field conditions, work areas and materials applied. Contractor shall complete Form 9900-A (or other approved form) on a daily basis and submit record copies on a weekly basis to Engineer.
- B. Surface Preparation. Receive approval before paint application.
- C. Finish. Receive approval on all coats prior to additional coating applications.
- D. Contractor to document and submit wet mil thickness for all applications using standard "notch" configuration or circular dial gauges.
- E. Testing. The following tests are considered the minimum field quality assurances tests. The prescribed test shall be performed by a third-party inspector that will be paid for by the Owner.
 - 1. Concrete – any concrete scheduled for specialty coating,
 - a. Prior to application, test substrate for relative humidity using ASTM F2170.
 - b. Consult Engineer if values are outside manufacturer's allowed range
 - 2. DFT of all applied coatings.
 - a. Equipment
 - 1) Type 1: Magnetic pull-off type gauge
 - 2) Type 2: Fixed probe magnetic flux gauge with microprocessor
 - 3) Use eddy current type gauge or probe attachment for non-ferrous metal substrates
 - 4) Gauge accuracy: ± 10 percent
 - b. Comply with inspection and film thickness testing requirements of SSPC-Volume 1, Chapter 6 and SSPC-PA 2.
 - 1) Make five (5) separate spot measurements (average of three readings for each spot measurement) spaced evenly over each 100 square feet (9.3 square meters) of area to be measured
 - 2) The average of five spot measurements for each such 100 square foot area shall not be less than the specified thickness
 - 3) No single spot measurement in any 100 square foot area shall be less than 80 percent of the specified thickness
 - 4) Any one of three readings which are averaged to produce each spot measurement may under-run by a greater amount
 - 5) The five spot measurements shall be made for each 100 square feet of area as follows:
 - 6) For structures not exceeding 300 square feet in area, each 100 square foot area shall be measured
 - 7) For structures not exceeding 1,000 square feet in area, three 100 square foot areas shall be randomly selected and measured
 - 8) For structures exceeding 1,000 square feet in area, the first 1,000 square feet shall be measured as stated above and for each additional 1,000 square feet of area or increment thereof, one 100 square foot area shall be randomly selected and measured
 - 9) If the dry film thickness for any 100 square foot area is not in compliance with the requirements above, then each 100 square foot area shall be measured

- c. Other size areas or number of spot measurements may be adjusted as appropriate for the size and shape of the structure to be measured as determined by Engineer

END OF SECTION

FORM 9900-A. DAILY FIELD COATING REPORT

DATE

COMPANY

SUPERVISOR

WEATHER (ATMOSPHERIC) DAILY HIGH

DAILY LOW

TEMP @ START

TEMP @ FINISH

% REL. HUMIDITY

DEW POINT

WORK AREA 1

LOCATION DESCRIPTION

APPLICATION PERSONNEL

EQUIPMENT

SUBSTRATE

PRODUCT DESCRIPTION (MFG AND TYPE)

INTENDED USE FOR PRODUCT

SURFACE PREPARATION REQUIREMENT

TIME FOR TOPCOAT

TIME FOR RECOAT – MAX.

PRODUCT PREPARATION AND MIX REQUIREMENTS

PRODUCT STORAGE REQUIREMENT

WORK AREA DAILY HIGH

DAILY LOW

TEMP @ START

TEMP @ FINISH

% REL. HUMIDITY

DEW POINT

WORK AREA PROTECTIVE MEASURES (TO PROTECT WORK)

NOTES:

SIGNATURE

SECTION 09 91 13 EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified approved by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer.
- B. Paints:
 - 1. BEHR Paint Company: www.behr.com/#sle.
 - 2. Cloverdale Paint, Brand Products of Rodda Paint Company: www.cloverdalepaint.com/#sle.
 - 3. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 - 4. Pittsburgh Paints: www.pittsburghpaints.com/#sle.
 - 5. Rodda Paint Company: www.roddapaint.com/#sle.
 - 6. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 7. Or approved equal..
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

2.03 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.02 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.

- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.03 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.04 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23 INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Glass.
 - 6. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. Cross-reference to specified paint system products to be used in project; include description of each system.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

- D. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer.
- B. Paints:
 - 1. BEHR Paint Company: www.behr.com/#sle.
 - 2. Cloverdale Paint, Brand Products of Rodda Paint Company: www.cloverdalepaint.com/#sle.
 - 3. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 - 4. Pittsburgh Paints: www.pittsburghpaints.com/#sle.
 - 5. Rodda Paint Co: www.roddapaint.com/#sle.
 - 6. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 7. Or approved equal..
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.03 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.
- F. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.02 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.03 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.04 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 23 07 19 HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.

1.02 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
- D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than 5 years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 - 1. Armacell LLC; ArmaFlex: www.armacell.us/#sle.
 - 2. Armacell LLC; ArmaFlex Shield: www.armacell.us/#sle.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. K Value: 0.28 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 2. Minimum Service Temperature: Minus 40 degrees F.
 3. Maximum Service Temperature: 220 degrees F.
 4. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Weather Barrier Coating: Pre-jacketed with durable moisture and UV resistant coating, suitable for outdoor applications, meeting ASTM C1775.

2.03 ACCESSORIES

- A. General Requirements:
1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
 2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
 3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
 4. Supply materials that are asbestos free.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

3.03 SCHEDULE

- A. Refer to Drawings for specific service thickness and applications.

END OF SECTION

SECTION 23 23 00 REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.

1.02 REFERENCE STANDARDS

- A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).
- B. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.
- C. ASME B31.9 - Building Services Piping; 2020.
- D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- F. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.
- G. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
- H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Include data on pipe materials, fittings, valves, and accessories.
- C. Shop Drawings: Indicate schematic layout of refrigerant piping, including equivalent, critical dimensions, and sizes. Indicate explicitly that actual lengths are within manufacturer's installation requirements.
- D. Installer's qualification statement.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure integrity of system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Provide pipe hangers and supports in accordance with MSS SP-58 unless indicated otherwise.

- C. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

2.02 REGULATORY REQUIREMENTS

- A. Comply with ASME B31.5 for installation of piping system.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- C. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.03 PIPING

- A. Refer to Drawings for schedule of specific piping material applications to the project.
- B. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
 - 1. Type: ACR.
 - 2. Fittings:
 - a. ASME B16.26 cast copper fittings for flared copper tubes.
 - b. ASME B16.50 wrought copper suitable for brazing.
 - c. Long radius elbows suitable for application.
 - d. Annealed Bends: Mandrel bent.
 - 3. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- C. Pipe Supports and Anchors:
 - 1. The material in contact with the pipe shall be compatible with the piping material so that neither shall have a deteriorating action on the other. Non-metallic wear pads shall be implemented where galvanic corrosion potential exists.
 - 2. Provide hangers and supports that comply with MSS SP-58.
 - a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 4. Copper Pipe Support: Carbon steel ring, adjustable, copper plated, vibration isolation insert.
 - 5. Vertical support: Cush clamp with vibration isolation insert.
 - 6. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 - 7. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
 - a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
 - b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 - d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
 - e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.04 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES

- A. Ball Valves:
 - 1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

- B. Service Valves:
 - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 APPLICATION

- A. Refer to Drawings for schedule of specific piping material applications to the project.

3.03 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Provide all manufacturer recommended piping accessories.
- C. Slope and arrange pipe as prescribed by the manufacturer's requirements.
- D. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- E. Install piping to conserve building space and avoid interference with use of space.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
 - 1. Install in accordance with MSS SP-58.
 - 2. Provide vibration isolation for all piping supports, including horizontal, vertical and concealed runs within the building.
 - 3. Support horizontal piping in accordance with MSS SP-58 or IMC Table 305.4.
 - 4. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 5. Place hangers within 12 inches of each horizontal elbow.
 - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Flood piping system with nitrogen when brazing.
- J. Insulate piping.
- K. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test and repair piping until no leakage.

END OF SECTION

SECTION 23 81 26.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Indoor air handling (fan and coil) units for ductless systems.
- C. Controls.

1.02 REFERENCE STANDARDS

- A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).
- B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- C. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
 - 1. Explicitly indicate performance at project specific conditions including both altitude effects and temperature conditions indicated on Drawings.
 - 2. Provide written confirmation that maximum lineset lengths specified by manufacturer will not be exceeded as applied to project specific installation.
- C. Design Data: Indicate refrigerant pipe sizing.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- F. Project Record Documents: Record actual locations of components and connections.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 10 years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience and approved by manufacturer.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 AIR SOURCE HEAT PUMPS - ONE TO ONE UNITS

- A. General: Horizontal discharge outdoor units. 1/2 to 3 ton nominal cooling and heating capacity.
 - 1. Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure is all the factorywiring, piping, controls, and the compressor.
 - 2. Units are to be used in a refrigeration circuit matched for use to the fan coil unit by the same manufacturer.
 - 3. Manufacturers:
 - a. Trane: MUZ-GX.
 - 4. Unit Cabinet:
 - a. Unit cabinet is constructed of galvanized steel, bonderized and coated with baked enamel finish on the inside and outside.
 - b. Unit access panels are removable with minimal crews and provides full access to the compressor, fan, and control components.

- c. The outdoor compartment is isolated and has an acoustic lining to assure quiet operation.
- 5. Fans:
 - a. Outdoor fans are the direct drive propeller type, and discharges air horizontally. Fans draw air through the outdoor coil.
 - b. Outdoor fan motors are totally enclosed, single phase motors with class E insulation and permanently lubricated ball bearings. The motor shall be protected by internal thermal overload protection.
 - c. The shaft has inherent corrosion resistance.
 - d. Fan blades are non-metallic and statically and dynamically balanced.
 - e. Outdoor fan openings are equipped with a PVC metal/mesh coated protection grille over the fan.
- 6. Compressor:
 - a. Compressor is the fully hermetic rotary type.
 - b. Motor is NEMA rated class E, suitable for operation in a refrigerant atmosphere.
 - c. Compressor assembly is installed on rubber vibration isolators.
- 7. OutdoorCoil:
 - a. The coil is constructed of aluminum hydrophilic pre-coated fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.
- 8. RefrigerationComponents:
 - a. Refrigerant circuit components include a brass external liquid line service valve with gage port connections, a suction line service valve with a service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, reversing valve.
- 9. ControlsandSafeties:
 - a. Operating controls and safeties are factory selected, assembled, and tested. The minimum control functions include the following:
 - b. Controls:
 - 1) A time delay control sequence is provided standard through the fan coil board.
 - 2) Automatic outdoor fan motor protection.
 - c. Safeties:
 - 1) System diagnostics.
 - 2) Compressor motor current and temperature overload protection.
 - 3) Outdoor fan failure protection.
- 10. ElectricalRequirements:
 - a. Unit electrical power has a single point connection.
 - b. All power and control wiring must be installed per NEC and all electrical codes.
 - c. The unit has high and low voltage terminal block connections.
- 11. Performance Requirements: See Drawings for additional requirements.

2.02 INDOOR DUCTLESS WALL-MOUNTED UNITS

- A. General: Indoor, direct-expansion, wall mounted fan coil. 1/2 to 3 ton nominal cooling and heating capacity.
 - 1. Manufacturers:
 - a. Trane: MSZ-GX.
 - 2. Unit is complete with a cooling/heating coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit is furnished with an integral wall mounting bracket and mounting hardware.
 - 3. Unit Cabinet:
 - a. Cabinet discharge and inlet grilles are attractively styled, high-impact polystyrene. Cabinet is fully insulated for improved thermal and acoustic performance.
 - 4. Fans:

- a. Fan is the tangential direct-drive blower type with air intake at the top of the unit and discharge at the bottom front. An automatic, motor-driven vertical and horizontal air sweep is provided as standard equipment.
5. Coil:
 - a. The coil is a copper tube with aluminum fins and galvanized steel tube sheets. The fins are bonded to the tubes by mechanical expansion and anti-corrosive fin coating. A drip pan under the coil has a drain connection for the hose attachment to remove condensate. The condensate pan has an internal trap.
6. Motors:
 - a. Motors are open drip-proof, with a permanently lubricated ball bearing. The fan motors is min 3-speed. Blower wheel and motor are easily removed for cleaning and service without removing the cabinet.
7. Controls:
 - a. Controls consist of a microprocessor-based control system which controls space temperature, , and run self diagnostics.
 - b. The unit has the following functions as a minimum:
 - 1) An automatic restart after a power failure at the same operating conditions as at the failure.
 - 2) A timer function to provide a minimum 24-hour timer cycle for system Auto Start/Stop.
 - 3) Temperature-sensing controls sense return air temperature.
 - 4) Indoor coil freeze protection.
 - 5) Wireless infrared remote control to enter set points and operating conditions.
 - 6) Dehumidification mode provides increased latent removal capability by modulating the system operation and the set point temperature using Relative Humidity percentage control.
 - 7) Fan-only operation to provide room air circulation when no cooling is required.
 - 8) Diagnostics provide continuous checks of unit operation and warn of possible malfunctions. Error messages appear on the unit.
 - 9) Fan speed control is user-selectable: turbo, high, medium, low, or microprocessor controlled automatic operation during all operating modes.
 - 10) Automatic heating-to-cooling changeover in the heat pump mode. Control includes deadband to prevent rapid mode cycling between heating and cooling.
 - 11) Indoor coil high temperature protection detects excessive indoor discharge temperature when the unit is in the heat pump mode.
8. Filters:
 - a. Units have a filter track located at the top of the unit with factory-supplied cleanable filters for easy cleaning.
9. Electrical Requirements:
 - a. Indoor fan motor to operate on 115V on model size 12 and on 208-230V on model sizes 06-36, as specified. Power is supplied by the outdoor unit.
10. Refrigerant Lines:
 - a. All units have refrigerant lines that can be oriented to connect from the left, right or back of unit. Both refrigerant lines need to be insulated.
11. Special Features (Field Installed):
 - a. Condensate Pumps. The condensate pump removes condensate from the drain pan when gravity drainage cannot be used. The pump is designed for quiet operation. The pump consists of two parts: an internal reservoir/sensor assembly, and a remote sound-shielded pump assembly. A liquid level sensor in the reservoir stops the cooling operation if the liquid level in the reservoir is unacceptable.
12. Performance Requirements: See Drawings for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.
- C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Utilize factory startup of equipment by manufacturer.
- C. Provide vibration isolation springs on all units mounted to the building, structure, wall, or roof.
- D. Install in accordance with NFPA 90A and NFPA 90B.
- E. Install condensate drains and disposal in accordance with applicable codes, to a permanent indoor location.
- F. Provide thermostat or room sensor as indicated on Drawings.
- G. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION

SECTION 26 32 13 ENGINE GENERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator system and associated components and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 36 00 - Transfer Switches.

1.03 REFERENCE STANDARDS

- A. ASTM D975 - Standard Specification for Diesel Fuel; 2026b.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.
- D. NEMA MG 00001 - Motors and Generators; 2024.
- E. NFPA 30 - Flammable and Combustible Liquids Code; 2024, with Errata (2025).
- F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2024, with Amendment.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.
- I. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.
- J. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.
- K. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
 - 1. Include characteristic trip curves for overcurrent protective devices.
 - 2. Include alternator thermal damage curve upon request.
- B. Shop Drawings: Include dimensioned plan views and sections indicating
 - 1. Locations of system components, required clearances, pad layout, and field connection locations.
 - 2. Overall dimensions of complete assembly including generator, fuel tank, and air intake and exhaust accessories.
 - 3. System interconnection schematic diagrams showing all factory and field connections.
- C. Accessory Power Requirements:
 - 1. Clearly indicate the quantity of circuits required from building for all generator accessories.
 - 2. For each required circuit, state the voltage, full load amperage, and connection location.
- D. Derating Calculations: Indicate ratings adjusted for site elevation as indicated below.
- E. Load Acceptance Calculations: Demonstrate acceptance of loads in the steps shown below in 2.01 (G), and show transient performance within the limits indicated.
- F. Specimen Warranty: Submit sample of manufacturer's warranty.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

- H. Manufacturer's factory emissions certification.
- I. Manufacturer's certification that products meet or exceed specified requirements.
- J. Source quality control test reports.
- K. EPA emissions certification.
- L. Manufacturer's detailed field testing procedures.
- M. Field quality control test reports.
- N. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

1.05 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
 - 2. NFPA 110 (Standard for Emergency and Standby Power Systems)
 - 3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
 - 4. NFPA 30 (Flammable and Combustible Liquids Code).
 - 5. UL 2200 (Stationary Engine Generator Assemblies)
- B. Source Limitations:
 - 1. Furnish engine generator sets, components, and accessories produced by a single manufacturer and obtained from a single supplier.
 - 2. In the event that a specific accessory is not available from the generator set manufacturer, provide documentation that the proposed accessory product is approved by the generator manufacturer for use with the specific generator being furnished.
- C. Manufacturer Qualifications:
 - 1. Company engaged in manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for minimum of 10 years.
 - 2. Technical support services available 24 hours per day, 7 days per week, 365 days per year from manufacturer or their representative.
 - 3. Maintain records of each product, by serial number, for minimum of 20 years.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- F. Exhaust Emissions Requirements:
 - 1. Comply with federal (EPA), state, and local regulations applicable at the time of startup.
 - 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer. Where such modifications are made, provide field emissions testing as necessary for certification.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.07 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

- A. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- B. Provide information about any extended warranties available beyond the minimum required.

PART 2 PRODUCTS

2.01 PACKAGED ENGINE GENERATOR SYSTEM

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:
 - 1. Application: Standby, Legally Required (NEC 701).
 - 2. Configuration: Single packaged engine generator set operated independently .
- D. Packaged Engine Generator Set:
 - 1. Type: Diesel (compression ignition).
 - 2. Voltage: 480Y/277 V, 3 phase, 60 Hz.
 - 3. Main Line Circuit Breaker:
 - a. Type: Electronic trip with long time and short time delay and instantaneous pickup.
 - b. Trip Rating: Select according to generator set rating.
- E. Generator Set General Requirements:
 - 1. Prototype tested in accordance with NFPA 110 for Level 2 systems.
 - 2. Factory-assembled, with components mounted on suitable base.
 - 3. List and label engine generator assembly as complying with UL 2200.
 - 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
 - 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
 - 6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.
- F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the intended installation location:
 - 1. Environment: Exterior, Not Covered
 - 2. Location: Whitewater, CO
 - 3. Altitude: 4700 feet.
 - 4. Ambient Temperature: Between 0 and 104 degrees F.
- G. Starting and Load Acceptance Requirements:
 - 1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
 - 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
 - 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 60 seconds.
 - 4. Load Table: Supports the following loads in the following steps. For calculation purposes, assume VFDs are 6 pulse unless stated otherwise in the table below.

Step One	Quantity	Load	Starter
	3	Duty Pumps 10 HP Each, 480V/3PH	VFD
	1	Heat Pump, 5 kVA	N/A
	1	Lighting & Receptacles 2 kVA	N/A
Step Two:	Quantity	Load	Starter
		none	

- Maximum Voltage Deviation with Load Step: 20 percent.
- Maximum Frequency Deviation with Load Step: 10 percent.
- Maximum THDV : 10 percent.

2.02 ENGINE AND ENGINE ACCESSORY EQUIPMENT

- Cold Weather Starting Accessories:
 - Provide electric heating accessories sufficient for manufacturer to warrant engine starting at the extreme low ambient temperature indicated above, after the equipment and fuel tank have been at that temperature for multiple days. These may include but are not limited to:
 - Battery heater
 - Coolant heater
 - Oil pan heater
 - Fuel filter heater
 - Enclosure heater
 - Fuel tank heater
 - Provide a winterized enclosure if necessary for starting at the extreme low temperature noted above, with the heating accessories being provided.
- Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- Engine Fuel System - Diesel (Compression Ignition):
 - Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
 - Fuel Storage: Sub-base fuel tank.
 - Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
 - Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
 - Sub-Base Fuel Tank:
 - Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
 - Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at maximum load indicated above, but not larger than permissible by applicable codes.
 - Features:
 - Direct reading fuel level gauge.
 - Normal atmospheric vent.
 - Emergency pressure relief vent.
 - Fuel fill opening with lockable cap.
 - Dedicated electrical conduit stub-up area.
 - Provide the following enhanced spill protection features:
 - Spill protection box at fuel inlet
 - Spill sensor between inner and outer tank wall, communicating with SCADA.

- D. Engine Starting System:
 - 1. System Type: Electric, with DC solenoid-activated starting motor(s).
 - 2. Battery(s):
 - a. Battery Type: Lead-acid.
 - b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
 - c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
 - 3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
 - 4. Battery Charger:
 - a. Provide dual rate battery charger with automatic float and equalize charging modes; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
 - b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 12 hours while carrying normal loads.
 - c. Recognized as complying with UL 1236.
 - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
 - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
 - f. Provide alarm output contacts as necessary for alarm indications.
- E. Engine Speed Control System (Governor):
 - 1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
 - 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- F. Engine Lubrication System:
 - 1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
- G. Engine Cooling System:
 - 1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
 - 2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
- H. Engine Air Intake and Exhaust System:
 - 1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
 - 2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

2.03 ALTERNATOR (GENERATOR)

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 00001; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:
 - 1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
 - 2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
 - 3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 00001, Class H; suitable for alternator temperature rise.
- E. Enclosure: NEMA MG 00001, drip-proof.

2.04 GENERATOR SET CONTROL SYSTEM

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
 - 1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
 - 2. Generator Set Control Functions:
 - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
 - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
 - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
 - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
 - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
 - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
 - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
 - 3. Generator Set Status Indications:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase.
 - c. Frequency (Hz).
 - d. Real power (W/kW).
 - e. Reactive power (VAR/kVAR).
 - f. Apparent power (VA/kVA).
 - g. Power factor.
 - h. Duty Level: Actual load as percentage of rated power.
 - i. Engine speed (RPM).
 - j. Battery voltage (Volts DC).
 - k. Engine oil pressure.
 - l. Engine coolant temperature.
 - m. Engine run time.
 - n. Generator powering load (position signal from transfer switch).
 - 4. Generator Set Protection and Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).
 - 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).

- b. In addition to NFPA 110 requirements, provide the following protections/indications:
 - 1) High AC voltage (shutdown).
 - 2) Low AC voltage (shutdown).
 - 3) High frequency (shutdown).
 - 4) Low frequency (shutdown).
 - 5) Overcurrent (shutdown).
 - c. Provide contacts for local and remote common alarm.
 - d. Provide lamp test function that illuminates all indicator lamps.
- 5. Other Control Panel Features:
 - a. Event log.

2.05 GENERATOR SET ENCLOSURE

- A. Enclosure Type: Sound attenuating, weather protective.
- B. Enclosure Material: Steel or aluminum.
- C. Hardware Material: Stainless steel.
- D. Color: Manufacturer's standard.
- E. Access Doors: Lockable, with all locks keyed alike.
- F. Openings: Designed to prevent bird/rodent entry.
- G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.
- H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

2.06 SOURCE QUALITY CONTROL

- A. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.
- B. Generator Set production testing to include, at a minimum:
 - 1. Operation at rated load and rated power factor.
 - 2. Load pick-up.
 - 3. Transient and steady state voltage and frequency performance.
 - 4. Operation of safety shutdowns.
- C. Diesel Fuel Storage Tanks: Perform pressurized leak test prior to shipment.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive equipment.
- E. Verify that conditions are satisfactory for installation.

3.02 INSTALLATION

- A. Provide crane service for offloading generator.
- B. Provide first fuel tank fill (winter blend diesel).
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install products in accordance with manufacturer's instructions.
- E. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
- F. Arrange equipment to provide minimum clearances and required maintenance access.

- G. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch high concrete pad constructed in accordance with Section 03 30 00.
- H. Provide required support and attachment in accordance with Section 26 05 29.
- I. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
- J. Provide grounding and bonding in accordance with Section 26 05 26.
- K. Identify system wiring and components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- B. Notify Owner and Engineer at least two weeks prior to scheduled inspections and tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- E. Preliminary inspection and testing to include, at a minimum:
 - 1. Inspect each system component for damage and defects.
 - 2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
 - 3. Check for proper oil and coolant levels.
- F. Prepare and start system in accordance with manufacturer's instructions.
- G. Perform acceptance test in accordance with NFPA 110.
- H. Inspection and testing to include, at a minimum:
 - 1. Verify compliance with starting and load acceptance requirements.
 - 2. Verify voltage and frequency; make required adjustments as necessary.
 - 3. Verify phase sequence.
 - 4. Verify control system operation, including safety shutdowns.
 - 5. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).
- I. Provide field emissions testing where necessary for certification.
- J. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
- C. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters and fill fuel storage tank.

3.06 PROTECTION

- A. Protect installed engine generator system from subsequent construction operations.

3.07 MAINTENANCE

- A. Provide trouble call-back service upon notification by Owner:
 - 1. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site; include hourly rate, milage cost, and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 26 36 00
AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Low-voltage automatic transfer switches.

1.02 RELATED REQUIREMENTS

- A. Section 26 32 13 - Engine Generators.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ATS: Automatic transfer switch.
- B. MTS: Manual (Non-automatic) transfer switch.

1.04 REFERENCE STANDARDS

- A. IEC 60947-6-1 - Low-Voltage Switchgear and Controlgear – Part 6-1: Multiple Function Equipment – Transfer Switching Equipment; 2021.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NEMA IA 10042-1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2025.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 891 - Switchboards; Current Edition, Including All Revisions.
- F. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.
- G. UL 1558 - Switchgear; Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. Provide sufficient information to determine compliance with contract documents. Identify submittal data with specific equipment tags and/or service descriptions to which they pertain. Identify specific model numbers, options, and features of equipment proposed.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
 - 1. Include characteristic trip curves for each overcurrent protective device.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing factory and field connections.
- D. Operation and Maintenance Data: Provide detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
- E. Warranty Information: Include full text of manufacturer's standard warranty terms, warranty length, any extended warranties available as options, and added cost for extended warranties.
- F. Executed warranty.
- G. Project Record Documents:
 - 1. Construction, installation, schematic, and wiring diagrams updated to as-installed and commissioned state.
 - 2. Configured settings/parameters for adjustable components updated to as-installed and commissioned state, noted if different from factory default.

1.06 QUALITY ASSURANCE

- A. Comply with the following:

1. NFPA 70.
 2. Requirements of local authorities having jurisdiction.
 3. Applicable local codes.
- B. Manufacturer Qualifications:
1. Company engaged in manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for minimum of 10 years.
 2. Service, repair, and technical support services available 24 hours per day, 7 days per week, 365 days per year from manufacturer or their representative.
 3. Maintain records of each product, by serial number, for minimum of 20 years.
- C. Warranty: Include a 5 year warranty in the base bid price.
- D. Installer Qualifications: Firm with minimum 10 years experience with transfer switches of similar type and scope.
- E. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Prior to delivery to project site, verify suitable storage space is available to store materials in well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres.
- B. Protect materials during delivery and storage and maintain within manufacturer's written storage requirements. At minimum, store indoors in clean, dry space with uniform temperature to prevent condensation and protect electronics from potential damage from electrical and magnetic energy.
- C. Deliver materials to project site in manufacturer's original wrappings and containers, labeled with manufacturer's name and equipment tag number. Include shipping costs.
- D. If the associated generator is supplied by a different manufacturer, coordinate communication details with generator manufacturer and installer to ensure proper operation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer warranty for defects in material and workmanship for five years from date of shipment. Provide replacements for parts determined to be defective at no charge during warranty period.
 1. Except for circuit breakers in service entrance transfer switches and soft load transition switches, provide replacements for parts determined to be defective at no charge for 5 years from date of shipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Provide automatic transfer switches, controllers, and accessories produced by single manufacturer and obtained from single supplier.

2.02 LOW-VOLTAGE AUTOMATIC TRANSFER SWITCHES

- A. Provide a non-service entrance rated power transfer switch with automatically initiated transfer between utility and generator sources, suitable for use with legally required standby systems per NEC Article 701.
 1. Neutral Configuration: solid neutral.
 2. Phase Poles: Three.
 3. Minimum Ampere Rating: 60 A.

4. Voltage: 480V.
- B. Comply with NEMA IA 10042-1 and IEC 60947-6-1; list and label as complying with UL 1008 and, where applicable, UL 891 or UL 1558.
- C. Transition Type:
 1. Automatic Transition Configuration: delayed transition.
- D. Transfer Switch Construction:
 1. Electrically operated, mechanically held.
 2. Positively locked, unaffected by momentary outages, such that contact pressure is maintained at constant value and contact temperature rise is minimized for maximum reliability and operating life.
 3. Designed to allow inspection of contacts without disassembly of operating linkages and disconnection of power conductors.
 4. Stationary and Moveable Contacts: Removable and replaceable without removing power conductors and/or bus bars.
 5. Devices utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- E. Transition Modes:
 1. Delayed Transition:
 - a. Transfer load between power sources using break-before-make switch with user-defined interruption period in both directions.
 - b. Delay: Adjustable from 0 to 6 minutes with 1-second resolution.
 - c. Provide both electrical and mechanical interlocks to prevent both sets of main contacts from being closed at same time.
- F. Withstand and Closing Ratings:
 1. Rate to close on and withstand 10,000 A RMS symmetrical short circuit current at terminals with overcurrent protection indicated.
 2. Label with UL 1008 time-based ratings, or appropriate short-time rating(s) as applicable. Transfer switches which have only series or specific-breaker ratings are not acceptable.
 3. Include 0.3-second, 18-cycle, short-time rating as standard for switch sizes 600 through 4,000 A for selective coordination purposes.
- G. Pilot Devices:
 1. Provide industrial-grade switches and pilot lights to facilitate viewing and replacement.
 2. Provide three-position momentary switch for test/automatic/reset modes.
 - a. Test Position: Simulates utility source failure.
 - b. Reset Position: Bypass time delays on either transfer to generator or retransfer to utility.
 3. Provide industrial-grade LED indicating lights visible without opening inner enclosure doors, to indicate the following:
 - a. Switch connected to utility.
 - b. Switch connected to generator source.
 - c. True source availability of generator source as determined by voltage sensing trip/reset settings.
 - d. True source availability of utility source as determined by voltage sensing trip/reset settings.
- H. Controller:
 1. Construction:
 - a. Provide single, built-in microprocessor for controller's sensing and logic.
 - b. Provide capability for serial communication.
 2. Voltage Sensing: True RMS, accurate to within plus/minus 2 percent of nominal voltage.
 3. Frequency Sensing: Accurate to within plus/minus 0.2 percent.

4. Provide the following integral features, capable of being activated through keypad programming:
 - a. Engine Exerciser:
 - 1) Enables user to program at least three different exercise routines.
 - 2) Programmable Routine Parameters:
 - (a) Enable/disable routine.
 - (b) Enable/disable transfer of load during routine.
 - (c) Start Time: By time of day, day of week, and week of month (first, second, third, fourth, alternate, or every week).
 - (d) Duration of run.
 - 3) At end of specified duration, transfer load back to utility source and run generator for specified cool down period.
 - b. System Status: Provide system status screen for controller LCD display.
 - c. Self-Diagnostics: Provide diagnostics screen for detecting system errors. Provide information on status input signals to controller, which may prevent load transfer commands from being completed.
- I. Data Logging: Log data, storing at least 50 events in nonvolatile memory, retained in event of total power loss; include the following:
 1. Event Logging:
 - a. Data, time and reason for transfer from utility to generator.
 - b. Data, time and reason for transfer from generator to utility.
 - c. Data, time and reason for engine start.
 - d. Data and time engine stopped.
 - e. Data and time generator source available.
 - f. Data and time generator source not available.
 - g. Data and time for utility source voltage surges, sags, and swells
- J. Communications:
 1. Provide digital status interface through manufacturer supplied communication module using one of the following communication protocols:
 - a. Modbus/TCP
 - b. Modbus/RTU
 - c. Profibus
 - d. Profinet
 2. Provide digital status indication of the following:
 - a. Availability of utility source
 - b. Availability of generator source
 - c. Switch position
 - d. Switch and generator alarm information
 - e. Power metering information (voltage and current per phase, real, reactive and apparent power and energy usage, power factor, total harmonic distortion)
 3. Provide relay contacts to indicate the following:
 - a. Utility source available
 - b. Generator source available
 - c. Connected to utility source
 - d. Connected to generator source
 - e. Signal before transfer (for selective load disconnection prior to transfer)
 - f. Alarm condition
- K. Voltage, Frequency, and Phase Rotation Sensing:
 1. Voltage and Frequency Sensing: Continuously monitored on utility and generator sources with the following minimum pickup and dropout/trip capabilities:
 - a. Undervoltage
 - b. Overvoltage

- c. Under Frequency
 - d. Over Frequency
 - e. Voltage Unbalance
- 2. Voltage and Frequency Settings: Field adjustable via display/keypad or remotely via serial communications port access.
- 3. When activated by keypad or through serial port, capable of sensing phase rotation of both utility and generator sources and rejecting source if phase rotation does not match rotation reference selected in settings.
- 4. Source Status Screens: For utility and generator sources, display digital readout of voltage on each phase, frequency, and phase rotation.
- 5. Include selectable algorithm to:
 - a. Prevent repeated transfer cycling to source which experiences primary-side, single-phase failures on grounded-wye-to-grounded-wye transformer then regenerates voltage when unloaded.
 - b. Inhibit retransfer to utility source upon detection of single-phasing condition until dedicated timer expires, alternate source fails, or utility source fails and is restored during time delay period; time delays adjustable via display/keypad.
- L. Time Delays:
 - 1. Provide adjustable time delay for override of momentary utility source outages and delay of transfer and engine starting signals.
 - 2. Provide adjustable time delay on transfer to generator for controlled timing of load transfer to generator source.
 - 3. Provide adjustable time delay on shut down of engine generator for cool down.
- M. Provide auxiliary contacts consisting of one contact which is closed when transfer switch is connected to utility source and one contact which is closed when transfer switch is connected to generator source.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine equipment exterior and interior for damage, including but not limited to, structure, moisture, and mildew.
- B. Examine for conditions detrimental to completion of work.
- C. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install equipment in accordance with manufacturer's written instructions.
- B. Install transfer switches in accordance with NECA 1.
- C. Unless otherwise indicated, install and anchor floor-mounted transfer switches on raised concrete pad 4 inches high; see Section 03 30 00.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer Services: Provide services of manufacturer's field representative to perform functional testing, commissioning, and first parameter adjusting.
 - 1. Replace damaged or malfunctioning equipment and report discrepancies or installation issues.
 - 2. Identify transfer switches with label indicating inspection/testing agency and date of service.
- B. Operational Readiness Testing:
 - 1. Inspect and test equipment and associated systems for conformance to Contract Documents, including equipment manufacturer's recommendations, and readiness for operation.
 - a. Visually inspect for physical damage and proper installation.
 - b. Perform tests in accordance with manufacturer's instructions.

- c. Perform tests to verify compliance with Contract Documents.
 - d. Perform tests to verify equipment is ready for operation.
 - e. Touch-up paint chips and scratches with manufacturer-supplied paint.
- C. Correct deficiencies and replace damaged or defective transfer switches or associated components.

3.04 CLOSEOUT ACTIVITIES

- A. Functional Demonstration Testing: Demonstrate proper operation of transfer switches and associated systems to Owner's designated representative and Engineer, observing and documenting compliance with Contract Documents.
- B. Training:
 - 1. Train Owner's personnel on operation and maintenance of system.
 - a. Accommodate minimum of four attendees.
 - b. Training Reference: Use submitted operations and maintenance manuals.
 - c. Location: Project site.
 - 2. Provide sufficient time and detail in each session to cover the following at minimum:
 - a. Operation theory.
 - b. Major equipment components.
 - c. Equipment operation.
 - d. Equipment configurations.
 - e. Maintenance, troubleshooting, and repair.
 - f. Component-level parts replacement.

3.05 PROTECTION

- A. Protect installed transfer switches from subsequent construction operations.

END OF SECTION

SECTION 40 00 00
MECHANICAL BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Mechanical demolition.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Concrete bases.
 - 10. Supports and anchorages.

1.02 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.03 SUBMITTALS

- A. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- C. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 1. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- D. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements..

PART 2 PRODUCTS

2.01 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 40 XX XX Sections for pipe, tube, and fitting materials and joining methods.

- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 JOINING MATERIALS

- A. Refer to individual Division 40 XX XX Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.

2.03 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.04 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.06 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

2.07 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 MECHANICAL DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 40 XX XX Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.03 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.04 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

- D. Install equipment to allow right of way for piping installed at required slope.

3.06 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

3.08 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.09 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 40 05 07
PIPE SUPPORTS AND HANGERS

PART 1 GENERAL

1.01 SUMMARY

- A. Work under this Section includes furnishing and installing pipe supports and hangers types shown and indicated on the Drawings and as specified herein.

1.02 REFERENCES

- A. Standards listed hereunder and referenced elsewhere in these Specifications shall become part of this Specification and are incorporated herein by reference. The latest edition, amendment or supplement thereto in effect 30 days before date of invitation shall apply.
- B. Manufacturer's Standardization Society (SP-69-2003) – ANSI/MSS Edition Pipe Hangers and Supports-Selection and Application.

1.03 SYSTEM DESCRIPTION

- A. Design and provide complete system of pipe supports and anchors for all piping.
- B. Support all piping to prevent undue strain on any valve, fitting or piece of equipment.
- C. Provide support and anchors at changes in direction, change in elevation, and adjacent to flexible couplings.
- D. Do not install in equipment access areas or bridge crane runs.

1.04 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Design pipe support system components to withstand total dead load.
- B. Dead load: Weight of pipe filled with water plus any insulation.
 - 1. Factor of safety: 5 minimum.
- C. Design pipe restraint system components to withstand thrusts created by fluid pressure within pipes.
 - 1. Factor of safety: 5 minimum.
- D. Do not exceed manufacturer's recommended loads.
- E. Brace all piping 2-1/2 inch and larger for seismic Zone 1 forces in accordance with International Building Code.
- F. Design and select channels and accessories for 25,000 psi maximum stress and 1/360 of span maximum deflection.

1.05 SUBMITTALS

- A. Submit under provisions of Sections 01 30 00.
- B. Shop Drawings: Indicated system layout with location and detail hangers. Include location of all pipe supports and hangers for review by Engineer.
- C. Product Data: Provide manufacturer's catalog data including load capacity.
- D. Design Data: Indicate loading carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Cooper B-Line.
 - 2. Tolco, a brand of Nibco.
 - 3. Unistrut Corporation.

4. ITT Grinnell.
5. Or Equal.

2.02 MATERIALS

- A. Field and Factory Manufactured Supports and Hangers Piping Systems:
 1. Unless specifically shown or detailed otherwise on the Drawings, pipe support systems shall conform to the following requirements.
 2. All hangers, supports, anchors and materials shall be Stainless Steel.
 3. Type of hanger required for most applications is specified on project drawings.
 4. The supporting systems shall provide for and control the free or intended movement of piping including its movement in relation to that of connected equipment.
 5. Piping supports shall conform to the surrounding structure and adjacent piping and equipment.
 6. Hangers, supports, anchors and restraints shall be selected to withstand all static and dynamic conditions of loading which the piping and associated equipment may be subjected.
 7. Hanger components shall not be used for purposes other than for which they were designed. They shall not be used for rigging and erection purposes.

2.03 CORROSION PROTECTION

- A. The material in contact with the pipe shall be compatible with the piping material so that neither shall have a deteriorating action on the other.
- B. Exposed ferrous metal surfaces shall be painted in accordance with Section 09900.

2.04 DIMENSION REQUIREMENTS

- A. Hangers and supports shall be sized to fit the outside diameter of pipe, tubing or, if specified, the outside diameter of insulation.
- B. Hangers for the suspension of 2-inch and larger pipe and tubing shall be capable of vertical adjustment under load.

2.05 PIPING ATTACHMENTS FOR INSULATED LINES

- A. The connections to pipe attachments shall be outside the insulation so that movement of the line shall not cause damage to the insulation.
- B. Insulation protection shields shall be provided to protect the vapor barrier of insulation. Do not apply hangers, supports or guides directly to horizontal pipe or tubing on vapor barriered lines.

2.06 MULTIPLE SUPPORTS

- A. Horizontal banks of piping may be supported on a common base member without regard to the pipe centerline elevation. The particular method of support to be used shall be as shown on the Drawings.
- B. In the supporting of multiple pipe runs, provisions shall be made to keep the lines in their relative lateral positions, using clamps or clips. Lines subject to thermal expansion shall be free to roll axially or slide.

2.07 RISER SUPPORTS

- A. The selection and location of riser supports shall take into consideration the entire weight of the riser, hydrostatic test load conditions, line temperature and available supporting structure. On a riser subject to expansion, only one support of the rigid type shall be used.
- B. Riser clamps shall have a positive means of engagement between the pipe and the clamp.
- C. Anchors, guides and restraints shall be located as shown on the Drawings. Should the need or the desirability of relocating, eliminating or adding anchors, guides or restraints arise, such changes shall be approved in advance.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Except as otherwise shown on the Drawings, conform to the following:
- B. Support vertical lines at bases using either a suitable hanger in a horizontal line near the riser or a base-type fitting set on a pedestal foundation or support.
- C. Drilling of holes for anchors, supports, hangers, and piping in the structural work will be permitted only where approved. The Contractor shall notify the Engineer prior to starting the drilling at each location. Install inserts to minimize drilling.
- D. Install hangers so as not to interfere with free expansion and contraction of piping. Hang pipe with its weight evenly distributed between hangers so as to prevent excessive deflection and stress in either pipe or the supporting member.

3.02 MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT SPACING

- A. The maximum spacing of hangers and supports is listed in Specification 40 05 07.01.

END OF SECTION

SECTION 40 05 07.01
PIPE SUPPORT AND HANGER SPACING

Nominal Pipe or Tube Diameter (inches)	Std. Wt. Steel Pipe (feet)	Copper Tube (feet)	Ductile Iron Pressure	Ductile Iron (non-pressure)	Plastic
1/4	7	5	12' (3.7 m) max. spacing	10 ft. (3.0 m) maximum,	Follow Pipe
3/8	7	5	minimum of one (1)	minimum of one (1) hanger	Manufacturer's
1/2	7	5	hanger per pipe section	per pipe section close to	recommendations
3/4	7	5	close to joint on the	joint on the barrel.	for material and
1	7	6	barrel. Also, at change	Also, at change of	service temperature
1 1/4	7	7	of direction and branch	and branch connections.	
1 1/2	9	8	connections.		
2	10	8			
2 1/2	11	9			
3	12	10			
3 1/2	13	11			
4	14	12			
5	16	13			
6	17	14			
8	19	16			
10	20	18			
12	23	19			
14	25				
16	27				
18	28				
20	30				
24	32				
30	33				

Note: Does not apply where span calculations are made, or where there are concentrated loads between supports such as flanges, valves, specialties, etc., or change directions requiring additional supports.

END OF SECTION

SECTION 40 05 19
DUCTILE IRON PROCESS PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior ductile iron piping 4-inches and larger, fittings, joint materials and other necessary appurtenances.

1.02 REFERENCES

- A. ANSI B16.1—Cast Iron Pipe and Flanges and Flanged Fittings, Class 25, 125, 250, and 800
- B. AWWA C104—Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water
- C. AWWA C110—Ductile-Iron and Gray-Iron Fittings, 3 Inch through 48 Inch, for Water and Other Liquids
- D. AWWA C111—Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
- E. AWWA C115—Flanged Ductile-Iron Pipe with Threaded Flanges
- F. AWWA C150—Thickness Design of Ductile-Iron Pipe
- G. AWWA C151—Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- H. AWWA C153—Ductile-Iron Compact Fittings, 3 Inch through 24 Inch and 54 Inch through 64 Inch, for Water and Other Liquids
- I. AWWA C600—Installation of Ductile-Iron Water Mains and Appurtenances
- J. AWWA C606—Grooved and Shouldered Joints

1.03 SYSTEM DESCRIPTION

- A. Interior ductile iron, 4-inch and larger, piping complete with all fittings, jointing materials, pipe hanger supports, anchors, encasement, and other necessary appurtenances

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 30 00
- B. Shop Drawings: Provide piping layout fabrication and assembly drawings with fittings dimensions. Provide sufficient information to verify compliance with specifications
- C. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturer's catalog information with dimensions, material and assembled weight. Indicate pressure ratings for pipe and appurtenances
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements
- E. Test Reports: Submit proposed method and reports of field pressure tests under provisions of Section 01 45 23

1.05 REGULATORY REQUIREMENTS

- A. Conform to local codes and ordinances, and laws and regulations of the State
- B. In case of apparent conflict, State and local requirements govern over these specifications
- C. In absence of State and local regulations, Uniform Plumbing Code applies

1.06 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01 77 00
- B. Accurately record actual locations of piping, fittings, valves, connections, and pipe centerline elevations
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

1.07 QUALITY ASSURANCE

- A. Manufacturer's name and pressure rating marked on piping and fittings

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 65 00
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation
- C. During loading, transporting, unloading, and installation, exercise care to prevent damage to material:
 - 1. Use nylon slings only
 - 2. Do not drop pipe or fittings
 - 3. Do not roll or skid against pipe already on ground
 - 4. Repair any damage done to coating or lining
 - 5. Handle per manufacturer's instructions
 - 6. Store rubber gaskets in cool dark location
 - 7. Store all material on wood pallets or timbers
- D. Adequately tag or otherwise mark all piping and fittings as to size

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. American Ductile Iron Pipe
- B. Griffin Pipe Products Company
- C. Tyler Pipe
- D. U.S. Pipe

2.02 DUCTILE IRON PIPE

- A. AWWA C151: As listed below except as otherwise specified or indicated on the Drawings:
 - 1. Where fitted with push-on joints, mechanical joints or mechanical joints with joint restraint device: 4 inch to 12 inch Pressure Class 350; 14 inch to 30 inch Pressure Class 250
 - 2. Where fitted with flanged, grooved or restrained joints: Class 53
- B. Fittings:
 - 1. Ductile iron: ANSI A21.10/AWWA C110, ASTM A536, Grade 80-60-03 or 70-50-05
 - a. 24 inch and below: 350 psi rating, mechanical joint or flanged
 - b. Over 24 inch: 250 psi rating
 - 2. Ductile iron compact fittings: ANSI A21.53/AWWA C153
 - a. Mechanical joints, 30" to 48": 250 psi
 - b. 24-inch and below: 350 psi rating, mechanical joint or flanged
- C. Ductile iron grooved fittings: ANSI/AWWA C606, AWWA Fittings, conform to AWWA C110 for center-to-center dimensions and AWWA C153 for wall thickness,
 - a. 12 inch and below: 350 psi rating, grooved joint
 - b. 14 inch to 30 inch: 250 psi rating, grooved joint
- 2. Comply with requirements for restrained fittings as indicated on Drawings
- D. Joints:
 - 1. Mechanical joints: ANSI A21.11/AWWA C111
 - a. Bolts and nuts: High strength, low alloy steel, "Cor-Ten" or accepted substitution
 - 2. Mechanical joints with tie rods:
 - a. Tie rods: ASTM A307, galvanized entire length
 - b. Steel pipe spacers: ASTM A120, standard weight galvanized
 - c. Washers: ANSI A27.2 plain steel, galvanized
 - 3. Flanged joints:
 - a. Flanges:
 - 1) General use: ANSI A21.15/AWWA C115 and ANSI B16.1, Class 125

- 2) Where 250 psi working pressure indicated on Drawings or specified: ANSI 21.15/AWWA C115
- 3) Where Class 250 indicated on Drawings or specified: ANSI B16.1, Class 250, flat faced
- b. Flange bolting:
 - 1) Material: ASTM A307
 - (a) Stainless Steel: For all submerged and enclosed basin headspace applications.
 - 2) Type: Bolt and nut, bolt-stud and 2 nuts permitted for 1 inch and larger
 - 3) Bolts and bolt-studs:
 - (a) Length: Ends project 1/4 inch to 1/2 inch beyond nuts
 - (b) Ends: Chamfered or rounded
 - (c) Threading: ANSI B1.1, coarse thread series, Class 2A fit. Bolt studs may be threaded full length. Studs for tapped holes threaded to match holes
 - 4) Bolt heads:
 - (a) Shape: Hexagonal or square
 - (b) Dimensions: ANSI B18.2 regular pattern for square, heavy pattern for hexagonal
 - 5) Nuts:
 - (a) Dimensions: ANSI B18.2 heavy, semi-finished pattern
 - (b) Threading: ANSI B1.1 coarse thread series, Class 1B fit
4. Push-on joints: ANSI A21.11/AWWA C111, except gaskets shall be neoprene or other synthetic rubber. Natural rubber is not acceptable
 - a. Lubricant: Heavy vegetable soap solution suitable for potable water contact
 - b. Pressure rated 350 psi
5. Restrained push-on joints
 - 1) Required for all pressurized yard piping
 - 2) Integral Restrained
 - (a) Griffin "Snap-Lok", U.S. Pipe "TR-Flex", or accepted substitution
 - 3) External Restrained
 - (a) Griffin "Bolt-Lok", American MJ Coupled Joint, or accepted substitution
6. Threaded connections: ANSI B2.1.NPT: provide boss or tapping saddle at all tapped connections
7. Mechanical couplings: Dresser "Style 38," Smith-Blair "411" or accepted substitution
8. Grooved couplings:
 - a. Standard groove/rigid groove
 - 1) Pipe ends: Grooved with "radius cut groove"
 - 2) Couplings: Victaulic "Style 31", Gustin-Bacon "Series 100 Gruvagrip", or accepted substitution
 - b. Gaskets: Compatible with pipe material
 - c. Vic-Flange Adapters: Victaulic "Style 341", "Style 342", or accepted substitution
9. Flanged coupling adapters:
 - a. ANSI B16.5 Class 150/ANSI 16.1 Class 125 Drilling Pattern
 - 1) Working Pressure: 250 psi
 - 2) EBBA Iron Megaflange, Series 2100
 - b. ANSI 16.5 Class 300/ ANSI B16.1 Class 250 Drilling Pattern
 - 1) Working Pressure: 400 psi
 - 2) Ford Uniflange, Series 420
10. Tapping saddles: Bronze with double stainless steel straps and rubber sealing gasket, 200 psi pressure rating
11. Mechanical joint with restraint device:
 - a. Multiple wedging action type
 - b. Twist off nuts used to insure proper actuating of the restraining device

- c. Working pressure rated to at least 250 psi
- d. EBAA Iron Sales, Inc., MEGA LUG or accepted substitution
- e. Waterline piping:
 - 1) With conventional thrust block restraint in addition to the mechanical joint restraint device (unless directed otherwise in writing by to Engineer)
- 12. Wall castings: Mechanical and/or flanged joints, integral or welded weep ring, sufficient space for bolting of connection piping to joint min. 6 inches from embedded wall or with tapped holes for follower bolts and plastic plugs to prevent holes from filling with concrete

2.03 CORROSION CONTROL

- A. Insulating fittings:
 - 1. Provide at all transitions between metal piping materials, and between interior and exterior piping
 - 2. Insulating kits to be used at all transitions, as manufactured by Central Plastics or accepted substitute
 - 3. Insulating gaskets:
 - a. Glass reinforced epoxy
 - b. 1/8 inch min thickness
 - c. Buna-N sealing element
 - 4. Insulating bolt sleeves:
 - a. Mylar
 - b. 1/32 inch min thickness
 - 5. Insulating washers:
 - a. Phenolic laminate
 - 6. 1/8 inch min thickness
 - a. One washer per flange bolt
 - 7. Backing washers:
 - a. Steel
 - b. 1/8 inch min thickness
 - c. Two washers per flange bolt

2.04 FABRICATION

- A. Joints:
 - 1. Except as indicated on Drawings
 - a. Buried locations: Restrained mechanical or push-on as indicated on Drawings
 - b. Buried fittings: Restrained mechanical as indicated on Drawings
 - c. Bells in wall pipe or casting: Mechanical with tapped holes for follower bolts or extended min. 6 inches beyond wall
 - d. Bells in structures: Mechanical joint type
 - e. Exposed: Flanged or grooved
 - 2. 12 inches and smaller branch outlets where main line is at least twice the diameter of the branch, tee or a tapping saddle is acceptable
- B. Where restrained joint with groove or grooved couplings are required, increase pipe thickness to provide
 - a. Buried: 0.29 inches minimum at bottom of groove
- 2. All other: 0.25 inches minimum at bottom of groove
- 3. Where tie rods are required, provide as indicated on Drawings
- 4. Mark the centerline of each flange and mechanical joint piece
- 5. Screw flanges onto screwed-on flanged pipe so that pipe extends completely through and flush with the flange
- 6. Finish machine pipe ends and flange faces flat and perpendicular to pipe centerline in a single operation
- C. Fittings and specials:

1. Finish with same lining and coating as abutting pipe
 2. Coat by hand all fittings and specials that cannot be mechanically lined using the same materials and in accordance with AWWA C104
 3. Mark each pipe with pipe class, date of manufacture and manufacturer's name or trademark
 4. Directly thread into wall of pipe outlets up to 2 inches in diameter. Provide integral tee fitting for outlets greater than 2 inches in diameter
- D. Shop Coating and Lining:
1. Comply with provisions under Section 09 90 00
 2. Shop paint all ferrous interior and exterior surfaces of pipe, fittings and accessory surfaces for corrosion protection
 - a. Exterior Surfaces
 - 1) Bituminous coating in buried locations, manufacturer's standard, AWWA C110, C151 or C153
 - b. Comply with Section 09 90 00 in exposed locations
 - c. Interior Surfaces:
 - 1) Used for all interior process piping.
 - (a) Ceramic epoxy, Protecto 401 or approved substitution:
 - (1) 1200 psi minimum tensile strength
 - (2) 300 percent minimum elongation
 - (b) Cement mortar lining, AWWA C104
 - 2) Used for all process fittings unless otherwise indicated
 - (a) Cement mortar lining, AWWA C104
 - (b) Fusion bonded epoxy, AWWA C116

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions under provisions of Division 1.
- B. Carefully examine pipe and fittings for cracks, damage to linings and coatings, and other defects prior to installation
- C. Remove all defective pipe from site and replace
- D. Examine areas for defects such as weak structural components or deviations beyond allowable tolerances for piping clearances that adversely affect execution and quality of Work
- E. Start installation only when conditions are satisfactory

3.02 BEDDING

- A. Excavate pipe trench in accordance with Division 31 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated
 1. Dig bell or coupling holes
 2. Do not support pipe on blocks or mounds of earth
 3. Provide uniform and continuous bearing and support for full length of pipe between bell holes
 4. Minor disturbance over a maximum length of 18 inches near the middle of each length of pipe will be permissible by the withdrawal of pipe slings or other lifting tackle
- B. Alignment and grade:
 1. Except as indicated on the Drawings, lay all pipe straight between changes in alignment and at a uniform grade between changes in grade
 2. Use batter boards to determine and check pipe subgrades
 3. Other methods of maintaining alignment and grade may be acceptable. Submit complete information describing the proposed method to the Engineer for review before pipe laying is started

- C. Place bedding material at trench bottom, level fill materials in one continuous layer per Division 31 23 23.

3.03 INSTALLATION

- A. Install as specified or in accordance with the manufacturer's instructions
- B. Cutting Pipe:
 - 1. Cut pipe to measurements taken at the site, not from the Drawings
- C. Cut pipe neatly without damage to pipe coating or lining
 - 1. Cut smooth, straight, and at right angles to pipe axis
 - 2. Dress and bevel end of cut pipe to remove roughness and sharp corners, recoat exposed metal with coating approved for intended service
 - a. Cut ductile iron pipe with saw or abrasive wheel
- D. Piping underground:
 - 1. Install ductile iron piping and fittings in accordance with AWWA C600 except as specified herein
 - 2. Inspect pipe and accessories for defects before lowering into trench
 - 3. Repair or replace any defective, damaged or unsound pipe
 - 4. Carefully lower pipe, fittings, and accessories into the trench with derricks, ropes, and other suitable equipment to prevent damage
 - 5. Do not dump or drop pipe or accessories into trench
 - 6. Do not lay pipe in water, under unsuitable weather conditions or under unsuitable trench conditions
 - 7. Joint to form true and smooth line
 - 8. Trim pipe only for closures
 - 9. Remove any pipe not making a good fit
 - 10. Begin pipe laying at the lowest point unless reverse laying is accepted by Engineer
 - 11. Utilize implements, tools and facilities as recommended by the manufacturer
 - 12. Keep pipe clean during and after laying
 - 13. Close all open ends with watertight expandable type plugs:
 - a. At the end of each day's operations
 - b. Whenever pipe ends are left unattended
 - c. Deposit adequate backfill on pipe to prevent flotation
 - d. Do not use wood, burlap or other similar temporary plugs
 - 14. Remove and re-lay any pipe which has floated
 - 15. Provide an isolation or shutoff valve and union at the water connections to each fixture and unit of equipment, whether shown on the Drawings or not
 - 16. Group piping with other site piping work whenever practical. Maintain 10 feet minimum separation between potable water and sanitary or storm sewer pipes
 - 17. Install pipe to indicated elevation to within tolerance of 1/2 inch
 - 18. Route pipe in straight line
 - 19. Install pipe to allow for expansion and contraction without stressing pipe or joints
 - 20. Install access fittings to permit disinfection of water system performed under Section 33 14 00
 - 21. Slope water pipe and position drain at low points
 - 22. Protect from lateral displacement by placing embedment evenly on both sides of pipe
 - 23. Lay pipe with bell ends facing the direction of laying except when Engineer authorizes reverse laying
 - 24. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main. Not required when using restrained joint pipe
 - 25. Establish elevations of buried piping to ensure not less than 5 feet of cover
 - 26. Backfill trench in accordance with Division 31
 - 27. Reference Division 31 for additional requirements

- E. Piping in buildings or structures:
 - 1. Completed installation should present a neat, orderly appearance
 - 2. Do not block openings, passageways, or pipe galleries
 - 3. Run piping parallel to walls of building or structure
 - 4. Keep piping from contacting walls, structures, or installed items

3.04 JOINTS

- A. Make joints carefully and neatly
- B. Connect piping in accordance with manufacturer's instructions
- C. Mechanical Joints:
 - 1. If an effective seal is not obtained, disassemble joint, clean thoroughly, and reassemble
 - 2. Do not over-tighten bolts to compensate for poor installation
 - 3. Carefully align holes in mechanical joints with restraint devices to permit installation of the harness bolts
 - 4. Install flange and mechanical joint pieces so the four mechanical joint holes, as well as the flange holes, straddle the top centerline for horizontal piping, or the side centerline for vertical piping
- D. Push-on Joints:
 - 1. Bevel spigot ends of field cut piping
 - 2. Groove spigot ends of field cut restrained joint piping
 - 3. Thoroughly clean and lubricate inside of receiving bell and outside of spigot and gasket immediately before jointing
 - 4. Relieve any tension in rubber gasket by inserting a dull instrument under the gasket and rake two complete revolutions around joint
 - 5. Place spigot end of the pipe in the bell end of the preceding pipe with care to prevent contact of the joint with the ground
 - 6. Complete the joint by pushing pipe home with slow steady pressure, without jerky or jolting movements
 - 7. Do not exceed 80 percent of the pipe manufacturer's instructions for maximum deflection
- E. Flanged Joints:
 - 1. Take care when bolting flanges to insure that there is no restraint on the opposite end of the pipe which would prevent gasket compression or cause unnecessary stress in flanges
 - 2. Leave one flange free to move in any direction while tightening flange bolts
 - 3. Do not pack or assemble bell and spigot joints until all flanges affected thereby have been tightened
 - 4. Tighten bolts gradually at a uniform rate to compress gaskets uniformly
 - 5. Take special care in connecting to pumping equipment to insure no stresses are transmitted to pump flanges by connecting piping:
 - a. Permanently support piping for accurate matching of bolt holes and uniform contact over the entire face of abutting pump and pipe flanges are obtained before bolting those flanges
 - b. Allow pump connection piping to move parallel to its longitudinal centerline while bolts are tightened
 - c. Level, align, and wedge pumps into position to fit connecting piping but do not install grout until after initial pipe fitting and alignment to allow shifting the pump on its foundation
 - d. Grout pumps prior to final bolting of connecting piping
- F. Flanged Coupling Adapters:
 - 1. Install per manufacturer installation instructions.
- G. Mechanical Couplings:
 - 1. Cut pipe ends clean and smooth
 - 2. Leave a space of 1/4 inch to 1 inch between pipe ends

- H. Grooved couplings: Arrange piping so the clear space between pipe ends inside each grooved coupling is not more than one times, or less than 2 times, the maximum recommended by manufacturer
- I. Reducers:
 - 1. Provide eccentric reducers adjacent to flowmeters where installed in horizontal position
 - 2. Install with straight side on top to avoid forming trapped air
- J. Pipe Restraining Methods:
 - 1. In interior locations and where subject to internal pressure, block, anchor or harness piping with mechanically coupled, push-on or similar joints to prevent separation of joints
 - 2. In buried piping subject to hydrostatic heads in excess of 30 feet provide concrete thrust blocking to prevent pipe movement caused by internal pressure at:
 - a. Fire hydrants and gate valves
 - b. Plugs, tees, and wyes
 - c. Bends deflecting 11-1/4 degrees or more
 - d. Other locations show on Drawings
 - 3. Concrete thrust blocking shall provide:
 - a. Bearing area as indicated on the Drawings
 - b. Provide bond break
 - c. Extend from fitting to solid undisturbed earth
 - d. Installed so joints are accessible for repair
 - e. If the lack of a solid vertical excavation face is due to improper excavation, all additional costs shall be borne by Contractor
 - 4. For areas where ground is unstable or unsuitable for concrete thrust blocking, as determined by the Engineer, or as indicated on the Drawings, provide joint restraint by tied pipe:
 - a. Provide sufficient number of tied joints to equal or exceed restraining length as shown on the Drawings
 - b. In fills and embankments provide concrete thrust blocks and tied joints to equal or exceed restraining length as shown on the Drawings:
 - 1) Tie rods and Cor-ten eye bolts at mechanical joints
 - 2) Tie rods and clamps at push-on joints
 - 3) Restrained joint pipe

3.05 CONCRETE ENCASEMENT

- A. Concrete encase all piping below slabs on grade and where indicated on the Drawings
- B. Provide reinforcing as indicated on the Drawings
- C. Suitably support and block pipe and anchor against flotation

3.06 CONNECTION TO EXISTING PIPE LINES

- A. Make connections between new and existing piping by other contractors with suitable fittings, provide all fittings required for testing
- B. Schedule connection to minimize inconvenience to the Owner, other contractors, and as authorized by Owner
- C. Provide facilities for adequate dewatering and disposal of water from dewatered line and excavations without damage to adjacent property

3.07 PROTECTIVE COATING

- A. Provide polyethylene tube encasement on all buried ductile iron pipe, fittings, valves and rodding:
 - 1. Comply with AWWA C105
 - 2. As detailed on Drawings
- B. Metal Surfaces:

- C. Coat all steel clamps, rods, bolts, and other metal accessories used in tapping saddles, anchorages, cut ends of pipe, follower rings and bolts or joint harnesses subject to submergence or contact with the earth and not concrete encased, but including pipe fittings and bolts in polyethylene tube encasement
 - 1. Apply 2 coats of high build coal tar epoxy to clean, dry metal surfaces
 - 2. Allow the first coat to dry and harden before applying the second coat
- D. Dielectric Fittings:
 - 1. Provide dielectric pipe fittings and isolators at all connections between dissimilar metals in all plumbing piping systems to control corrosion potential caused by galvanic or electrolytic action
 - 2. Typical locations for dielectric isolation are: water heaters, storage and pressure tanks, water conditioning equipment, pumps, changes in service piping materials, make-up connections to boilers and chilled water systems, valves, deaerators, flexible connectors and the like where materials of different electrode potential are joined
 - 3. Storage tanks shall be isolated from piping and tank stands by use of anti-electrolytic and galvanic isolators

3.08 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot, two percent minimum but never less than 1/8 inch per foot. Maintain gradients
- B. Slope exposed water piping and arrange to drain at low points

3.09 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 40 00
- B. Perform pressure and leakage tests on all newly installed pipe.
- C. Furnish all necessary equipment and material, make all taps in the pipe as required, and conduct the tests.
- D. Conduct the tests between valved sections of the pipeline, or as approved by the Engineer. The Engineer will monitor the tests.
- E. Furnish the following equipment and material for the tests:

Amount	Description
2	Approved graduated containers
2	Pressure gauges
1	Hydraulic force pump approved by Engineer
1	Additional 1/2 inch pressure tap for Engineer's test gauge
	Suitable hose and suction pipe as required

- F. Wait at least 5 days after concrete reaction blocks have been placed to test any section of pipe with concrete reaction blocking. This time can be reduced to 2 days if high-early cement is used for the concrete reaction blocking.
- G. Conduct the pressure tests as follows after the trench has been partially backfilled with the joints left exposed for inspection, or when completely backfilled, as permitted by the Engineer.
 - 1. Test pressure:
 - a. As specified by the Engineer.
 - b. Generally at least one and a half (1.5) times normal working pressure or 150 psi minimum.
 - c. Calculated for the point of lowest elevation of the test section
 - 2. Duration
 - a. The duration of each pressure test shall be 2 hours, unless otherwise directed by the Engineer.
 - 3. Procedure
 - a. Slowly fill the pipe with water and allow to stand for 24 hours.

- b. Expel all air from the pipe.
 - c. Allow and maintain the specified test pressure by continuous pumping if necessary for the entire test period.
 - d. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to maintain the test pressure may be measured accurately.
 - e. Before pressurizing the test section of line, the Engineer is to verify:
 - 1) All necessary main line valves are open or closed with regard to the section of line being tested.
 - 2) All hydrant valves are open.
4. Leakage
- a. Leakage Allowance: The maximum quantity of makeup water that can be added into a pipeline undergoing hydrostatic pressure testing, or any valved section thereof, to maintain pressure within ± 5 psi.
 - b. The Leakage Allowance is exceeded if the quantity of makeup water is greater than that determined by the following formula:
- $$Q = \frac{LD\sqrt{P}}{148,000}$$
- where,
- Q = Allowable leakage, in gallons per hour.
 - L = Tested length of pipe (feet)
 - D = Nominal diameter of pipe, in inches.
 - P = Average test pressure during the leakage test, in pounds per square inch gauge.
5. Correction of Excessive Leakage
- a. Should any test of pipe laid disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

3.10 CLEANING AND DRAINING

- A. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected
- B. Wire brush, if necessary, wipe clean and keep joint contact surfaces clean until connection is complete
- C. Flush all lines thoroughly before disinfection in accordance with Section 33 14 00.
- D. When testing against a closed valve connected to an existing potable water system, complete flushing and passing disinfection tests per Section 33 14 00 prior to conducting hydrostatic pressure test.

END OF SECTION

SECTION 40 05 51 PROCESS VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Copper-alloy ball valves.
 - 2. Ferrous-alloy butterfly valves.
 - 3. Ductile-iron non-slam check valve
 - 4. Combination Air/Vacuum Valve

1.02 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; furnished specialties; and accessories.

1.03 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and Smaller: Threaded ends, unless otherwise indicated.
- C. Ferrous Valves NPS 2-1/2 and Larger: Flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
 - 1. Handwheel: For valves other than quarter-turn types.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Valve Grooved Ends: AWWA C606.
 - 1. Solder Joint: With sockets according to ASME B16.18.
 - a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.
 - 2. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

2.03 COPPER-ALLOY BALL VALVES

- A. Manufacturers:
 - 1. One-Piece, Copper-Alloy Ball Valves:

- a. American Valve, Inc.
- b. Conbraco Industries, Inc.; Apollo Div.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. DynaQuip Controls.
- f. Grinnell Corporation.
- g. Jamesbury, Inc.
- h. Kitz Corporation of America.
- i. Legend Valve & Fitting, Inc.
- j. NIBCO INC.
- k. Watts Industries, Inc.; Water Products Div.
- 2. Two-Piece, Copper-Alloy Ball Valves:
- 3. Conbraco Industries, Inc.; Apollo Div.
- a. Crane Co.; Crane Valve Group; Crane Valves.
- 4. Crane Co.; Crane Valve Group; Jenkins Valves.
- a. Crane Co.; Crane Valve Group; Stockham Div.
- b. DynaQuip Controls.
- c. Flow-Tek, Inc.
- d. Grinnell Corporation.
- e. Hammond Valve.
- f. Honeywell Braukmann.
- g. Jamesbury, Inc.
- h. Jomar International, LTD.
- i. Kitz Corporation of America.
- j. Legend Valve & Fitting, Inc.
- k. Milwaukee Valve Company.
- l. Nexus Valve Specialties.
- m. NIBCO INC.
- n. R & M Energy Systems (Borger, TX).
- o. Red-White Valve Corp.
- p. Richards Industries; Marwin Ball Valves.
- q. Watts Industries, Inc.; Water Products Div.
- B. Three-Piece, Copper-Alloy Ball Valves:
- a. Conbraco Industries, Inc.; Apollo Div.
- b. DynaQuip Controls.
- c. Grinnell Corporation.
- d. Hammond Valve.
- e. Jamesbury, Inc.
- f. Kitz Corporation of America.
- g. NIBCO INC.
- h. PBM, Inc.
- i. Red-White Valve Corp.
- j. Worcester Controls.

2.04 FERROUS-ALLOY BUTTERFLY VALVES

- A. Manufacturers:
- 1. Flangeless, Ferrous-Alloy Butterfly Valves:
- a. American Valve, Inc.
- b. Bray International, Inc.
- c. Cooper Cameron Corp.; Cooper Cameron Valves Div.
- d. Crane Co.; Crane Valve Group; Center Line.
- e. Crane Co.; Crane Valve Group; Stockham Div.
- f. Dover Corp.; Dover Resources Company; Norriseal Div.

- g. General Signal; DeZurik Unit.
- h. Grinnell Corporation.
- i. Hammond Valve.
- j. Kitz Corporation of America.
- k. Legend Valve & Fitting, Inc.
- l. Metraflex Co.
- m. Milwaukee Valve Company.
- n. Mueller Steam Specialty.
- o. NIBCO INC.
- p. Process Development & Control.
- q. Red-White Valve Corp.
- r. Techno Corp.
- s. Tyco International, Ltd.; Tyco Valves & Controls.
- t. Watts Industries, Inc.; Water Products Div.

B. Materials:

- 1. General:
 - a. Rubber seat, tight closing discs seat at 90 degrees with pipe axis.
 - 1) Shaft: Keys and pins for securing disc to shaft to be 18-8 stainless steel.
 - b. Valve ends suitable for specified use:
 - 1) Lugged.
 - c. Materials:
 - 1) Body: Cast iron
 - 2) Shaft: Stainless steel, one piece
 - 3) Disc: Bronze or cast iron with corrosion-resistant metal plating
 - 4) Seat: Synthetic rubber or elastomer with suitable temp rating
 - 5) Shaft bearings: Bronze or Teflon
 - 6) Shaft seal: Suitable synthetic rubber rings

C. Valve Actuators: Handwheel.

2.05 DUCTILE IRON NON-SLAM CHECK VALVE

A. Manufacturers:

- 1. Val-Matic Surgebuster
- 2. Engineer Approved Equal

B. Materials:

- 1. Body and Cover: ASTM A536 Grade 65-45-12 ductile iron.
- 2. Disc: Buna-N (NBR), ASTM D2000-BG.
- 3. Disc Accelerator: Type 302 Stainless Steel.

C. Shop Coatings:

- 1. Coal tar epoxy: Tnemec "Series 46H-413 Hi-Build Tneme-Tar", or equal.
- 2. Epoxy: Tnemec "Series 66 Hi-Build Epoxoline", or equal.
- 3. Rust-inhibitive primer: Tnemec "37H Chem-Prime H.S.", or equal.
- 4. Rust-preventive compound: Rust-Oleum, or equal.

2.06 COMBINATION AIR/VACUUM VALVE

A. Manufacturers:

- 1. A.R.I. Model D-040 B
- 2. Engineer Approved Equal

B. Materials:

- 1. Reinforced Nylon Body
- 2. Brass Base

PART 3 EXECUTION

3.01 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Throttling Service: Angle, ball, butterfly, or globe valves.
 - 3. Pump Discharge: Ductile-iron non-slam check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
 - 1. Ball Valves, NPS 2 and Smaller: One-piece, 400-psig CWP rating, copper alloy.
 - 2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
 - 3. Butterfly Valves, NPS 2-1/2 and Larger: Lugged-style, 150-psig CWP rating, ferrous alloy, with EPDM liner.
 - 4. Non-Slam Check Valves, NPS 2 and Larger: 250-psig CWP rating, horizontal, ductile-iron with Buna-N disc. Val-Matic Surgebuster or approved equal.
 - 5. Pressure Relief & Surge Anticipator Valve, 6 inch: 250-psig CWP rating, ductile-iron. Cla-Val Model 52-03 or approved equal.

3.02 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 40 XX XX Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.03 JOINT CONSTRUCTION

- A. Refer to Section 40 00 00 Section for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.04 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

**SECTION 40 70 05
METERS AND GAGES**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following meters and gages for mechanical systems:
- B. Gages.
 - 1. Analog Pressure Gauge
 - 2. Pressure Transmitter
 - 3. Magnetic Flowmeter

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Operation and maintenance data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 PRESSURE GAGES

- A. Manufacturers:
 - 1. AMETEK, Inc.; U.S. Gauge Div.
 - 2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 3. Ernst Gage Co.
 - 4. Eugene Ernst Products Co.
 - 5. KOBOLD Instruments, Inc.
 - 6. Marsh Bellofram.
 - 7. Miljoco Corp.
 - 8. Noshok, Inc.
 - 9. Palmer - Wahl Instruments Inc.
 - 10. REO TEMP Instrument Corporation.
 - 11. Terrice, H. O. Co.
 - 12. Weiss Instruments, Inc.
 - 13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - 14. WIKA Instrument Corporation.
 - 15. Winters Instruments.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Dry type, drawn steel or cast aluminum, 2-1/2-inch diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 6. Pointer: Red metal.
 - 7. Window: Glass.
 - 8. Ring: Metal.

9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
1. Valves: NPS 1/4 brass or stainless-steel needle type.
 2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
 3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.03 PRESSURE TRANSMITTERS

- A. Pressure Transducer/Transmitter
1. Communication: 4-20mA
 2. Temperature Range: -13 degrees F to 80 degrees F
 3. Reference Accuracy: 0.5%
 4. Capacitive sensors, can withstand water hammer of 20 times nominal pressure
 5. Provided with all communication and power supply interconnecting cables for complete operating system.
 6. Manufacturers:
 - a. Endress+Hauser; Model Cerabar PMC11
 - b. Or Engineer Approved Equal

2.04 FLOWMETERS

- A. Magnetic Flowmeter:
1. Indicator/Transmitter:
 - a. Remotely mounted
 - b. All solid state circuitry
 - c. Except for indicating scale and totalizer, interchangeable between magnetic flow meters
 - d. Indicator and totalizer visible without opening enclosure
 - e. Display; 4-1/2 digits
 - f. Self-contained zero return which sets flow meter output to zero when flow through meter is minimal
 - g. NEMA 4X enclosure
 - h. Two programmable setpoint relays, Form "C" rated at 5A resistive
 - i. One Analog output; 4-to-20 mA and pulse output for remote totalizer
 - j. Accuracy: +/- 1.0 percent
 - k. Stability: 0.5 percent of full scale
 - l. Response time: 2 seconds minimum
 - m. Power: 120 V AC
 - n. Liner Material: Hard Rubber
 2. Sensor:
 - a. Magnetic flow meter
 - b. No moving parts in contact with fluid
 - c. Flanged
 - d. Suitable for 250 psig working pressure
 - e. Capable of standing empty for extended periods of flow through time without damage
 - f. No constriction in or obstruction of flow through meter
 - g. Weather resistant and splash-proof
 - h. Encapsulated characterized field coils
 - i. Range: As shown on instrument list
 - j. Accuracy: ± 0.1 percent of Full Scale
 - k. Repeatability: +/- 0.1 percent
 - l. Temperature Range: 32-to-176 degrees F

- m. Provide spare flanged spool piece of exact laying length
- 3. Provided with all communication and power supply interconnecting cables for complete operating system.
- 4. Selected model shall have no requirements for upstream/downstream straight pipe lengths.
- 5. Manufacturers:
 - a. Endress+Hauser; Model Promag W 400 0XDN.
 - b. Engineer Approved Equal.

PART 3 EXECUTION

3.01 GAGE APPLICATIONS

- A. Install one pressure gage/pressure transmitter on suction and discharge headers.

3.02 INSTALLATIONS

- A. Calibration of Instruments:
 - 1. Notify the Project Engineer two weeks prior to calibrating instruments
 - 2. The Project Engineer shall determine if calibration procedures will be witnessed
 - 3. Perform calibration exactly as outlined in Manufacturer's printed instructions
 - 4. Check calibration at several points along instrument range
 - 5. Complete data entry on Instrument Calibration Record Sheet immediately after each step of calibration and obtain the Project Engineer's initials for each sheet
 - 6. Completed Instrument Calibration Record Sheets must be submitted prior to substantial completion
- B. Control Loop Checkout:
 - 1. Perform control loop checkout in an organized fashion:
 - a. Final elements should be first tested and verified
 - 2. Check loop from final element back to instrument cabinet, and/or control panel.
 - a. Verify loop operation at control cabinet or control panel
 - b. The Contractor will demonstrate each working loop to the Project Engineer.
- C. Install flowmeter elements in accessible positions in piping systems.
- D. Install permanent indicators on walls or brackets in accessible and readable positions.
- E. Install connection fittings for attachment to portable indicators in accessible locations.
- F. Calibrate meters according to manufacturer's written instructions, after installation.
- G. Adjust faces of meters and gages to proper angle for best visibility.

3.03 FIELD QUALITY CONTROL

- A. Field testing will be performed under provisions of Section 01 45 23
- B. Provide Manufacturer's field services for Work of this Section
- C. Prior to start-up:
 - 1. Advise Contractor on installation
 - 2. Check, calibrate, and place equipment in operation
 - 3. Visit the job as often as required and spend as much time as necessary to insure compliance with specification
 - 4. Advise Contractor of necessary corrections for start-up
- D. Start-up:
 - 1. Check each loop and demonstrate operation to the Project Engineer
- E. Provide written directions to Contractor detailing all corrections necessary for proper operation
 - 1. Provide 8 hours preliminary instruction to plant personnel on operation of instrumentation and controls after conclusion of loop checks
- F. Follow-up and Training:
 - 1. As specified in Section 01 79 00

2. Check all corrections made since start-up and recalibrate instruments where changes have occurred
3. Inspect all instrument and control loops with plant personnel, address operation and performance concerns
4. Provide minimum of 8 hours of training encompassing all equipment described in this section

END OF SECTION

**SECTION 43 23 31.01
PACKAGED PUMP SYSTEM**

PART I – GENERAL

1.01 SUMMARY

- A. Furnish and install a packaged, variable speed pump system with variable frequency drives.

1.02 REFERENCE STANDARDS

- A. ANSI - American National Standards Institute; -.
- B. ASTM - ASTM International; -.
- C. ISO 9906 - Rotodynamic Pumps - Hydraulic Performance Acceptance Tests - Grades 1, 2 and 3; 2012.
- D. NEMA - National Electrical Manufacturers Association; -.
- E. NSF 61 - Drinking Water System Components - Health Effects; 2024.
- F. NSF 372 - Drinking Water System Components - Lead Content; 2024.
- G. UL - Underwriters Laboratories; -.
- H. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

PART 2 – PRODUCTS

2.01 VARIABLE SPEED PACKAGED PUMPING SYSTEM

- A. Manufacturers:
 - 1. The basis if design was around Grundfos.
 - a. Packaged Pumping System: Grundfos Hydro MPC-E 3CRE 15-5.
 - b. Or approved equal.
- B. Furnish and install a pre-fabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.
- C. The packaged pump system shall be a standard product of a single pump manufacturer. The entire pump system including pumps and pump logic controller, shall be designed, built, and tested by the same manufacturer.
- D. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ – Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.
- E. The complete packaged pumping system shall be NSF 61 / NSF 372 Listed for drinking water and low lead requirements.
- F. The packaged pump system shall be ASHRAE 90.1 – 2010 compliant without the need of a remote mounted sensor. The control logic used to simulate a remote mounted sensor shall be proportional pressure control with squared or linear adaptation. An actual flow rate or calculated flow rate based on performance curves (5th order polynomial) loaded into the controller; shall be used to adjust setpoint pressure in proportional pressure control.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

- A. General
 - 1. Stable and free of cavitation and noise throughout the specified operating head range.
 - 2. Minimum hydrostatic test pressure: 1.5 x shutoff head plus suction pressure.
 - 3. The pump manufacturer must be certified to ISO 9001 by an accredited certification agency.
- B. Service Conditions
 - 1. Service: Potable water.
 - 2. Temperature of pumped liquid: 33 to 70 deg F.
 - 3. Elevation of pump station: 6,019 feet ASL.

4. Ambient air temperatures:
 - a. Average range: 15 - 75 deg F.
 - b. Summer maximum: 98 deg F.
 - c. Winter minimum: -10 deg F.
- C. Design Requirements:
 1. Packaged System
 - a. Service Conditions: Potable water
 - b. Number of pumps: 3
 - c. System Flowrate, gpm: 140
 - d. Flowrate per pump, gpm: 70
 - e. Rated total head, ft: 247
 - f. Power requirements: 3 phase, 460 volt
 - g. Max rotative speed: 3600 rpm
 - h. Minimum horsepower, individual pump: 10 hp
 - i. Efficiency: 70% or greater
 - j. Suction Connection: 4 inch flanged
 - k. Discharge Connection: 4 inch flanged

2.03 PUMPS

- A. All pumps shall be ANSI NSF 61 / NSF 372 Listed for drinking water and low lead requirements.
- B. The pumps shall be of the in-line vertical multi-stage design.
- C. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
- D. Small (CR3 to CR20) Vertical In-Line Multi-Stage Pumps (Nominal flow from 3 to 125 gallons per minute) shall have the following features:
 1. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
 2. The suction/discharge base shall have ANSI Class 250 flange or internal pipe thread (NPT) connections as determined by the pump station manufacturer.
 3. Pump Construction.
 - a. Suction/discharge base, pump head, motor stool: Cast iron (Class 30)
 - b. Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel
 - c. Shaft: 316 or 431 Stainless Steel
 - d. Impeller wear rings: 304 Stainless Steel
 - e. Shaft journals and chamber bearings: Silicon Carbide
 - f. O-rings: EPDM
 - g. Shaft couplings for motor flange sizes 184TC and smaller shall be made of cast iron or sintered steel. Shaft couplings for motor flange sizes larger than 184TC shall be made of ductile iron ((ASTM)) 60-40-18).
 - h. Optional materials for the suction/discharge base and pump head shall be cast 316 stainless steel ((ASTM)) CF-8M resulting in all wetted parts of stainless steel.
 4. The shaft seal shall be a balanced o-ring cartridge type with the following features:
 - a. Collar, Drivers, Spring: 316 Stainless Steel
 - b. Shaft Sleeve, Gland Plate: 316 Stainless Steel
 - c. Stationary Ring: Graphite embedded Silicon Carbide
 - d. Rotating Ring: Graphite embedded Silicon Carbide
 - e. O-rings: EPDM
 5. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling and motor. The entire cartridge shaft seal shall be removable as a one-piece component.

6. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

2.04 INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

- A. Efficiency: The motors shall be of permanent magnet design meeting IE5 efficiency levels where the combined motor and VFD efficiency exceed NEMA Premium Efficiency standards.
- B. Bearing Current Mitigation: Motors shall use WSB (Winding Set Back) and/or CHS (Coil Head Shield) designs that reduce the Bearing Voltage Ratio (BVR) far enough to eliminate damaging bearing currents. Shaft grounding rings/brushes or common mode filters shall not be required.
- C. Motor Enclosure/Cooling: The motor shall be Totally Enclosed Fan Cooled (TEFC) with a standard NEMA C-Face with Class F insulation and a temperature rise class no higher than Class B. The cooling design of the motor and VFD shall be such that a Class B motor temperature rise is not exceeded at full rated load and speed at a minimum switching frequency of 9.0 kHz.
- D. The power and control electronics shall be housed in a UL Type 3 enclosure and the combined motor/VFD rating shall be IP55 (protection against dust and nozzle directed water from any direction).
- E. The VFD shall be of the PWM (Pulse Width Modulation) design using IGBT (Insulated Gate Bipolar Transistor) technology.
- F. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor current suitable for centrifugal pump control and to eliminate the need for motor de-rating.
- G. The VFD shall automatically reduce the switching frequency and/or the output voltage and frequency to the motor during periods of sustained ambient temperatures that are higher than the normal operating range. The switching frequency shall be reduced before motor speed is reduced.
- H. An integral RFI filter shall be standard in the VFD.
- I. The VFD shall have a minimum of two skip frequency bands which can be field adjustable.
- J. The VFD shall have internal solid-state overload protection designed to trip within the range of 105-110% of rated current.
- K. The integrated VFD motor shall include protection against input transients, phase imbalance, loss of AC line phase, over-voltage, under-voltage, VFD over-temperature, and motor over-temperature. Three-phase integrated VFD motors shall be capable of providing full output voltage and frequency with a voltage imbalance of up to 10%.
- L. The integrated VFD motor shall have, as a minimum, the following input/output capabilities:
 1. Speed Reference Signal: 0-10 VDC, 4-20mA
 2. Digital remote on/off
 3. Fault Signal Relay (NC or NO)
 4. Fieldbus communication port (RS485)
- M. Motor drive end bearings shall be adequately sized so that the minimum L10 bearing life is 20,000 hours at the minimum allowable continuous flow rate for the pump at full rated speed.

2.05 PUMP SYSTEM CONTROLLER

- A. The pump system controller shall be a standard product developed and supported by the pump manufacturer.
- B. The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller user interface shall have a color display with a minimum screen size of 3-1/2" x 4-5/8" for easy viewing of system status parameters and for

field programming. The display shall have a back light with contrast adjustment. Password protection of system settings shall be standard.

- C. Galvanic Isolation: The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections.
- D. Backup Battery: The controller shall have the ability to be connected to a backup battery to supply power to the controller during periods of loss of supply power.
- E. Home Status Screen: The controller shall display the following as status readings from a single display on the controller (this display shall be the default):
 - 1. Current value of the control parameter, (typically differential pressure)
 - 2. Most recent existing alarm (if any)
 - 3. System status with current operating mode
 - 4. Status of each pump with current operating mode and rotational speed as a percentage (%)
 - 5. Estimated flow-rate, (or actual flow if flow sensor is used)
 - 6. One user defined measured parameter (i.e. power consumption)
- F. Inputs/Outputs: The controller shall have as a minimum the following hardware inputs and outputs:
 - 1. Three analog inputs (4-20mA or 0-10VDC)
 - 2. Three digital inputs
 - 3. Two digital outputs
 - 4. Ethernet connection (built-in web server)
 - 5. Field Service connection to PC for advanced programming, software and/or firmware upgrades and data logging
- G. Pump system programming: As a minimum, the following parameters shall be available and/or field adjustable:
 - 1. Sensor Settings: Suction, Discharge, Differential Pressure analog supply/range
 - 2. PI Controller: Proportional gain (Kp) and Integral time (Ti)
 - 3. Low suction: Pressure/level shutdown via digital contact
 - 4. Limit Exceeding function: For low system, low suction warnings and shut down via analog input
 - 5. Flow meter settings (if used, analog signal)
- H. Pump Curve Data: The actual pump performance curves (5th order polynomial) shall be loaded (software) into the pump system controller. Pump curve data shall be used for the following:
 - 1. Display and data logging of calculated flow rate
 - 2. Variable pressure control (quadratic or proportional)
 - 3. Pump outside of duty range protection
 - 4. Sequence pumps based on efficiency
- I. Variable Pressure Control: The controller shall have variable pressure control to compensate for pipe friction loss by decreasing the pressure set-point at lower flow-rates and increasing the pressure set-point at higher flow-rates by using the actual flow rate or calculated flow rate. Variable pressure control that uses power consumption and speed only shall not be considered equal to variable pressure control that uses actual differential pressure measurement along with pump power and speed.
- J. Multi-Sensor: The controller shall be able to control using up to six differential pressure (DP) sensors (zones). Each zone shall have a programmable maximum and minimum DP range. The controller shall be capable of an energy optimal mode where pump speed/energy shall be reduced until any of the zones reach the minimum DP setting.
- K. Check Valve Failure Detection (Systems with integrated VFD motors): The system controller shall be able to detect motors turning in the opposite direction and give check valve failure notification.
 - 1. For minor leaks the pump shall start with a warning indicated

- a. For major leaks the pump shall remain off to prevent damage with an alarm indication
- L. Pulse flow meter: The system controller shall be able to receive pulse readings from a digital pulse meter and log/display accumulated flow.
- M. DP Subtraction: The system controller shall be able to control off subtraction of two pressure or temperature sensors for differential pressure or differential temperature control.
- N. Programmable Setpoints: The system controller shall be able to accept up to seven programmable set-points via a digital input, (additional input/output module may be required).
- O. Setpoint Influence: The system pressure set-point shall be capable of being automatically adjusted by using an external set-point influence. The set-point influence function enables the user to adjust the control parameter (typically differential pressure) by measuring an additional parameter. (Example: Lower the system differential pressure set-point based on a flow or outdoor temperature measurement).
- P. Remote Control: The controller shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) as well as a remote system on/off (digital) signal.
- Q. Setpoint Ramp: The controller shall be able to adjust the ramp time of a change in set point (increase and decrease).
- R. Warnings and Alarms: The pump system controller shall store up to 24 warnings and alarms in memory. The time, date and duration of each alarm shall be recorded. A potential-free relay shall be provided for alarm notification to the building management system. The controller shall display the following alarm conditions:
 - 1. Individual pump failure
 - 2. Check valve failure
 - 3. VFD trip/failure
 - 4. Loss of sensor signal (4-20 mA)
 - 5. Loss of remote set-point signal (4-20mA)
 - 6. External Fault
 - 7. Pump outside of duty range
 - 8. Limit 1 and 2 exceeded*
 - 9. *The controller shall be capable of monitoring two analog signals (i.e. suction pressure and discharge pressure) for additional pump or system protection.
- S. Built-in data log: The controller shall have built-in data logging capability. Logged values shall be graphically displayed on the controller and shall be downloadable to a notebook/pc as a delimited text file. A minimum of 7200 samples per logged value shall be available for the following parameters:
 - 1. Estimated flow-rate (or actual flow if flow sensor is connected)
 - 2. Speed of pumps
 - 3. Process Value/sensor feedback (usually differential pressure)
 - 4. Power consumption
 - 5. Controlling parameter (setpoint)
 - 6. Inlet pressure (when remote differential pressure is the primary sensor)
- T. Redundant Primary Sensor: The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor.
- U. Secondary Sensor: Upon loss of signal from the remote sensor, the controller shall be capable of reverting control to the pump system mounted sensors with a programmable setpoint. The pumps shall maintain a constant, proportional or quadratic pressure across the system until the remote setpoint signal is restored.
- V. Pump Test: The controller shall have a pump "Test Run" feature such that pumps are switched on during periods of inactivity (system is switched to the "off" position but with electricity supply still connected). The inoperative pumps shall be switched on for a period of three to four seconds every 24 hours, 48 hours or once per week and at a programmable time of day.

- W. Reduced Operation: During backup generator operation, the controller shall be capable of reducing the power consumed by the pump system by either limiting the number of pumps in operation or by limiting the amount of power consumption (kW). The controller shall receive a digital input indicating backup generator operation.
- X. Power and Energy Consumption: The controller shall be capable of displaying instantaneous power consumption (Watts or kilowatts) and cumulative energy consumption (kilowatt-hours).
- Y. Specific Energy: When a flow sensor is connected, the controller shall be capable of displaying instantaneous specific energy in Watt-hours per gallon (Wh/gal) or Watt-hours per 1,000 gallons (Wh/kgal).
- Z. Built-in Ethernet: The controller shall have an Ethernet connection with a built-in web server allowing for connection to a building computer network with read/write access to the controller via a web browser.
- AA. Service Contact Information: The controller shall have a programmable Service Contact Field that can be populated with service contact information including: contact name, address, phone number(s) and website.

2.06 CONTROL PANEL

- 1. SCCR: The complete control panel assembly shall have a Short Circuit Current Rating of 100 kA
- 2. BMS Integration: Standard shall be BACnet MS/TP
- 3. *Other protocols available: BACnet IP, Ethernet IP, Modbus RTU,
- 4. Modbus TCP, LON
- 5. The pump system controller shall be mounted in a UL Type 3R rated enclosure. A self-certified NEMA enclosure rating shall not be considered equal. The entire UL Type 3R control panel shall be UL 508 listed as an assembly. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions. The control panel shall include the following:
 - a. 80 dB System Fault Audible Alarm with push button to silence
 - b. Emergency/Normal Operation Switches (Control bypass)
 - c. Individual Service Disconnect Switches (accessible outside of panel)
 - d. Pump Run Lights
 - e. System Fault Light
 - f. Surge Arrestor

2.07 SEQUENCE OF OPERATION

- A. The system controller shall operate equal capacity variable speed pumps to maintain a constant differential pressure (system set-point from remote DP sensor) or proportional pressure differential pressure setpoint (system setpoint from local mounted sensor(s)), depending on the application. The system controller shall receive an analog signal 4-20mA from the factory installed pressure transducer on the discharge and suction manifolds, indicating the actual system pressure and inlet pressure. The controller shall be capable of controlling off the subtraction of discharge minus suction transducers for differential pressure across the manifolds.
 - 1. Standard Cascade Control (Pumping Efficiency Based):
 - a. The pump system controller shall adjust pump speed as necessary to maintain system set-point pressure as flow demand increases. Utilizing the pump curve information (5th order polynomial), the pump system controller shall stage on additional pumps when pump hydraulic efficiency will be higher with additional pumps in operation. Exception: When the flow and head are outside the operating pump(s) allowable operating range the controller shall switch on an additional pump thus distributing flow and allowing all pump(s) to operate in allowable operating range. When the system pressure is equal to the system set-point, all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional Gain and Integral time (PI) settings for system optimization.

- B. The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.
- C. All pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous (no flow shut-down does not occur), the system controller shall have the capability to alternate the pumps every 24 hours, every 48 hours or once per week. The interval and actual time of the pump change-over shall be field adjustable.
- D. The system controller shall be able to control a pressure maintenance pump, (jockey pump), in the system in pressure boosting applications. The set point of the pressure maintenance pump shall be able to be any value above or below the pump system's set point. The pressure maintenance pump shall be able to be staged on as back-up pump when capacity of pump system is exceeded.

2.08 LOW FLOW STOP FUNCTION (CONSTANT PRESSURE APPLICATIONS)

- A. The system controller shall be capable of stopping pumps during periods of low-flow or zero-flow without wasting water or adding unwanted heat to the liquid. Temperature based no flow shut-down methods that have the potential to waste water and add unwanted temperature rise to the pumping fluid are not acceptable and shall not be used.
- B. Standard Low Flow Stop and Energy Saving Mode
 - 1. If a low or no flow shut-down is required (periods of low or zero demand) a bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When only one pump is in operation the system controller shall be capable of detecting low flow (less than 10% of pump nominal flow) without the use of additional flow sensing devices. When a low flow is detected, the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band, adjustable). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off band, adjustable). Upon low flow shut-down a pump shall be restarted in one of the following two ways:
 - 2. Low Flow Restart: If the low flow condition still exists, the pump shall start and the speed shall again be increased until the stop pressure is reached and the pump shall again be switched off.
 - 3. Normal Flow Restart: If the pump system controller determines a low flow condition no longer exists the pump shall start and the speed shall be increased until the system pressure reaches the system set-point.
 - 4. OPTIONAL Low Flow Stop and Energy Saving Mode
 - a. The pump system controller shall be capable receiving a digital signal from a flow switch or an analog signal from a flow meter to indicate a low flow condition. A bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When low flow is detected (signal from flow switch or meter), the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off band). The pump shall remain in the energy saving on/off mode during low flow indication. When low flow is no longer present (low flow indication ceases), the pump(s) shall resume constant pressure operation.
 - 5. It shall be possible to change from the standard low flow stop to the optional low flow stop (and vice-versa) via the user interface.

2.09 SYSTEM CONSTRUCTION

- A. Suction and discharge manifold construction shall be in way that ensures minimal pressure drops, minimize potential for corrosion, and prevents bacteria growth at intersection of piping into the manifold. Manifold construction that includes sharp edge transitions or interconnecting

piping protruding into manifold is not acceptable. Manifold construction shall be such that water stagnation can not exist in manifold during operation to prevent bacteria growth inside manifold.

- B. The suction and discharge manifolds material shall be 316 stainless steel.
- C. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 2 inch and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 3 inch and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.
- D. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of stainless steel or epoxy coated iron (fusion bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.
- E. For systems that require a diaphragm tank, a connection of no smaller than 3/4" shall be provided on the discharge manifold.
- F. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.
- G. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2 1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
- H. Systems with a flooded suction inlet or suction lift configuration shall have a factory installed water shortage protection device on the suction manifold.
- I. The base frame shall be constructed of corrosion resistant 304 stainless steel for systems with CR pump sizes up to CR64. The pump system base shall be powder coated white aluminum RAL9006, carbon steel ASTM A36 structural steel, for systems with CR95 and larger pumps.
- J. Rubber vibration dampeners shall be fitted between each pumps and base frame to minimize vibration.
- K. Depending on the system size and configuration, the control panel shall be mounted in one of the following ways:
 - a. On a 304 stainless steel fabricated control cabinet stand attached to the system skid.
 - b. On a 304 stainless steel fabricated skid, separate from the main system skid
 - c. On its own base (floor mounted with plinth)

PART III – EXECUTION

3.01 TESTING

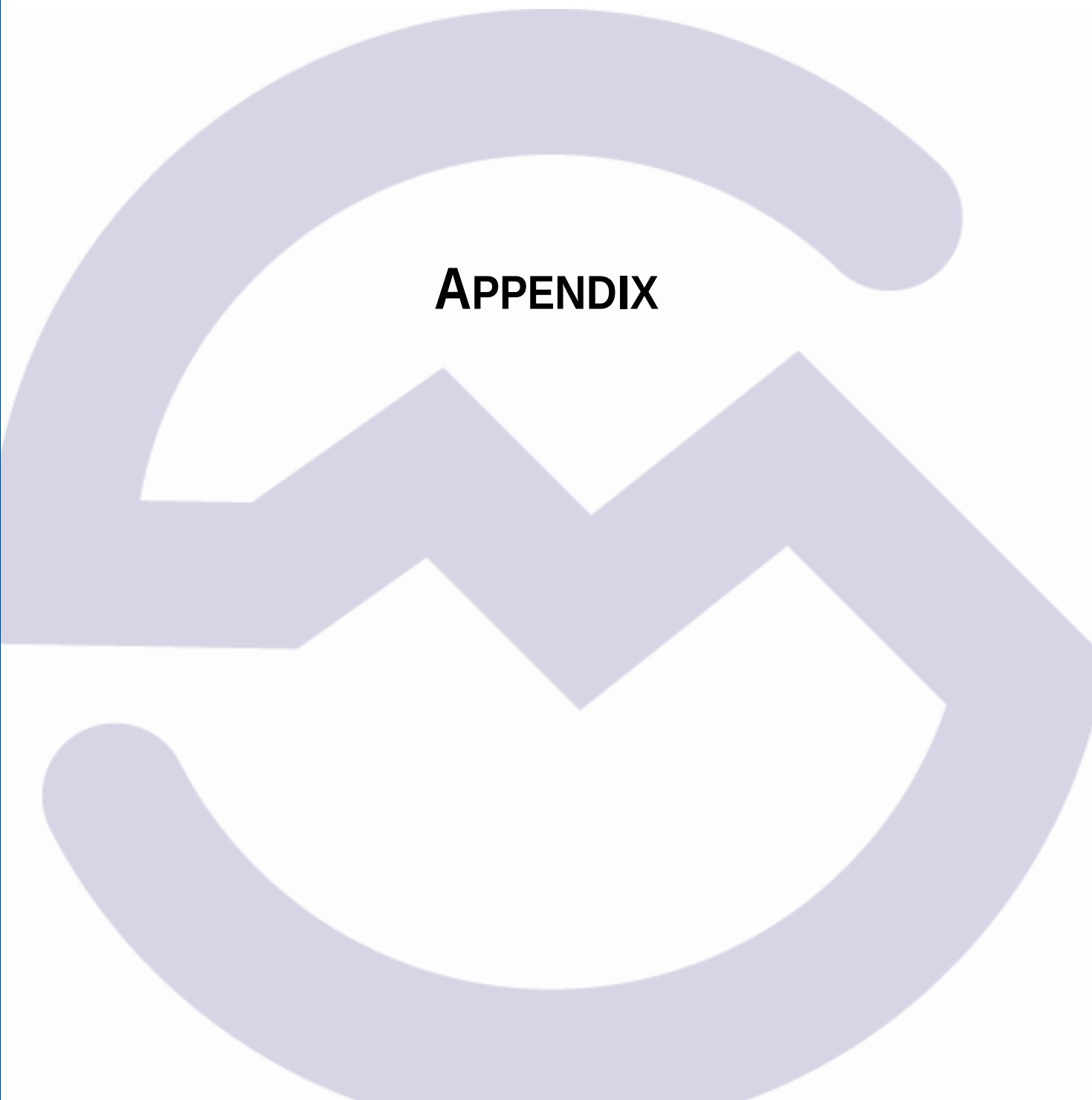
- A. The tester used for testing the pump system shall be constructed and calibrated according to the requirements of hydraulic test standard ISO 9906.
- B. The entire pump station shall as a minimum be factory tested for functionality and documented results of functionality test supplied with pump station.
 - 1. Functionality testing shall include the following parameters:
 - 2. Complete System Hydrostatic Test – 1.5 times the nameplate maximum pressure
 - 3. No-Flow Detection Shutoff Test
 - 4. Water Shortage Test
 - 5. Two-Point Setpoint Performance Test.

- C. C. Water used for testing shall be treated with three different filtration systems to ensure only clean water is used for testing pump station.
 - 1. 25 micron mechanical filter – removes solid parts from water
 - 2. Activated carbon filter – keeps water clear and eliminates odor
 - 3. Ultraviolet light system – kills all bacteria growth
- D. D. Optional performance testing shall include: (Select one)
 - 1. 10-Point Verified Performance Test
 - 2. Witnessed Verified Performance Test

3.02 WARRANTY

- A. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.

END OF SECTION

A large, stylized purple logo is centered in the background. It features a thick, curved line at the top that sweeps from the left towards the right. Below this is a horizontal line with a jagged, zigzag pattern in the center. At the bottom, another thick, curved line sweeps from the left towards the right, mirroring the top curve. The entire logo is rendered in a solid purple color.

APPENDIX



Huddlestone-Berry
Engineering & Testing, LLC

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Grand Junction, Colorado 81501
Phone: 970-255-8005
Info@huddlestoneberry.com

February 11, 2026
Project#00509-0025

Clifton Water District
510 34 Road
Clifton, Colorado 81520

Attention: Mr. Jacob Lenihan

Subject: Geotechnical Investigation
Desert Road Pump Station
Whitewater, Colorado

Dear Mr. Lenihan,

This letter presents the results of a geotechnical investigation conducted by Huddlestone-Berry Engineering & Testing, LLC (HBET) for the proposed Desert Road Pump Station to be located on Parcel 2969-303-00-333 in Whitewater, Colorado. The site location is shown on Figure 1 – Site Location Map. The scope of our investigation included evaluating the subsurface conditions at the site to aid in developing foundation and excavation recommendations for the proposed construction.

Site Conditions

At the time of the investigation, the site was open and consisted of undulating terrain. However, topography in the vicinity of the investigated area was gently sloping down to the east. Vegetation at the site primarily consisted of weeds and brush. The site was generally surrounded by open land.

Subsurface Investigation

The subsurface investigation included one boring at the site as shown on Figure 2 – Site Plan. The boring was drilled to a depth of 20.0 feet below the existing ground surface. A typed boring log is included in Appendix A.

The boring encountered 1.0 foot of topsoil above tan, moist, very stiff sandy lean clay with gravel soils that extended to a depth of 7.0 feet below the existing ground surface. The clay soils were underlain by brown to gray, soft to medium hard, moderately weathered shale bedrock that extended to the bottom of the boring. Groundwater was not encountered in the subsurface at the time of the investigation.

Laboratory Testing

Laboratory testing was conducted on samples of the native soils and shale bedrock collected from the boring. The testing included grain-size analysis, Atterberg limits determination, natural moisture content determination, and maximum dry density and optimum moisture content (Proctor) determination. The laboratory testing results are included in Appendix B.

The laboratory testing results indicate that the native clay soils are slightly plastic. In general, based upon the Atterberg limits and upon our experience with similar soils in the vicinity of the subject site, the native clay soils are anticipated to be slightly collapsible.

The shale bedrock was determined to be moderately plastic. Due to the degree of weathering/fracturing of the material, undisturbed samples of the shale were unable to be collected for swell/consolidation testing. However, based upon the Atterberg limits of the material and upon our experience with the Mancos shale in the vicinity of the subject site, the shale bedrock at the site is anticipated to be slightly to moderately expansive.

Foundation Recommendations

Based upon the results of the subsurface investigation and nature of the proposed construction, shallow foundations such as spread footings and monolithic (turndown edge) structural slabs are both appropriate alternatives. However, as discussed previously, the native soils in the shallow subsurface are anticipated to be slightly collapsible. Therefore, in order to provide a uniform bearing stratum and reduce the risk of excessive differential movements, it is recommended that the foundations be constructed above a minimum of 24-inches of structural fill.

The native clay soils, exclusive of topsoil, are suitable for reuse as structural fill. Imported structural fill should consist of a granular, non-expansive, **non-free draining** material with greater than 10% passing the #200 sieve and Liquid Limit of less than 30. However, all proposed imported structural fill materials should be approved by HBET.

For spread footing foundations, the footing areas may be trenched. However, for monolithic slab foundations, the structural fill should extend across the entire building pad area to a depth of 24-inches below the turndown edges. Structural fill should extend laterally beyond the edges of the foundations a distance equal to the thickness of structural fill for both foundation types.

Prior to placement of structural fill, it is recommended that the bottom of the foundation excavation be scarified to a depth of 6 to 9 inches, moisture conditioned, and compacted to a minimum of 95% of the standard Proctor maximum dry density, within $\pm 2\%$ of the optimum moisture content as determined in accordance with ASTM D698. Structural fill should be moisture conditioned, placed in maximum 8-inch loose lifts, and compacted to a minimum of 95% of the standard Proctor maximum dry density for fine grained soils and 90% of the modified Proctor maximum dry density for coarse grained soils, within $\pm 2\%$ of the optimum moisture content as determined in accordance with ASTM D698 and D1557, respectively.

Structural fill should be extended to within 0.1-feet of the bottom of slabs-on-grade. No more than 0.1-feet of gravel should be placed below the footings or turndown edge as a leveling course.

For structural fill consisting of the native soils or imported granular materials, and foundation building pad preparation as recommended, a maximum allowable bearing capacity of 1,500 psf may be used. In addition, a modulus of subgrade reaction of 150 pci may be used for structural fill consisting of the native soils and a modulus of 200 pci may be used for suitable imported structural fill. Foundations subject to frost should be at least 24 inches below the finished grade.

Lateral Earth Pressures

Any retaining walls should be designed to resist lateral earth pressures. For backfill consisting of the native soils or imported granular, non-free draining, non-expansive material, we recommend that the walls be designed for an active equivalent fluid unit weight of 45 pcf in areas where no surcharge loads are present. An at-rest equivalent fluid unit weight of 65 pcf is recommended for braced walls. Lateral earth pressures should be increased as necessary to reflect any surcharge loading behind the walls.

Corrosion of Concrete

Water soluble sulfates are common to the soils in Western Colorado. Therefore, at a minimum, cement adequate for Sulfate Exposure Class S1 is recommended for construction at this site.

Non-Structural Floor Slab and Exterior Flatwork Recommendations

In order to limit the potential for excessive differential movements of slabs-on-grade it is recommended that non-structural floating floor slabs be constructed above a minimum of 18-inches of structural fill with subgrade preparation and fill placement in accordance with the *Foundation Recommendations* section of this report. It is recommended that exterior flatwork also be constructed above a minimum of 12-inches of structural fill.

Drainage Recommendations

Due to the presence of moisture sensitive soils and bedrock at the site, proper site grading is critical to the performance of the structure. In order to improve the long-term performance of the foundations and slabs-on-grade, grading around the structure should be designed to carry precipitation and runoff away from the structure. It is recommended that the finished ground surface drop at least twelve inches within the first ten feet away from the structure.

HBET recommends that downspout extensions be used which discharge a minimum of 15 feet from the structure or beyond the backfill zone, whichever is greater. However, if subsurface downspout drains are utilized, they should be carefully constructed of solid-wall PVC and should daylight a minimum of 15 feet from the structure. In addition, an impermeable membrane is recommended below subsurface downspout drains. Dry wells should not be used.

Excavation

Excavations in the soils at the site may stand for short periods of time but should not be considered to be stable. Trenching and excavations should be sloped back, shored, or shielded for worker protection in accordance with applicable OSHA standards. The soils generally classify as Type C soil with regard to OSHA's *Construction Standards for Excavations*. For Type C soils, the maximum allowable slope in temporary cuts is 1.5H:1V.

Less weathered shale bedrock at this site may classify as Bedrock with regard to OSHA standards. However, HBET should be contacted to evaluate the exposed bedrock during construction to determine the appropriate classification for worker safety.

General Notes

The recommendations included above are based upon the results of the subsurface investigation and on our local experience. These conclusions and recommendations are valid only for the proposed construction.

As discussed previously, only one boring was conducted at the site. Therefore, the precise nature and extent of subsurface variability may not become evident until construction. As a result, it is recommended that HBET provide construction materials testing and engineering oversight during the entire construction process.

It is important to note that the recommendations herein are intended to reduce the risk of structural movement and/or damage, to varying degrees, associated with volume change of the subsurface materials. However, HBET cannot predict long-term changes in subsurface moisture conditions and/or the precise magnitude or extent of volume change in the native soils or shale bedrock. Where significant increases in subsurface moisture occur due to poor grading, improper stormwater management, utility line failure, excess irrigation, or other cause, either during construction or the result of actions of the property owner, several inches of movement are possible. In addition, any failure to comply with the recommendations in this report releases Huddlestone-Berry Engineering & Testing, LLC of any liability with regard to the structure performance.

We are pleased to be of service to your project. Please contact us if you have any questions or comments regarding the contents of this report.

Respectfully Submitted:

Huddlestone-Berry Engineering and Testing, LLC



Michael A. Berry, P.E.
Vice President of Engineering

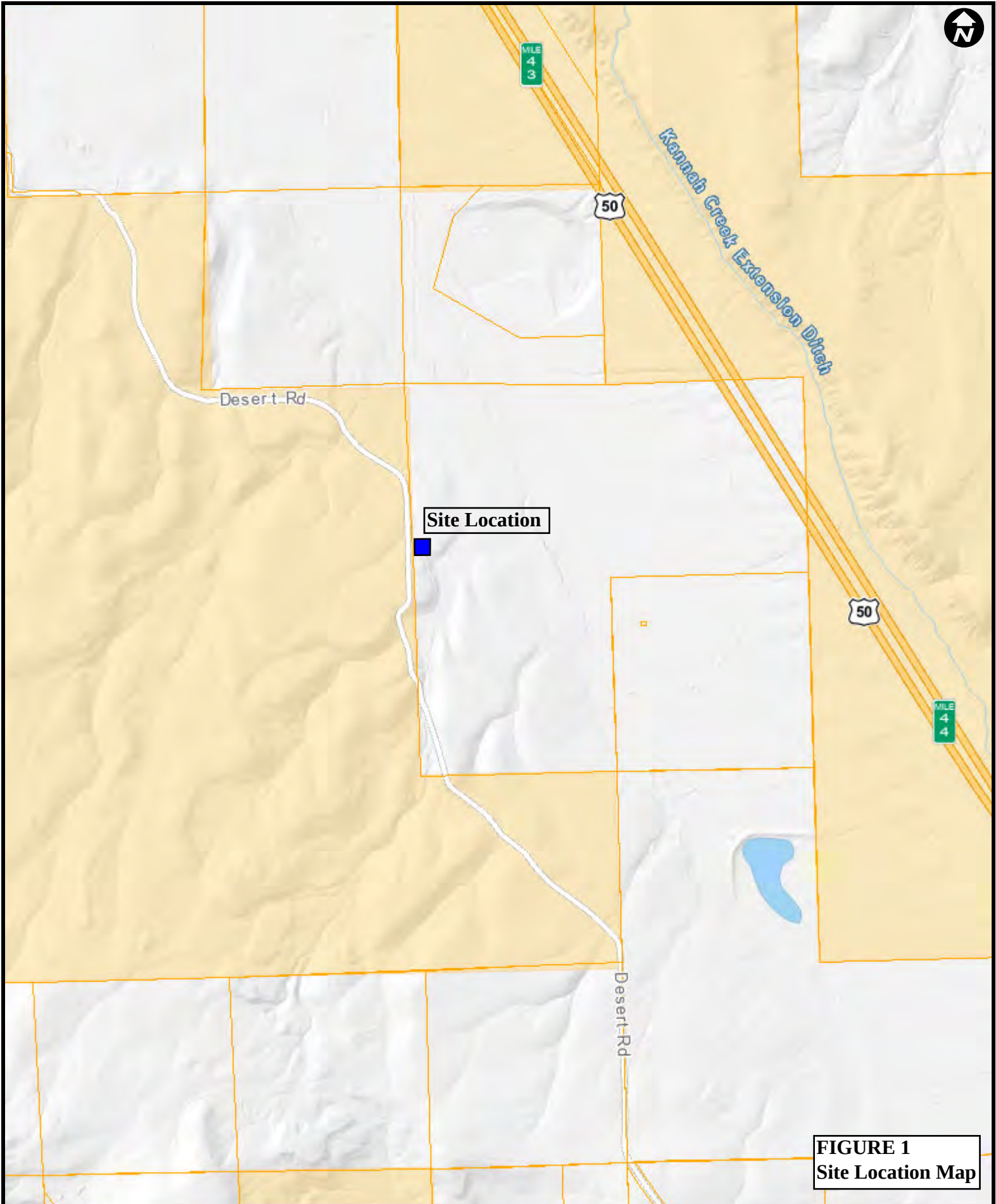
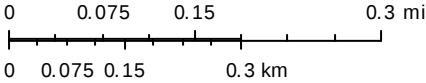


FIGURE 1
Site Location Map

Mesa County Map

The Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended or does not replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Records office or the courts. In addition, the representations of location in this GIS cannot be substitute for actual legal surveys. The information contained herein is believed accurate and suitable for the limited uses, and subject to the limitations set forth above, Mesa County makes no warranty as to the accuracy or suitability of any information contained herein. Users assume all risk and responsibility for any and all damages, including consequential damages, which may flow from the user's use of this information.

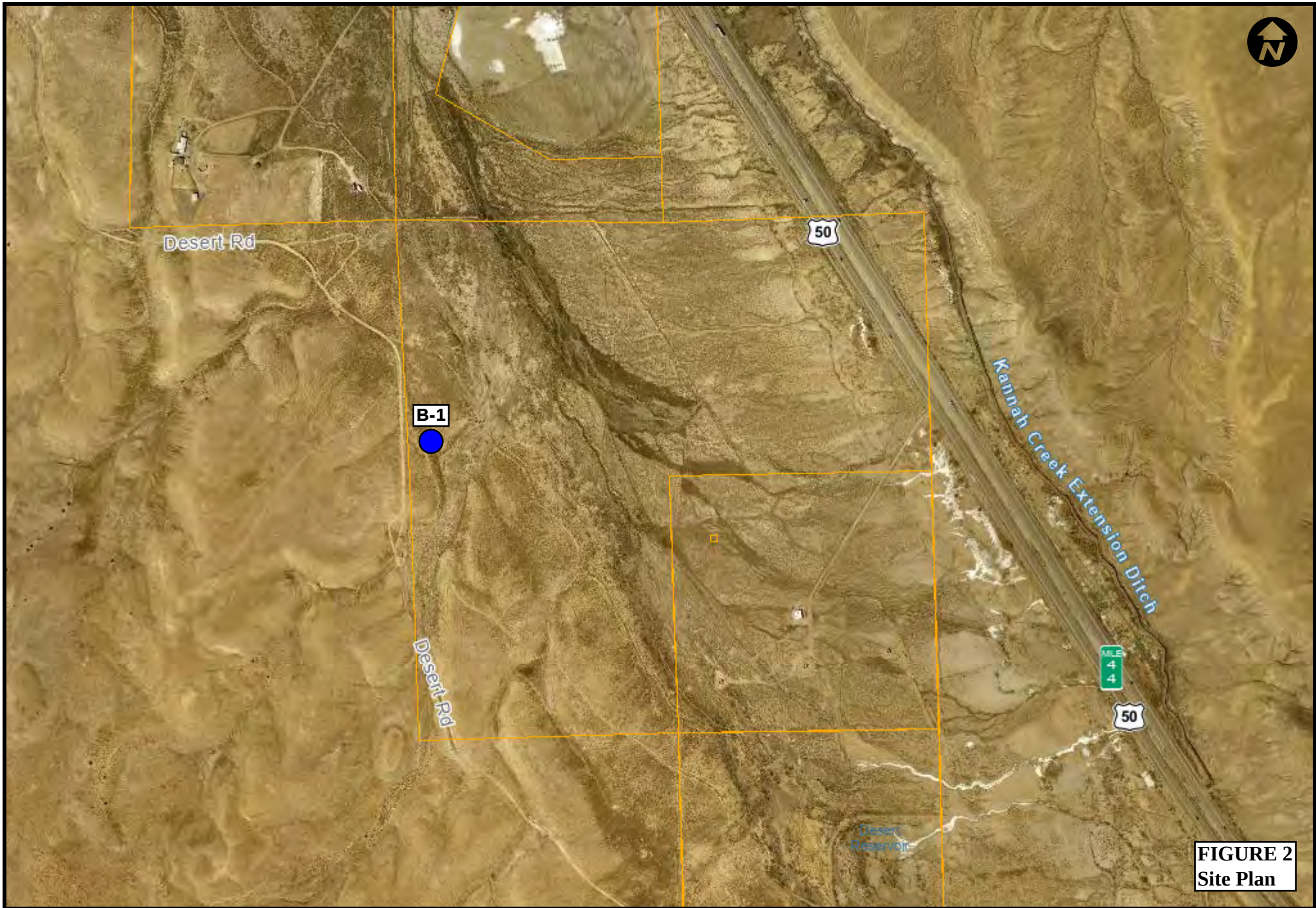


2/10/2026



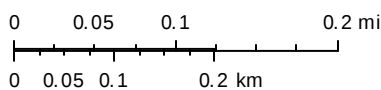
Mesa County, Colorado

GIS/IT Department
gis.mesacounty.us



Mesa County Map

The Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended or does not replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Records office or the courts. In addition, the representations of location in this GIS cannot be substitute for actual legal surveys. The information contained herein is believed accurate and suitable for the limited uses, and subject to the limitations, set forth above, Mesa County makes no warranty as to the accuracy or suitability of any information contained herein. Users assume all risk and responsibility for any and all damages, including consequential damages, which may flow from the user's use of this information.



APPENDIX A
Typed Boring Log



Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

BORING NUMBER B-1

PAGE 1 OF 1

CLIENT Clifton Water District

PROJECT NAME Desert Road Pump Station

PROJECT NUMBER 00509-0025

PROJECT LOCATION Whitewater, CO

DATE STARTED 1/20/26

COMPLETED 1/20/26

GROUND ELEVATION

HOLE SIZE 4-Inch

DRILLING CONTRACTOR S. McKracken

GROUND WATER LEVELS:

DRILLING METHOD Simco 3000 Truck

AT TIME OF DRILLING Dry

LOGGED BY TC

CHECKED BY WDA

AT END OF DRILLING Dry

NOTES

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		Sandy Lean Clay with Organics (TOPSOIL)										
		Sandy Lean CLAY with Gravel (CL), tan, moist, very stiff										
		GB-1: Lab Classified	SS 1	94	8-10-18 (28)							
5			GB 1					5	26	16	10	54
		SHALE, brown to gray, soft to medium hard, moderately weathered	SS 2	67	10-25-10 (35)				33	18	15	
10			SS 3	58	24-26							
15												
20		Bottom of hole at 20.0 feet.										

GEOTECH BH COLUMNS 00509-0025 DESERT ROAD PUMP HOUSE.GPJ GINT US LAB.GDT 2/11/26

APPENDIX B
Laboratory Testing Results



Huddlestone-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

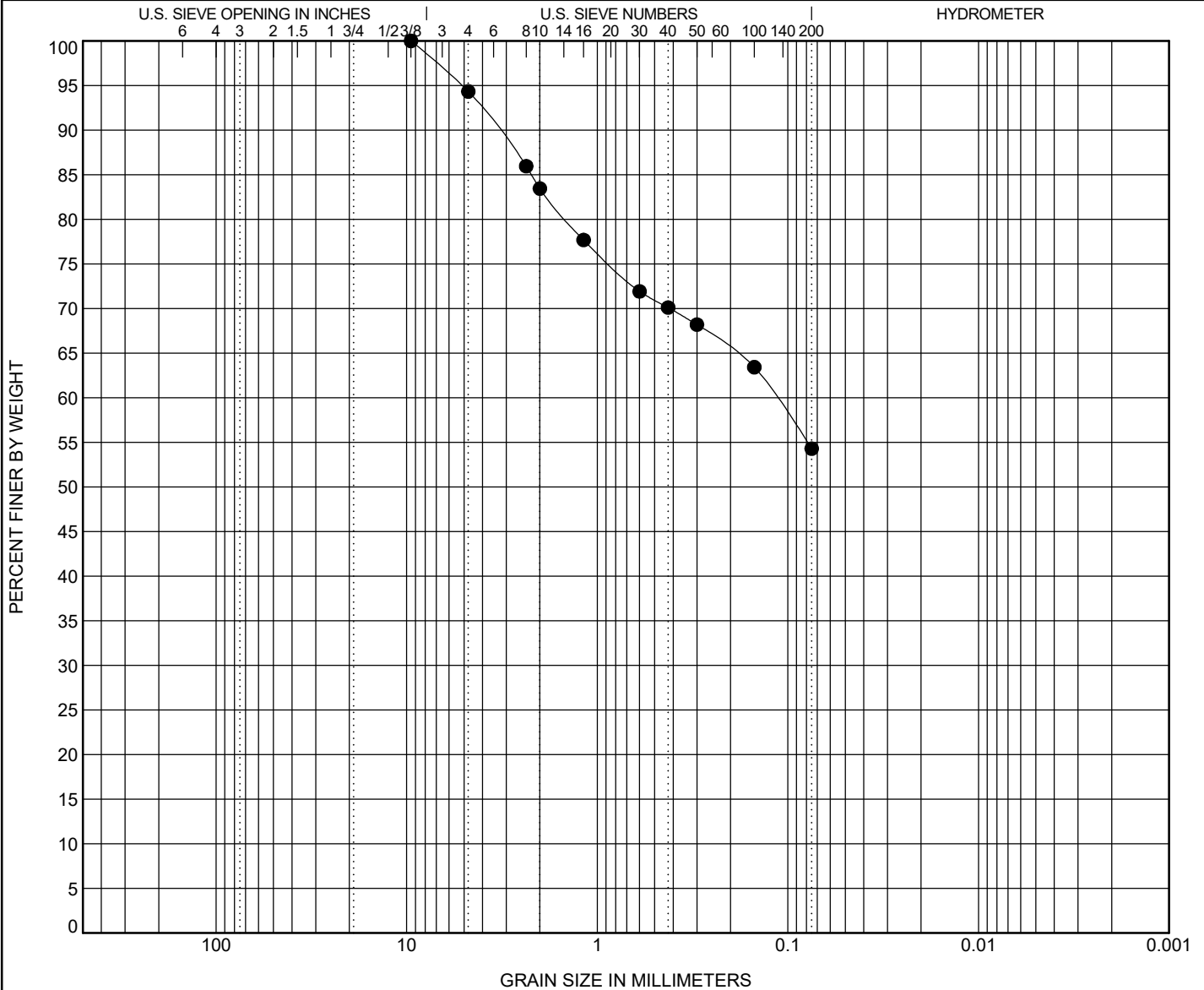
GRAIN SIZE DISTRIBUTION

CLIENT Clifton Water District

PROJECT NAME Desert Road Pump Station

PROJECT NUMBER 00509-0025

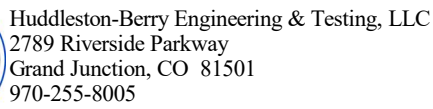
PROJECT LOCATION Whitewater, CO



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification				LL	PL	PI	Cc	Cu
●	B-1, GB1	1/26	SANDY LEAN CLAY(CL)				26	16	10		
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay
●	B-1, GB1	1/26	9.5	0.116			5.7	40.0	54.3		

GRAIN SIZE 00509-0025 DESERT ROAD PUMP HOUSE.GPJ GINT US LAB.GDT 2/11/26





Huddlestone-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

MOISTURE-DENSITY RELATIONSHIP

CLIENT Clifton Water District

PROJECT NAME Desert Road Pump Station

PROJECT NUMBER 00509-0025

PROJECT LOCATION Whitewater, CO

Sample Date: 1/20
Sample No.: 26-0036
Source of Material: B-1, GB-1
Description of Material: SANDY LEAN CLAY(CL)
Test Method (manual): ASTM D698A

TEST RESULTS

Maximum Dry Density 121.0 PCF
Optimum Water Content 12.5 %

GRADATION RESULTS (% PASSING)

#200	#4	3/4"
<u>54</u>	<u>94</u>	<u>100</u>

ATTERBERG LIMITS

LL	PL	PI
<u>26</u>	<u>16</u>	<u>10</u>

Curves of 100% Saturation
for Specific Gravity Equal to:

2.80
2.70
2.60

