



City of Jefferson, GA

Technical Specifications

Central City Water Reclamation Facility Phase 1 Improvements

Prepared By:

CEC

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**SECTION 00 11 13
ADVERTISEMENT FOR BIDS**

The City of Jefferson, Georgia (Owner) is soliciting BIDS for the construction of the following project:

CITY OF JEFFERSON, GA – CENTRAL CITY WRF PHASE 1

This project shall include the construction of the construction of the City of Jefferson Central City WRF Phase 1. Work includes upgrades to Central City 1 pump station, new influent screen with conveyor, disk filters, upgrades to the plant site pump station upgrades and all associated civil site work, structural and process mechanical improvements, erosion control, yard piping, electrical and instrumentation.

SEALED BIDS will be accepted until **11:30 a.m.** local time on **September 19, 2024** at **City Hall, City of Jefferson located at 147 Athens Street, Jefferson, Ga 30549**, then publicly opened and read aloud.

Bids must be submitted in a sealed, non-transparent envelope and clearly marked on the outside with the words, “**City of Jefferson Central City WRF Phase 1**”, along with Bidder’s name, address, phone number and contact person.

Bid Documents: All Bid Documents are available for download at <https://cecincga.com> under the 'Bid Information' tab. Upon payment of \$200.00 (non-refundable), the Contractor will be added to the Plan Holders list and eligible to submit a bid for the project. Make checks payable to Civil Engineering Consultants and mail to 4994 Lower Roswell Road, Suite 18, Marietta, GA 30068. Please include the project name, contact person, phone number, and email address. **Hard copies of the Contract Documents will not be available.**

Pre-Bid Conference: A mandatory pre-bid conference for the Project will be held on **Friday, September 6, 2024, at 11:00 am at City Hall, City of Jefferson located at 147 Athens Street, Jefferson, Ga 30549** . Bids will not be accepted from Bidders who do not attend the mandatory pre-bid conference.

Contractor Questions: All questions pertaining to the Project and Bid Documents must be submitted electronically. Questions must be submitted by September 10, 2024. All Contractor questions should be made in writing to David Gauker at david@cecincga.com.

A satisfactory Bid Bond (in the amount of 5% of the Bid), executed by the Bidder, and an acceptable surety company listed in the latest issue of U.S. Treasury Circular 570, will accompany each BID. In lieu of a Bid Bond, the City will accept a cashier's check, certified check, or cash deposit in an amount equal to at least 5% of the total contract amount. The Owner reserves the right to reject any or all Bids or to waive any informality in the bidding, to evaluate Bids, and to accept any Bid, which in his opinion, may be for his best interest.

The successful Bidder for this Contract will be required to furnish a satisfactory Performance Bond and a Labor and Material Payment Bond, with a corporate surety approved by the OWNER and listed in the latest issue of U.S. Treasury Circular 570, each in the amount of 100% of the Bid. An Irrevocable Letter of Credit from a local, Hall County bank is acceptable in lieu of Performance Bond and Labor and Material Payment Bond.

Instructions to Bidders: For all further requirements regarding Bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

**SECTION 00 21 13
INSTRUCTIONS TO BIDDERS**

BIDS will be received by the City of Jefferson, herein called the "OWNER", until 11:30 a.m., local time, on Thursday, September 19, 2024.

Each BID must be submitted in a sealed envelope, addressed to **City of Jefferson** located at **Jefferson City Hall, 147 Athens Street, Jefferson, Georgia 30549**. Each sealed envelope containing a BID must be plainly marked on the outside as **BID for the CITY OF JEFFERSON – CENTRAL CITY WRF PHASE 1** and the envelope should bear on the outside, the name of the BIDDER, his address, his license number (if applicable). If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to **City of Jefferson** located at **Jefferson City Hall, 147 Athens Street, Jefferson, Georgia 30549**.

All BIDS must be made on the required BID Form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID Form must be fully completed and executed when submitted. Only one (1) copy of the BID Form is required.

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. No BIDS will be received or accepted after the above specified date and time for the opening of BIDS, unless otherwise extended by an Addendum. BIDS submitted after the designated hour will be deemed invalid and returned unopened to the BIDDER. No BIDDER may withdraw a BID within 120 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 OWNER and the BIDDER.

A mandatory pre-bid meeting will be held at the time and location indicated in the Request for Bid. Representatives of Owner and Engineer will be present to discuss the Project. Bids will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre-bid conference to verify its participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of qualified Bidders that attended the pre-bid meeting and are eligible to submit a Bid for this Project will be posted on the designated website.

Information presented at the pre-bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

The BIDDER must meet the minimum project experience requirements stated in the Advertisement for Bids. Those requirements are as follows:

1. Minimum of three (3) projects in the last five (5) years involving similar work.
2. Proposed Project Superintendent shall have been directly involved in at least one of the above-mentioned projects.
3. To demonstrate current qualifications to perform the Work, each Bidder must submit the following with their Bid:
 - a. Section 00 41 13 – Bid Form
 - b. Section 00 43 13 – Bid Bond
 - c. Section 00 45 13 – Statement of Bidder’s Qualifications
 - d. Section 00 45 20 – Oath of Successful Bidder
 - e. Section 00 45 47 – Security and Immigration Compliance Act Certification
 - f. Section 00 45 48 – Contractor Affidavit

BIDDERS must satisfy themselves of the amount of required work and materials by a review of the plans and specifications and including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done. Any request for interpretation of Contract Documents or ADDENDA shall be made to the Engineer, in writing.

Each BID must be accompanied by a BID Bond payable to the OWNER for five percent of the total amount of the BID. As soon as the BID prices have been compared, the OWNER will return the Checks or BID Bonds of all except the three (3) lowest responsible BIDDERS. When the Agreement is executed, the Bonds of the two (2) remaining unsuccessful BIDDERS will be returned. If no Award has been made within 120 days after the opening of BIDS, the BIDDERS may request return of their Checks or BID Bonds, if they have not been notified of the acceptance of his/her or their BID. The BID Bond of the successful BIDDER will be retained until the Performance Bond has been executed and approved, after which, it will be returned. A certified check may be used in lieu of a BID Bond. The BID Bond shall be secured by a guaranty or a surety company, listed in the latest issue of U.S. Treasury Circular 570, licensed to do business in the State of Georgia.

The party to whom the Contract is Awarded will be required to execute the Agreement and obtain the Performance Bond and the Payment Bond 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 Agreement and bond forms. In case of failure of the BIDDER to execute the Agreement, the OWNER may, at his option, consider the BIDDER in default, in which case the BID BOND accompanying the bid shall become the property of the OWNER.

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

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

The OWNER reserves the right to add to and/or delete from the Contract after it has been Awarded. BIDS may be held by the OWNER for a period not to exceed ninety (90) days from the date of the opening of BIDS for the purpose of reviewing the BIDS, prior to Awarding the Contract.

A conditional or qualified BID will not be accepted.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction 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.

The specifications contained herein are intended to provide performance and material requirements for the execution and completion of this Project.

The number and trade names given for any products are taken from various manufacturer catalogs as stated and shall be construed as being descriptive only of type, style, and quality of material required. Material of other reputable manufacturers of equal quality, type and style may be acceptable only if approved by the Engineer.

The CONTRACTOR, in signing his BID on the whole or any portion of the WORK, shall conform to the following requirements:

- (a) BIDS which are not signed by individuals making them shall have attached thereto a power of attorney evidencing authority to sign the BID in the name of the person for whom it is signed.
- (b) BIDS which are signed for a partnership shall be signed by all of the partners or by an attorney-in-fact. If a BID is signed by an attorney-in-fact, there should be attached to the BID a power of attorney executed by the partners evidencing authority to sign the BID.

- (c) BIDS which are signed for a corporation shall have the correct corporate name thereof and the signature of the President or other authorized officer of the corporation manually written below the corporate name following the wording "By _____". The Corporation seal shall also be affixed to the BID and the signature shall be attested by the Secretary.

The Award of the Contract will be made to the lowest responsive, responsible BIDDER, based on the BID Form with the lowest TOTAL BID PRICE. The BIDDER to whom the Award is made will be notified at the earliest possible date. The OWNER reserves the right to reject any and all BIDS and to waive any informality in BIDS whenever such rejection or waiver is in its interest.

BIDDER must agree to commence work on or before a date to be specified in a written "NOTICE TO PROCEED" of the OWNER. The Contract Time for Substantial Completion shall be 450 consecutive calendar days. BIDDER must also agree to pay as Liquidated Damages the sum of \$500.00 dollars per day for each consecutive calendar day thereafter as hereinafter provided in the General Conditions.

Any questions should be directed to David Gauker in writing to david@cecincga.com. The last day for submission of questions shall be September 10, 2024.

END OF SECTION

**SECTION 00 41 43
BID FORM**

BID SUBMITTED BY: _____
(Typed or printed name of organization)

BID ADDRESSED TO: **City of Jefferson
Jefferson City Hall
147 Athens Street
Jefferson, Georgia 30549**

1. The undersigned BIDDER proposes and agrees, if this BID is accepted, to enter into an agreement with the OWNER in the form included in the Contract Documents to perform and furnish all WORK as specified or indicated in the contract Documents for the TOTAL BID AMOUNT and within the BID times indicated in this BID and in accordance with the other terms and conditions of the Contract Documents. The Project will be awarded based on the Lowest Responsive TOTAL BID AMOUNT.
2. BIDDER accepts all of the terms and conditions of the Advertisement for Bids and Information for Bidders, including without limitation those dealing with the disposition of the BID security. This BID will remain subject to acceptance for ninety (90) days after the day of BID opening, or for such longer period of time that BIDDER may agree to in writing upon request of the OWNER. BIDDER will sign and deliver the required number of counterparts of the Agreement with the Bonds, Certifications of Insurance, and other documents required by the Bidding Requirements within ten (10) days after the date of the OWNER’s Notice of Award.
3. In submitting this BID, BIDDER represents, as more fully set forth in the Agreement, that:
 - (a) BIDDER has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda receipt of all which is hereby acknowledged (list Addenda by Addendum Number and Date):

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

- (b) BIDDER has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance and furnishing of the WORK, and BIDDER has not relied upon any oral representations by employees or agents of OWNER or ENGINEER.

- (c) BIDDER is familiar with and is satisfied to all federal, state, and local Laws and Regulations that may affect cost, progress, performance and furnishing of the WORK.
- (d) BIDDER has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or continuous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions of the General Conditions. BIDDER acknowledges that such reports and drawings are not Contract Documents and may not be complete for BIDDER's purposes. BIDDER acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Bidding Documents with respect to Underground Facilities at or contiguous to the site.
- (e) BIDDER has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the WORK or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by BIDDER and safety precautions and programs incident thereto.
- (f) BIDDER does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this BID for performance and furnishing of the WORK in accordance with the times, price and other terms and conditions of the Contract Documents.
- (g) BIDDER is aware of the general nature of WORK to be performed by OWNER and OTHERS at the site that relates to WORK for which this BID is submitted as indicated in the Contract documents.
- (h) BIDDER has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- (i) BIDDER has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that BIDDER has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to BIDDER, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the WORK for which this BID is submitted.
- (j) This BID is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, associates, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other BIDDER to submit a false or sham BID; BIDDER has not

solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other BIDDER or over OWNER.

4. UNIT PRICES have been computed in accordance with the General Conditions. All specific cash allowances are included in the price(s) and have been computed in accordance with the General Conditions.

BIDDER acknowledges that quantities are not guaranteed and are solely for the purpose of comparison of BIDS, and final payment for all Unit Price BID items will be based on actual quantities provided, determined as provided in the Contract Documents.

5. BIDDER declares that he understands that the quantities shown on the bid are subject to adjustment by either increase or decrease, and that should the quantities of any of the items or WORK be increased, the undersigned proposes to do the additional work at the Unit Prices stated herein; and should the quantities be decreased, BIDDER also understands that payment will be made on actual quantities at the Unit Price bid and will make no claim for anticipated profits for any decrease in the quantities and that actual quantities will be determined upon completion of WORK, at which time adjustment will be made to the Contract Amount by direct increase or decrease.
6. BIDDER will complete the WORK in accordance with the Contract Documents for the prices listed in the following Bid Schedule.

CITY OF JEFFERSON – CENTRAL CITY WRF PHASE 1 IMPROVEMENTS

BID SCHEDULE

All bid items shall include all costs for furnishing all labor, materials, equipment, supplies, allowances, and all other costs, including permit fees, taxes, insurance, miscellaneous costs, overhead, and profit incurred for the Work complete in place and ready for continuous service.

The Bids shall be shown in both words and figures. In case of a discrepancy, the amount shown in words shall govern. In the event of a discrepancy between the unit price bid and the extension, the unit price will be deemed intended by the bidder and the extensions adjusted. In the event of a discrepancy between the sum of the extended amounts and the bid total, the sum of the extended amounts shall govern.

LUMP SUM BID(s): Bidder will complete the Work in accordance with the Contract Documents for the following lump sum prices, together with Allowances and Unit Prices.

PART 1 - BASE BID: CITY OF JEFFERSON, GA – CENTRAL CITY WRF PHASE 1					
<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Qty.</u>	<u>Unit Price(figures)</u>	<u>Total Unit Price (figures)</u>
1a.	General Construction of the Central City WRF Phase 1 Improvements per Contract Documents including all work shown on the Drawings, excluding Parts 2 and Part 3 of this Bid Form.	LS	1	\$ _____	\$ _____
Total Price Part 1 – Item (1a):					
\$ _____ (figures)					
Total Price Part 1 – Cost in Words:					
\$ _____					
_____ (words)					

PART 2 - ALLOWANCE COSTS

The Bidder shall include in the Total Bid price the lump sum allowances identified below. Payment will be in accordance with the General Conditions. Any unused balance of the allowances shall revert to the Owner upon completion of the project. Contractor is not entitled to overhead and profit on any unused balance.

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Approx. Qty.</u>	<u>Unit Price</u>	<u>Total Price</u>
1.	Allowance for correction of unforeseen utility conflicts and utility relocation	LS	1	\$ <u>50,000.00</u>	\$ <u>50,000.00</u>
2.	Owner Contingency	LS	1	\$ <u>300,000.00</u>	\$ <u>300,000.00</u>
3.	Spare Parts	LS	1	\$ <u>20,000.00</u>	\$ <u>20,000.00</u>
4.	Metal Canopy Allowance	LS	1	\$ <u>125,000.00</u>	\$ <u>125,000.00</u>
Total Price Part 2 – Items (1-4):					\$ 495,000.00

Total Price Part 2 – Cost in Words:

PART 3- UNIT PRICE BIDS

Bidder will provide the following Work at the indicated installed unit prices.

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Approx. Qty.</u>	<u>Unit Price</u>	<u>Total Price</u>
1.	Stone Stabilization	Tons	10	\$ _____	\$ _____
2.	Silt Fence Type Sd1-S (with or without mulch)	LF	6200	\$ _____	\$ _____
3.	Inlet Protection Type Sd2-F	EA	2	\$ _____	\$ _____
4.	Stone Check Dam	EA	3	\$ _____	\$ _____
5.	Slope Stabilization	LS	1	\$ _____	\$ _____
6.	Silt Fence Removal	LF	6200	\$ _____	\$ _____
7.	Construction Exits	EA	2	\$ _____	\$ _____

8. Permanent Grassing	AC	2.5	\$ _____	\$ _____
9. Relining of Stone Drainage Ditch	LS	1	\$ _____	\$ _____
10. Erosion Control Monitoring	LS	1	\$ _____	\$ _____
11. Concrete Wash Out	EA	3	\$ _____	\$ _____
12. Gravel Road Repair & Replacement	SY	350	\$ _____	\$ _____
13. Asphalt Milling & Replacement	SY	350	\$ _____	\$ _____

Total Price Part 3 – Items (1 - 13, inclusive): \$ _____

Total Price Part 3 – Cost in Words: _____

The amount of Total Price for Part 3 shall be shown in both figures and words. In case of a discrepancy, the amount shown in words shall govern. In the event of a discrepancy between the Unit Price bid and the extension, the Unit Price will be deemed intended by the Bidder and the extension adjusted. In the event of a discrepancy between the sum of the extended amounts and the Bid total, the sum of the extended amounts shall govern.

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PART 4- BID SUMMARY

All work shown and specified in the Contract Documents

Description	Amount in Figures
Part 1 - Base Bid	\$ _____
Part 2 - Allowance Items	\$ <u>495,000.00</u>
Part 3 – Unit Pricing	\$ _____
Total Bid Amount	\$ _____

Total Bid Amount in Words: (Parts 1+2+3) _____

In case of a discrepancy, the amount shown in words shall govern. In the event of a discrepancy between the sum of the extended amounts and the bid total, the sum of the extended amounts shall govern.

- BIDDER agrees that the WORK will be Substantially Completed within 450 consecutive calendar days, from the date when the Contract Time commences to run as provided in the General Conditions or 30 days after delivery of all materials and major equipment and will be completed and ready for final payment in accordance with the General Conditions.***

BIDDER accepts the provisions of the Agreement as to Liquidated Damages in the event of failure to complete the WORK within the time(s) specified in the Agreement.

- The following documents are attached and made a condition of this BID:
 - Required Bid Security in the form of Bid Bond, Certified Check, or Cashier’s Check. *(Strikeout inapplicable terms.)*
 - BIDDERS who submit Bid Security in the form of a Certified Check or Cashier’s Check are bound by the “Terms of Bid Bond” as if submitted on the attached “Bid Bond” form. The address of BIDDER is indicated below.

BIDDER'S NAME: _____

Primary Contact Person: _____

Secondary Contact Person: _____

Bidder's Street Address: _____

Bidder's Mailing Address (if different from above): _____

Bidder's Telephone Number: _____

Bidder's Fax Number: _____

3. Terms used in this BID which are defined in the General Conditions will have the meanings indicated in the General Conditions.

THIS BID SUBMITTED on _____, 20__.

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____

(Signature)

Title: _____

Attest: _____

(CORPORATE SEAL)

(Signature)

Business Address: _____

Telephone Number: _____

Fax Number: _____

Date of Qualification to do business is: _____

PART 5–BASE BID MAJOR EQUIPMENT SCHEDULE

The Base Bid shall include the costs for the circled Manufacturers/Suppliers listed in this Major Equipment Schedule, exclusive of any Alternate Bid Items. Should a Bidder fail to indicate which manufacturer or supplier its Bid is based on, or circle more than one listed manufacturer/supplier per equipment item, the Bidder shall provide the first listed manufacturer/supplier (A) for its Bid for the amount included in the Total Bid at no increase in the Contract amount. The Contractor shall submit working drawings in accordance with the General Conditions for any modifications to the Contract Drawings required due to the submittal of the base bid manufacturers/suppliers. The Bidder is aware that the Owner will award the Contract without consideration of Alternate manufacturers/suppliers.

The Major Equipment Schedule lists the base bid equipment manufacturer/supplier as applicable for major equipment items and key suppliers for the Project. The Bidder must indicate which named manufacturer/supplier it intends to provide by circling one of the manufacturers/suppliers listed.

Specification Section	Equipment Description	Manufacturer/Supplier
40 05 59	Aluminum Stop Gates	A. Whipps B. Rodney Hunt
40 71 69	Parshall Flume	A. Tracom B. Warminster
43 25 00	Submersible Wastewater Pumps	A. Flygt B. Homa
46 21 13	Mechanical Fine Screen	A. Vulcan B. Infilco
46 61 41	Disk Filters	A. Aqua Aerobics

PART 6– MAJOR EQUIPMENT MANUFACTURERS SUBSTITUTION

Any Manufacturer, including those not listed as an acceptable manufacturer, may be listed as a substitution.

The Bidder understands that **after a Contract is awarded**, the Owner may, at its sole discretion, select items of any Manufacturer listed in the following substitute tabulation. If awarded the Contract, the Bidder agrees to furnish and install any substitutions for the price indicated. The BID will be adjusted accordingly.

The Engineer may require detailed information to be submitted for preliminary evaluation of a substitute Manufacturer. This information could include technical and performance details of the equipment and other information deemed necessary by the Engineer and/or described in the Contract Documents.

If an offered substitution included items of equipment of any Manufacturer that may require any modification to or deviation from the Drawings, the undersigned agrees to prepare and submit detailed Drawings to the Engineer showing all modifications to structures, piping, electrical, mechanical, and instrumentation work, required to adapt the plans to the equipment selected. The Bidder further understands that the Engineer will review said detailed drawings of modifications and either approve them or indicate changes necessary to comply with the project requirements. Detailed drawings that are not approved will be revised and resubmitted to the Engineer for approval. If the Engineer determines that the substitute equipment cannot be approved, the original Base Bid equipment shall be provided. The prices listed in the following tabulation are “installed” prices and take into consideration any changes that may be required to the original design.

The Bidder may wish to include an Additive or Deductive alternate for the screening equipment or disk filters, or other Major Piece of Equipment specified in these specifications listed below. Payment will be in accordance with the General Conditions.

However, the BID will be evaluated on the items included in the Bid Summary Part 4.

Specification Section	List Equipment Vendor	Circle to Indicate Additive or Deductive	Add or (Deduct) Price From Base Bid (in words)
46 61 41 Disk Filter	Beacon Water Technologies	Add Deduct	\$
		Add Deduct	\$
		Add Deduct	\$

All BID Items shall include all costs for furnishing all labor, materials, equipment, supplies, allowances, and all other costs including permit fees, taxes, insurance, miscellaneous costs, overhead and profit incurred for the WORK, complete in place and ready for continuous service.

**SECTION 00 43 13
BID BOND**

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

_____ as PRINCIPAL, and

_____ as SURETY, are held and firmly bound unto

City of Jefferson, Georgia, hereinafter called the "Local Public Agency", in the penal sum of

_____ Dollars,

(\$ _____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that Whereas the Principal has submitted the

Accompanying Bid, dated _____, 20__ for the construction of

**CITY OF JEFFERSON, GA – CENTRAL CITY WRF
PHASE 1**

NOW, THEREFORE, if the Principal shall not withdraw said Bid within the period specified therein after the opening of the same, or, if no period be specified, within thirty (30) days after the said opening and shall within the period specified therefore, or if no period be specified, within ten (10) days after the prescribed forms are presented to him for signature, enter into a written Contract with the Local Public Agency in accordance with the Bid as accepted, and give bond with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such Contract, or in the event of the withdrawal of said Bid within the period specified, or the failure to enter into such Contract and give such bond within the time specified, if the Principal shall pay the Local Public Agency the difference between the amount specified in said Bid and the amount for which the Local Public Agency may procure the required work or supplies or both, if the latter be in excess of the former, than the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, 20__, the name and corporate seal of each corporate party being hereto affixed, and these presents signed by its undersigned representative, pursuant to authority of its governing body.

In presence of:

_____ (SEAL)
(Individual Principal)

(Address, Zip Code)

_____ (SEAL)
(Partnership)

(Address, Zip Code)

By: _____

(Corporate Principal)

(Address, Zip Code)

By: _____

(Affix Corporate Seal)

(Corporate Surety)

By: _____

(Affix Corporate Seal)

Countersigned by:

_____ State of _____
Attorney-in-Fact, State of

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the _____, Secretary of the Corporation named as Principal in the within bond; that _____, who signed the said bond on behalf of the Principal was then _____ of said corporation; that I know his signature, and his signature thereto is genuine; and that said bond was duly signed, sealed, and attested to for and in behalf of said corporation by authority of this governing body.

_____ (Corp.)
_____ (Seal)
Title _____

**SECTION 00 45 13
STATEMENT OF BIDDER’S QUALIFICATIONS**

All questions must be answered, and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information desired. Attach all additional sheets to this statement. (Sample “Project Information Form” contained at the end of this Section.)

1. Name of Bidder: _____
2. Permanent main office address and phone number: _____
3. When organized: _____
4. How many years have you been engaged in the contracting business under your present firm or trade name: _____
5. Contracts on hand (list major contracts, total number, and dollar value) _____

6. Have you ever failed to complete any work awarded to you? If so, where, and why?

7. Have you ever defaulted on a contract? If so, where, and why? _____

8. Attach a list of the most important projects recently completed by your company which are similar in scope to this Project. (Complete a “Project Information Form” attached, for each Project listed.) See the Advertisement for Bid and the Instructions to Bidders for required minimum project experience.
9. List your major equipment available for this Contract. _____

10. Background and experience of the Principal members of your organization, including

- officers. Attach resume(s)
11. Background and experience of the Project Manager who will be assigned to this Project. Attach resume.
 12. Background and experience of the Superintendent who will be assigned to this Project. Attach resume.
 13. Any history of litigation, arbitration, or other related mediation actions for the proposed Project Manager, Project Superintendent, or referenced Projects? _____

 14. The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the Owner in verification of the recitals comprising this Statement of Bidder's Qualifications.

I certify that I am _____ of the Bidder, and that the answers to the foregoing questions and statements contained therein are true and correct.

BIDDER: _____

By: _____

(name signed)

(name printed or typed)

Title: _____

Date: _____

Subscribed and sworn to me this ___ day of _____, 20 ___.

NOTARY PUBLIC: _____

(name signed)

(name printed or typed)

Commission Expires: _____

(Date)

(SEAL)

PROJECT INFORMATION FORM
(Attach Copies for Three (3) Projects)

Project Title: _____

Project Description: _____

Project Owner:

1. Owner Name: _____

2. Address: _____

3. Contact Person: _____

4. Phone Number: _____

Contractor Project Manager:

1. Company Name: _____

2. Contractor Project Manager: _____

3. Phone Number: _____

Contract Amount:

1. Initial: _____

2. Final: _____

3. Reason if Different: _____

Contract Time

1. Initial: _____

2. Final: _____

3. Completion Date: _____

4. Reason if Different: _____

**SECTION 00 45 20
CONTRACTOR AFFIDAVIT AND
OATH OF SUCCESSFUL BIDDER**

Personally appeared before me, the undersigned officer, duly authorized to administer oaths,
_____, (insert name), who, after being duly sworn, deposes as follows:

I, _____, (insert name), am a competent adult, and I have personal knowledge of the facts set forth in this Affidavit and Oath which I make for any lawful use or purpose.

I, _____ (insert name) swear or affirm that I have not prevented or attempted to prevent competition in bidding or submitting a bid for this Project by any means whatsoever. I swear or affirm that I have not prevented or endeavored to prevent anyone from making a Bid for this Project by any means whatsoever, I swear I have not caused or induced any other person to withdraw a Bid for this Project. I swear or affirm that I have not violated O.C.G.A. §36-91-21(d) in any way, directly or indirectly.

We, the undersigned, to the best of our knowledge, affirm that no other officers, agents, or other persons acted for or represented the Contractor in the bidding for and procurement of this Contract.

I hereby declare under penalty of perjury that the foregoing is true and correct. Executed on _____, 202_ in _____ (city), _____ (state).

By: _____

Signature

Print Name of Affiant

Print Title of Affiant

Subscribed and sworn before me on this the _____ day of _____, 202_.

NOTARY PUBLIC

My Commission Expires:

**SECTION 00 45 47
SECURITY AND IMMIGRATION**

Pursuant to the Georgia Security and Immigration Compliance Act of 2006, Contractor understands and agrees that compliance with the requirements of OCGA 13-10-91 and Georgia Department of Labor Rule 300-10-1 et. seq. are conditions of Agreement. Contractor further agrees that such compliance shall be attested through execution of Contractor Affidavit and Agreement required by Georgia Department of Labor Rule 300-10-1-.07, or a substantially similar contractor affidavit. Contractor’s fully executed affidavit is attached and is incorporated into this Agreement by reference herein.

By initialing in the appropriate line below, Contractor certifies that the following employee number category as identified in OCGA 13-10-91 is applicable to Contractor:

- 1. _____ 500 or more employees.
- 2. _____ 100 or more employees.
- 3. _____ Fewer than 100 employees.

Contractor understands and agrees that, in the event Contractor employs or contracts with Subcontractor in connection with this Agreement, Contractor shall:

- 1. Secure from each Subcontractor an indication of the employee-number category as identified in OCGA 13-10-91; and
- 2. Secure from each Subcontractor an attestation of Subcontractor’s compliance with OCGA 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02 by causing each Subcontractor to execute the attached Subcontractor Affidavit required by Georgia Department of Labor Rule 300-10-1-.08, or a substantially similar subcontractor affidavit. Contractor further understands and agrees that Contractor shall require the executed Subcontractor Affidavit to become a part of the agreement between Contractor and each Subcontractor. Contractor agrees to maintain records of each Subcontractor attestation required hereunder for inspection by Owner.

BY: Authorized Officer or Agent

Date

Title of Authorized Officer or Agent if Contractor

Printed Name of Authorized Officer or Agent

Subscribed and Sworn Before Me on this
_____ day of _____, 20____

Notary Public
My Commission Expires: _____

**SECTION 00 45 48
CONTRACTOR AFFIDAVIT**

By executing this affidavit, the undersigned Contractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm, or corporation which is engaged in the physical performance of services on behalf of the _____ (Public Employer) has registered with, is authorized to use, and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned Contractor will continue to use the federal work authorization program throughout the contract period, and the undersigned contractor will contract for the physical performance of services in satisfaction of such contract only with Subcontractors who present an affidavit to the Contractor with the information required by O.C.G.A. § 13-10-91(b). Contractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

Federal Work Authorization Number
(EEV / E-Verify User Identification Number)

Date of Authorization

Name of Contractor

Name of Project

Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.
Executed on _____, 20__ in _____ (City), _____ (State).

Signature of Authorized Officer or Agent

Printed Name and Title of Authorized Officer or Agent

Subscribed and sworn before me on this the _____ day of _____, 20__.

Notary Public

My Commission Expires: _____ [NOTARY SEAL]

**SECTION 00 45 49
SUBCONTRACTOR AFFIDAVIT**

By executing this affidavit, the undersigned Subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm, or corporation which is engaged in the physical performance of services on behalf of the _____ (Public Employer) has registered with, is authorized to use, and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned Subcontractor will continue to use the federal work authorization program throughout the contract period and the undersigned Subcontractor will contract for the physical performance of services in satisfaction of such contract only with sub-subcontractors who present an affidavit to the contractor with the information required by O.C.G.A. § 13-10-91(b). Subcontractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

Federal Work Authorization Number
(EEV / E-Verify User Identification Number)

Date of Authorization

Name of Subcontractor:

Name of Contractor

Name of Project

Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.
Executed on _____, 20__ in _____ (City), _____ (State).

Signature of Authorized Officer or Agent

Printed Name and Title of Authorized Officer or Agent

Subscribed and sworn before me on this the _____ day of _____, 20__.

Notary Public

My Commission Expires:

**CITY OF JEFFERSON – CENTRAL CITY WRF
PHASE 1 IMPROVEMENTS**

06/06/2024

[NOTARY SEAL]

**SECTION 00 51 00
NOTICE OF AWARD**

DATE OF ISSUANCE: _____
OWNER: CITY OF JEFFERSON, GEORGIA
ENGINEER: CIVIL ENGINEERING CONSULTANTS, INC.

PROJECT: CENTRAL CITY WRF PHASE 1 IMPROVEMENTS
CONTRACTOR: _____
CONTRACTOR'S ADDRESS: _____

DESCRIPTION OF WORK: CENTRAL CITY WRF PHASE 1 IMPROVEMENTS

The OWNER has considered the BID submitted by you for the above described. Work includes upgrades to Central City 1 pump station, new influent screen with conveyor, disk filters, upgrades to the plant site pump station and all associated civil site work, structural and process mechanical improvements, erosion control, yard piping, electrical and instrumentation.

You are hereby notified that the Owner has accepted your BID for items in the amount of \$XXXXXXXXX.

You are required, by the General Information for Contractor, to execute the Agreement and certificates of insurance within ten (10) days from the date of this Notice to you.

If you fail to execute said Agreement within ten (10) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

OWNER: CITY OF JEFFERSON, GEORGIA
BY (signature): _____
NAME (printed): Priscilla Murphy
TITLE: City Manager

**CITY OF JEFFERSON – CENTRAL CITY WRF
PHASE 1 IMPROVEMENTS**

06/06/2024

ACCEPTANCE OF NOTICE: Receipt of the above NOTICE OF AWARD is hereby acknowledged by

CONTRACTOR: _____

BY *(signature)*: _____

NAME *(printed)*: _____

TITLE: _____

DATE: _____

PHASE 1 IMPROVEMENTS

SECTION 00 52 13
STANDARD FORM OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR
ON THE BASIS OF STIPULATED PRICE

This Agreement dated _____ is by and between the **City of Jefferson** and **CONTRACTOR NAME** (“Contractor”).

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **CITY OF JEFFERSON, GA – CENTRAL CITY WRF PHASE 1 IMPROVEMENTS**

1.02 The Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

The project shall include furnishing all materials, labor, equipment, and any appurtenances as necessary for completion of the work described within the plans and specifications.

ARTICLE 2—ENGINEER

2.01 The Owner has retained **CIVIL ENGINEERING CONSULTANTS, INC.** (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

2.02 The part of the Project that pertains to the Work has been designed by Engineer, and that same entity prepared the design.

ARTICLE 3—CONTRACT TIMES

3.01 *Time is of the Essence*

A. All time limits for Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

3.02 *Contract Times: Dates*

A. Notice to Proceed Date shall be _____.

B. The Work will be substantially completed on or before _____.

3.03 *Contract Times: Days*

A. The Work will be substantially completed within **450 consecutive calendar days** from the date when the Contract Time commences to run as provided in paragraph 4.01 of the General Conditions or 30 days after delivery of all materials and major equipment. Work will be finally completed within 60 consecutive calendar days after substantial completion.

PHASE 1 IMPROVEMENTS3.04 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 3.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. *Substantial Completion*: Contractor shall pay Owner Five Hundred Dollars \$500 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.
 2. *Completion of Remaining Work*: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$500 for each day that expires after such time until the Work is completed and ready for final payment.
 3. Liquidated damages for failing to timely attain Substantial Completion, and final completion are not additive, and will not be imposed concurrently.
- B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 4—CONTRACT PRICE

- 4.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:
- A. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).
The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

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CITY OF JEFFERSON, GA – CENTRAL CITY WRF PHASE 1 IMPROVEMENTS

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Approx. Qty.</u>	<u>Unit Price</u>	<u>Total Price</u>
1.				\$ _____	\$ _____
2.				\$ _____	\$ _____
3.				\$ _____	\$ _____
4.				\$ _____	\$ _____
5.				\$ _____	\$ _____
6.				\$ _____	\$ _____
7.				\$ _____	\$ _____
8.				\$ _____	\$ _____
9.				\$ _____	\$ _____
10.				\$ _____	\$ _____

- B. Total of Unit Price Work (subject to final Unit Price adjustment) is \$ **(Enter Total Amount)**.
- C. According to paragraph 13.02 of the General Conditions, all allowances are included in the abovementioned Lump Sum price.
 - 1. Contractor's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum and not in the allowances.
 - 2. The Contractor shall cause work covered by these allowances to be performed for such amounts and by such persons as the Owner/Engineer may direct, but he will not be required to employ persons against whom he makes a reasonable objection. If the cost, when determined and approved by the Owner/Engineer, exceeds, or falls below the allowance, the Contract Sum shall be adjusted accordingly through a Change Order. The contractor is not entitled to overhead, profit, or mark-up on unutilized allowance funds. The amount of the Change Order shall reflect the difference between actual costs and the allowances.

ARTICLE 5—PAYMENT PROCEDURES

5.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

PHASE 1 IMPROVEMENTS

5.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 1st day of each month during performance of the Work as provided in Paragraph 5.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. **90%** of the value of the Work completed (with the balance being retainage).
If 50% or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. **100%** of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **95%** of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **such amounts as Engineer shall determine** as the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

5.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

ARTICLE 6—CONTRACT DOCUMENTS6.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
 - a. Performance bond (together with power of attorney).
 - b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.

PHASE 1 IMPROVEMENTS

5. Specifications (not attached but incorporated by reference) consisting of [#] sections with each sheet bearing the following general title: CITY OF JEFFERSON – CENTRAL CITY WRF Phase 1 Improvements
 6. Drawings (not attached but incorporated by reference) consisting of [#] sheets with each sheet bearing the following general title: JEFFERSON CENTRAL CITY WRF UPGRADE PHASE 1.
 7. Addenda: Addendum No. # dated _____.
 8. Appendices to this Agreement (enumerated as follows): Appendix A, Appendix B, Appendix C.
 9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
- B. The Contract Documents listed in Paragraph 6.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 6.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 7—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

7.01 Contractor's Representations

- A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
 2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

PHASE 1 IMPROVEMENTS

4. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
5. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
6. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
7. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
8. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
9. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

7.02 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 7.02:
 1. "Corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the Proposal process or in the Contract execution.
 2. "Fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the Proposal process or the execution of the Contract to the detriment of Owner, (b) to establish Proposal or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.
 3. "Collusive practice" means a scheme or arrangement between two or more Proposers, with or without the knowledge of Owner, a purpose of which is to establish Proposal prices at artificial, non-competitive levels.

PHASE 1 IMPROVEMENTS

- 4. “Coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the Proposal process or affect the execution of the Contract.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on Month Day, Year, (which is the Effective Date of the Contract).

OWNER:

CONTRACTOR:

(typed or printed name of organization)

(typed or printed name of organization)

By: _____
(individual’s signature)

By: _____
(individual’s signature)

Date: _____
(date signed)

Date: _____
(date signed)

Name: _____
(typed or printed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

(If Type of Entity is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual’s signature)

Attest: _____
(individual’s signature)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

Address for giving notices:

Designated Representative:

Designated Representative:

Name: _____
(typed or printed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

Address: _____

Address: _____

Phone: _____

Phone: _____

Email: _____

Email: _____

License No.: _____
(where applicable)

State: _____

**SECTION 00 55 00
NOTICE TO PROCEED**

OWNER: CITY OF JEFFERSON, GEORGIA

ENGINEER: CIVIL ENGINEERING CONSULTANTS, INC.

CONTRACTOR: _____

PROJECT: CENTRAL CITY WRF PHASE 1 IMPROVEMENTS

**EFFECTIVE DATE
OF CONTRACT:** _____

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on _____ pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The number of days to achieve Substantial Completion is **450** days from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of , **DATE** .

Owner: CITY OF JEFFERSON, GEORGIA

By *(signature)*: _____

Name *(printed)*: Priscilla Murphy

Title: City Manager

Date Issued: _____

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

Contractor: _____

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Date Issued: _____

Bond No. _____

**SECTION 00 61 14
PERFORMANCE BOND**

KNOW ALL PERSONS BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

A Corporation hereafter called (Corporation, Partnership or Individual) PRINCIPAL and

(Name of Surety)

hereinafter called SURETY, are held, and firmly bound unto the City of Jefferson located at 147 Athens Street, Jefferson, Ga 30549 herein after called OWNER in the total aggregate penal sum of _____ (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain Contract with the OWNER, dated the ____ day of _____, 2024, a copy of which is hereto attached and made a part hereof for the construction of the **CITY OF JEFFERSON, GEORGIA – CENTRAL CITY WRF PHASE 1 IMPROVEMENTS.**

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 OWNER, with or without notice to the SURETY and during the one year guaranty period and if the PRINCIPAL shall satisfy all claims and demands incurred under such Contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER 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 to WORK to be performed there under or the SPECIFICATIONS accompanying same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time,

**CITY OF JEFFERSON – CENTRAL CITY WRF
PHASE 1 IMPROVEMENTS**

06/06/2024

alteration or addition to the terms of the Contract or to the WORK or to the SPECIFICATIONS. PROVIDED, FURTHER, that it is expressly agreed that the BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the CONTRACT as so amended. The term "Amendment", wherever used in this BOND, and whether referring to this BOND, the Contract or the Loan Documents shall include any alteration, addition, extension, or modification of any character whatsoever.

PROVIDED, FURTHER, that no final settlement between the OWNER and the PRINCIPAL shall abridge the right of the other beneficiary hereunder, whose claim may be unsatisfied. The OWNER is the only beneficiary hereunder.

WITNESS WHEREOF, this instrument is executed in Three (3) counterparts, each of which shall be deemed an original.

Signed and sealed this _____ day of _____, 20__.

Contractor as Principal

Surety

(Full formal name and address of Contractor)

(Full formal name and address of Surety) (corporate seal)

By:

By:

(Signature)

(Signature)(Attach Power of Attorney)

Name:

Name:

(Printed or typed)

(Printed or typed)

Title:

Title:

Attest:

Attest:

(Signature)

(Signature)

Name:

Name:

(Printed or typed)

(Printed or typed)

Title:

Title:

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is partnership, all partners should execute BOND.

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

Bond No. _____

**SECTION 00 61 15
PAYMENT BOND**

KNOW ALL PERSONS BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

A Corporation hereinafter called (Corporation, Partnership or Individual) PRINCIPAL and

(Name of Surety)

hereinafter called SURETY, are held and firmly bound unto the City of Jefferson located at 147 Athens Street, Jefferson, Ga 30549 herein after called OWNER in the total aggregate penal sum of _____ (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain Contract with the OWNER, dated the ___ day of _____, 20___, a copy of which is hereto attached and made a part hereof for the construction of the **CITY OF JEFFERSON – CENTRAL CITY WRF PHASE 1 IMPROVEMENTS**.

NOW, THEREFORE, if the PRINCIPAL shall promptly make payment to all persons, firms, and corporations furnishing materials for or performing all labor in the prosecution of the WORK provided for in such Contract, and any authorized extensions or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and for all labor cost incurred in such WORK including that by a SUBCONTRACTOR, and to any mechanic or materialman lienholder whether it acquires its lien by operation of State or Federal law; then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, that beneficiaries or claimants hereunder shall be limited to the SUBCONTRACTORS, and persons, firms, and corporations having a direct contract with the PRINCIPAL or its SUBCONTRACTORS.

PROVIDED, FURTHER, that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL, shall have given written notice to any two of the following: The PRINCIPAL, the OWNER, or the SURETY above named within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the PRINCIPAL, OWNER, or SURETY, at any place where an office is regularly maintained for the transaction of business or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer. (b) After the expiration of one (1) year following the date of which PRINCIPAL ceased work on said CONTRACT, is being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

PROVIDED, FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract no increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract or the loan Documents shall include any alteration, addition, extension, or modification of any character whatsoever.

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

WITNESS WHEREOF, this instrument is executed in Three (3) counterparts, each of which shall be deemed an original.

Signed and Sealed this _____ day of _____, 20__.

Contractor as Principal

Surety

(Full formal name and address of Contractor)

(Full formal name and address of Surety) (corporate seal)

By:

By:

(Signature)

(Signature)(Attach Power of Attorney)

Name:

Name:

(Printed or typed)

(Printed or typed)

Title:

Title:

Attest:

Attest:

(Signature)

(Signature)

Name:

Name:

(Printed or typed)

(Printed or typed)

Title:

Title:

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is partnership, all partners should execute BOND.

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

**SECTION 00 62 15
CERTIFICATE OF OWNER'S ATTORNEY**

I, the undersigned, _____, the duly authorized and acting legal representative of the _____ City of Jefferson _____, (the “City”) do hereby certify as follows:

I have examined the attached Contract Documents and the manner of execution thereof by the City, and I am of the opinion that each of the aforesaid agreements are adequate and have been duly executed by the proper parties on behalf of the City; that said representative(s) has full power and authority to execute said agreements on behalf of the City, and that the foregoing agreements constitute valid and legally binding obligations upon the City in accordance with terms, conditions, and provisions thereof.

By: _____

Date: _____

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

SECTION 00 62 76
APPLICATION FOR PAYMENT

Prepared By



Endorsed By



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1420 King Street, Alexandria, VA 22314-2794
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American Council of Engineering Companies
1015 15th Street N.W., Washington, DC 20005
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GUIDELINES FOR THE INTENDED USE OF EJCDC C-620, APPLICATION FOR PAYMENT

1.0 PURPOSE AND INTENDED USE OF THE DOCUMENT

The Application for Payment is used to facilitate periodic progress payments to the Contractor for Work completed and for stored materials and equipment (referred to in this document as "Stored Materials").

For additional information regarding the Application for Payment, see EJCDC® C-700, Standard General Conditions of the Construction Contract (2018), Paragraph 15.01, and EJCDC® C-001, Commentary on the 2018 EJCDC Construction Documents (2018).

2.0 APPLICATION FOR PAYMENT OVERVIEW

This document was prepared in Microsoft Excel due to the number of calculations involved in the preparation of the Application for Payment. The application consists of a Summary worksheet, and 3 supporting worksheets: Lump Sum worksheet, Unit Price worksheet, and Stored Materials worksheet.

- 2.1 *Summary Worksheet* — calculates the amount to be paid to the Contractor at the end of each Application for Payment period. This calculation imports numbers from the supporting worksheets to determine the value of the Work completed and Stored Materials, calculate retainage, and deduct amounts previously paid to determine the amount the Contractor should be paid for the current application period. Application periods are typically one month; however these periods may be extended when Contractor's efforts do not result in the billable completion of Work or storage of materials and equipment during the payment period.

- 2.2 *Lump Sum Worksheet* — calculates the total value for completed Work for which compensation is paid on a Lump Sum basis. The schedule of values included in this worksheet reflects a breakdown of lump sum Work items to which Contractor and Engineer have agreed, pursuant to Article 2 of the General Conditions. Costs for Stored Materials associated with lump sum items are included on this worksheet to calculate the total value for completed lump sum Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for materials currently stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.

- 2.3 *Unit Price Worksheet* — calculates the total value for completed Work for which compensation is paid on a Unit Price basis. The schedule of values included in this spreadsheet is typically a tabulation of Unit Price items from the Agreement. Costs for Stored Materials associated with unit price items are included in this worksheet to calculate the total value for completed Unit Price Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for Materials Currently Stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.

2.4 *Stored Materials Worksheet* — calculates the total value for materials and equipment that have been purchased and are being stored until they are incorporated into the Work. This worksheet adds materials and equipment to the worksheet as they are brought to the site and stored; such Stored Materials are then deducted from the Stored Materials worksheet total as they are incorporated into the Work, providing a running net value for the materials and equipment remaining in storage. The values of Stored Materials must be manually added to the Lump Sum or Unit Price line items. These do not automatically update when changes are made. The amount of materials remaining in storage is eligible for payment but must be tracked separately from Work completed since different retainage rates may apply to Work completed and Stored Materials.

3.0 Instructions for filling out the Payment Application form

3.1 Project-specific information is to be entered in the top portion (header) of the Summary worksheet. This same information will automatically be copied to the other worksheets to complete the headers on all other worksheets.

3.2 Outside of the header, data can be entered in non-shaded cells when the sheet is protected. Cells shaded light blue contain equations that will automatically transfer data from other cells or make calculations to complete the worksheet. Altering any of these cells can result in errors in the Application for Payment. It is recommended that the worksheets be protected at all times unless alterations are deliberately being made to the Application for Payment form other than to enter data. See Paragraph 4.0 below for information on Protection of Worksheets.

3.3 Enter information regarding each item in the Lump Sum and/or Unit Price worksheets. For Lump Sum projects, each item should represent an item in the schedule of values prepared by the Contractor and approved by the Engineer/Owner, breaking down the Lump Sum amount into measurable components. For Unit Price contracts, use numbers from the Agreement as the schedule of values. Specific information on the data to be entered into each column may be seen by clicking on the header description for that column. Similar comments may be seen for cells in the "Totals" row that indicates how the number is calculated and where this number is exported to another part of the spreadsheet. See the Commentary for additional information.

3.4 The equations in the Summary worksheet use numbers imported from both the Lump Sum and Unit Price worksheets. Projects will typically either use the Lump Sum or the Unit Price worksheet, but some projects may use both. If one of the worksheets is not used, it should be hidden and not deleted. If it is deleted, Users will need to correct the equations in the Summary worksheet by unprotecting the worksheet and editing the equations. To hide a worksheet, right click on the worksheet tab at the bottom of the worksheet and select "Hide." To unhide a worksheet, right click on any worksheet tab and select "Unhide," and then select the worksheet to unhide and click "Okay." This same process may be used to hide these Guidelines for Use.

4.0 Protection of Worksheets

- 4.1 The cells in this Workbook that create the forms or contain equations have been coded to "lock" the cells that should not be altered. It is recommended that the Workbook be Protected (cells locked) at all times unless it is necessary to add or delete rows. Directions for adding and deleting rows are provided in the next section. Passwords can be used to lock the Protect / Unprotect settings on spreadsheets, however the worksheets in this workbook do not require a password.
- 4.2 To unprotect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Unprotect Sheet." To protect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Protect Sheet." This will open a dialog box in which the User is allowed to select protection options. It is recommended that only the top two checkboxes for "Select Locked Cells" and "Select Unlocked Cells" be checked. This will reset the protection for the Worksheet.

5.0 Adding and Deleting Rows

- 5.1 A limited number of blank rows are provided in the Lump Sum, Unit Price, and Stored Material worksheets. Additional rows may be added to these worksheets by the User. The first step in this process is to unprotect the worksheet as previously discussed. After the sheet is unprotected, move with caution to prevent inadvertently deleting any cells that contain equations. To insert a row, right click in the row heading at the left of the spreadsheet and select "Insert." A new row will be inserted at the location where the cursor was placed in the row heading. If more than one new row is desired, left click and drag the cursor to include the desired number of rows, right click in the selected row headings and then select "Insert." It is important that the line immediately above the "Totals" row not be included in the rows selected. Doing so will require that equations in the "Totals" row be adjusted. When rows are inserted, Excel automatically adjusts the equations to include the new rows, unless the row directly above the "Totals" row is also selected.
- 5.2 After new rows are inserted, it is important to copy a line from one of the original rows so correct formatting and equations are copied into each new row. To do this, select the row to be copied by clicking the cell in Column A and dragging the cursor to the last column in the table. Then select "Copy" from the menu or type CTRL+C to copy the cells. Excel will show that this row has been copied by showing a moving dashed line around the cells that are to be copied. Then select the new rows into which the information is to be copied as before and select Paste from the menu or type CTRL+V.
- 5.3 To delete an unused row, right click in the row heading on the left of the spreadsheet for the row to be deleted and select "Delete." The selected row will be deleted. If more than one row is to be deleted, left click and drag the cursor to the desired number of rows to be deleted and then right click to open the menu and select "Delete." Unlike the admonition on adding new rows, it is okay to delete the row just above the "Totals" row.
- 5.4 After rows have been added or deleted, it is important reset the worksheet protection.

6.0 Saving Files

This file is provided as a Microsoft[®] Excel Open XML workbook template (.xltx) to prevent this file from being inadvertently changed. When an application for payment is created for a specific project it should be saved as an Excel workbook (.xlsx) file. To do this, select Save As (F12), type in a new file name and select Excel Workbook (.xlsx) from the drop down Save As Type menu.

7.0 License Agreement

This document is subject to the terms and conditions of the License Agreement, 2018 EJCDC[®] Construction Series Documents. A copy of the License Agreement was furnished at the time of purchase of this document, and is available for review at www.ejcdc.org and the websites of EJCDC's sponsoring organizations.

Contractor's Application for Payment

Owner: _____	Owner's Project No.: _____
Engineer: _____	Engineer's Project No.: _____
Contractor: _____	Contractor's Project No.: _____
Project: _____	
Contract: _____	
Application No.: _____	Application Date: _____
Application Period: From _____ to _____	

1. Original Contract Price	\$	-
2. Net change by Change Orders	\$	-
3. Current Contract Price (Line 1 + Line 2)	\$	-
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)	\$	-
5. Retainage		
a. _____ X \$ - Work Completed	\$	-
b. _____ X \$ - Stored Materials	\$	-
c. Total Retainage (Line 5.a + Line 5.b)	\$	-
6. Amount eligible to date (Line 4 - Line 5.c)	\$	-
7. Less previous payments (Line 6 from prior application)		
8. Amount due this application	\$	-
9. Balance to finish, including retainage (Line 3 - Line 4)	\$	-

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

Recommended by Engineer	Approved by Owner
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____
Approved by Funding Agency	
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____

Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: _____
 Engineer: _____
 Contractor: _____
 Project: _____
 Contract: _____

Owner's Project No.: _____
 Engineer's Project No.: _____
 Contractor's Project No.: _____

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I	J	K	L		
Bid Item No.	Description	Contract Information				Work Completed		Materials Currently Stored (not in G) (\$)	Work Completed and Materials Stored to Date (H + I) (\$)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) (\$)		
		Item Quantity	Units	Unit Price (\$)	Value of Bid Item (C X E) (\$)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) (\$)						
Original Contract													
					-		-		-		-		
					-		-		-		-		
					-		-		-		-		
					-		-		-		-		
					-		-		-		-		
					-		-		-		-		
					-		-		-		-		
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					-		-		-		-		
					-		-		-		-		
					-		-		-		-		
Original Contract Totals					\$	-		\$	-	\$	-	\$	-

SECTION 00 63 63
CHANGE ORDER FORM

OWNER: CITY OF JEFFERSON, GA

ENGINEER: CIVIL ENGINEERING CONSULTANTS, INC.

CONTRACTOR: _____

PROJECT: CENTRAL CITY WRF – PHASE 1 IMPROVEMENTS

ORIGINAL AGREEMENT DATE: _____

ORIGINAL CONTRACT AMOUNT: _____

CHANGE ORDER DATE: _____

_____ is hereby directed to comply with the following additions and deductions to the above referenced Contract Plans and Specifications.

1.	<u>Additions / Deductions:</u>	Brief Description	
	Itemized Detail		\$ _____
	Itemized Detail		\$ _____
	Itemized Detail		\$ _____
	Subtotal Additions / Deductions:		\$ _____
2.	<u>Additions / Deductions:</u>	Brief Description	
	Itemized Detail		\$ _____
	Itemized Detail		\$ _____
	Itemized Detail		\$ _____
	Subtotal Additions / Deductions:		\$ _____
	TOTAL CHANGE ORDER NO. ___		\$ _____

The **Contract Amount** shall be **increased / decreased** by \$ _____, from \$ _____ to \$ _____. The **completion date** is **changed / unchanged**.

This Document will become a supplement to the Contract Documents and all provisions will apply hereto.

Requested By: OWNER
CITY OF JEFFERSON, GA

EMPLOYEE NAME: _____ Date: _____
EMPLOYEE POSITION: _____

Recommended By: ENGINEER
CIVIL ENGINEERING CONSULTANTS, INC.

Andrew E. Lovejoy, P.E. Date: _____
President

Accepted By: CONTRACTOR
CONTRACTOR COMPANY NAME

Contractor Contact Name Date: _____
Title

**SECTION 00 65 20
FINAL LIEN WAIVER**

TO: CITY OF JEFFERSON, GEORGIA

FROM: _____ (Contractor)

Re: Agreement between the City of Jefferson, Georgia and _____
(Contractor) dated _____, _____ for construction of the Central City WRF Phase 1 Improvements.

I hereby certify that all suppliers of materials, equipment and services, subcontractors, mechanics and laborers employed by _____ (contractor) or any of its subcontractors have been paid and satisfied in full as of _____, that there are no outstanding obligations or claims of any kind for the payment of which the City of Jefferson, Georgia on the above-named project might be liable, or subject to, in any lawful proceeding at law or in equity.

The undersigned is authorized by the contractor to execute this document on contractor's behalf and has personal knowledge of the facts herein stated.

By: Authorized Officer or Agent

Date

Title of Authorized Officer or Agent

Printed Name of Authorized Officer or Agent

Subscribed and sworn before me on this
_____ day of _____, _____

Notary Public
My Commission Expires: _____

**SECTION 00 72 00
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ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

- A. Wherever used in the Bid Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. Addenda—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bid Requirements or the proposed Contract Documents.
 2. Agreement—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. Application for Payment—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. Bid—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. Bidder—An individual or entity that submits a Bid to Owner.
 6. Bid Documents—The Bid Requirements, the proposed Contract Documents, and all Addenda.
 7. Bid Requirements—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. Change Order—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. Change Proposal—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. Claim
 - a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

- b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer’s decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.
 - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
 - d. A demand for money or services by a third party is not a Claim.
- 11. Constituent of Concern—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
 - 12. Contract—The entire and integrated written contract between Owner and Contractor concerning the Work.
 - 13. Contract Documents—Those items so designated in the Agreement, and which together comprise the Contract.
 - 14. Contract Price—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
 - 15. Contract Times—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
 - 16. Contractor—The individual or entity with which Owner has contracted for performance of the Work.
 - 17. Cost of the Work—See Paragraph 13.01 for definition.
 - 18. Drawings—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
 - 19. Effective Date of the Contract—The date, indicated in the Agreement, on which the Contract becomes effective.
 - 20. Electronic Document—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
 - 21. Electronic Means—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.
 - 22. Engineer—The individual or entity named as such in the Agreement.
 - 23. Field Order—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. Hazardous Environmental Condition—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
 - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
 - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
 - c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
25. Laws and Regulations; Laws or Regulations—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. Liens—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
27. Milestone—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.
28. Notice of Award—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
29. Notice to Proceed—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
30. Owner—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
31. Progress Schedule—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor’s plan to accomplish the Work within the Contract Times.
32. Project—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
33. Resident Project Representative—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.
34. Samples—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
35. Schedule of Submittals—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals.
36. Schedule of Values—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.

37. Shop Drawings—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
38. Site—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.
39. Specifications—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
40. Subcontractor—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
41. Submittal—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. Substantial Completion—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion of such Work.
43. Successful Bidder—The Bidder to which the Owner makes an award of contract.
44. Supplementary Conditions—The part of the Contract that amends or supplements these General Conditions.
45. Supplier—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
46. Technical Data
 - a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
 - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements

of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

- c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. Underground Facilities—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. Unit Price Work—Work to be paid for on the basis of unit prices.

49. Work—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. Work Change Directive—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bid Requirements or Contract Documents, have the indicated meaning.
- B. Intent of Certain Terms or Adjectives: The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. Day: The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

- D. Defective: The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
1. does not conform to the Contract Documents.
 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).
- E. Furnish, Install, Perform, Provide
1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- F. Contract Price or Contract Times: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.
- G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 Delivery of Performance and Payment Bonds; Evidence of Insurance

- A. Performance and Payment Bonds: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. Evidence of Contractor’s Insurance: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. Evidence of Owner’s Insurance: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies

to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 Copies of Documents

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 Before Starting Construction

- A. Preliminary Schedules: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract.
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 Preconstruction Conference; Designation of Authorized Representatives

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 Acceptance of Schedules

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.
4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 Electronic Transmittals

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 Intent

- A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.
- F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- G. Nothing in the Contract Documents creates:
 1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
 2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 Reference Standards

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies

1. Contractor's Verification of Figures and Field Measurements: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
2. Contractor's Review of Contract Documents: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

- b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Requirements of the Contract Documents

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs) or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer’s written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 Reuse of Documents

- A. Contractor and its Subcontractors and Suppliers shall not:
 - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner’s express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

- A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 Starting the Work

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 Reference Points

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 Progress Schedule

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 Delays in Contractor's Progress

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 - 1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes.
 - 2. Abnormal weather conditions.
 - 3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.
- D. Contractor’s entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
1. Contractor’s entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
 2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
 3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:
1. The circumstances that form the basis for the requested adjustment.
 2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work.
 3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work.
 4. The number of days’ increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
 5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.
- Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.
- F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 Availability of Lands

- A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and

Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 Use of Site and Other Areas

A. Limitation on Use of Site and Other Areas

- 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

- 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. Removal of Debris During Performance of the Work: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

- C. Cleaning: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

- D. Loading of Structures: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 Subsurface and Physical Conditions

- A. Reports and Drawings: The Supplementary Conditions identify:
 - 1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.
 - 2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
 - 3. Technical Data contained in such reports and drawings.
- B. Underground Facilities: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.
- C. Reliance by Contractor on Technical Data: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.
- D. Limitations of Other Data and Documents: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 - 1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto.
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings.
 - 3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner’s archival documents concerning the Site; or
 - 4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 Differing Subsurface or Physical Conditions

- A. Notice by Contractor: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:
 - 1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate.
 - 2. is of such a nature as to require a change in the Drawings or Specifications.
 - 3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. **Engineer's Review:** After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. **Owner's Statement to Contractor Regarding Site Condition:** After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. **Early Resumption of Work:** If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. **Possible Price and Times Adjustments**
 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work, subject, however, to the following:
 - a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A.
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise.
 - b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bid Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice required by Paragraph 5.04.A.
 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.
- F. Underground Facilities; Hazardous Environmental Conditions: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 Underground Facilities

- A. Contractor's Responsibilities: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following is included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site.
 2. complying with applicable state and local utility damage prevention Laws and Regulations.
 3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction.
 4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 5. the safety and protection of all existing Underground Facilities at the Site and repairing any damage thereto resulting from the Work.
- B. Notice by Contractor: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except

in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. Engineer's Review: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings or was not shown or indicated with reasonable accuracy.
2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary, issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question.
3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and
4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. Owner's Statement to Contractor Regarding Underground Facility: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. Early Resumption of Work: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. Possible Price and Times Adjustments

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work, subject, however, to the following:
 - a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03.
 - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
 - c. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's

issuance of the Owner’s written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor’s remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 Hazardous Environmental Conditions at Site

- A. Reports and Drawings: The Supplementary Conditions identify:
 1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
 2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 3. Technical Data contained in such reports and drawings.
- B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto.
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly

thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition and impose a set-off against payments to account for the associated costs.

- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.
- H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants,

and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bid Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
- E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
- F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
- H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 Insurance—General Provisions

- A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.
- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
- F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party’s full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party’s obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner’s option, may purchase and maintain Owner’s own liability insurance. Owner’s liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner’s liability policies for any of Contractor’s obligations to the Owner, Engineer, or third parties.
- H. Contractor shall require:
 1. Subcontractors to purchase and maintain worker’s compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor’s liability policies) on each Subcontractor’s commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.
- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.
- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 Contractor's Insurance

- A. Required Insurance: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. General Provisions: The policies of insurance required by this Paragraph 6.03 as supplemented must:
 1. include at least the specific coverages required.
 2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater.
 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract.
 4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and
 5. include all necessary endorsements to support the stated requirements.

- C. Additional Insureds: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions.
 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds.
 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);
 4. not seek contribution from insurance maintained by the additional insured; and
 5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 Builder's Risk and Other Property Insurance

- A. Builder's Risk: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.
- B. Property Insurance for Facilities of Owner Where Work Will Occur: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.
- C. Property Insurance for Substantially Complete Facilities: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- D. Partial Occupancy or Use by Owner: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.
- E. Insurance of Other Property; Additional Insurance: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 Property Losses; Subrogation

- A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.
 - 1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
 - 2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.
 - 1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.
- C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 Receipt and Application of Property Insurance Proceeds

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such

named insured shall act as fiduciary for the other insureds and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 Contractor's Means and Methods of Construction

- A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 Supervision and Superintendence

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 Labor; Working Hours

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.
- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will

be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner’s written consent, which will not be unreasonably withheld.

7.04 Services, Materials, and Equipment

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 “Or Equals”

- A. Contractor’s Request; Governing Criteria: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or equal” item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an “or equal” item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
 - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics.
 - 2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole.
 - 3) has a proven record of performance and availability of responsive service; and
 - 4) is not objectionable to Owner.

- b. Contractor certifies that if the proposed item is approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. Contractor's Expense: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. Engineer's Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. Effect of Engineer's Determination: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding and may not be reversed through an appeal under any provision of the Contract.
- E. Treatment as a Substitution Request: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 Substitutes

- A. Contractor's Request; Governing Criteria: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.
 - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
 - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
 - a. will certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design.
 - 2) be similar in substance to the item specified; and
 - 3) be suited to the same use as the item specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times.

- 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
- c. will identify:
- 1) all variations of the proposed substitute item from the item specified; and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
- d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. Engineer's Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. Reimbursement of Engineer's Cost: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. Contractor's Expense: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. Effect of Engineer's Determination: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 Concerning Subcontractors and Suppliers

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.
- B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

- C. Subsequent to the submittal of Contractor’s Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bid process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.
- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner’s requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.
- M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 Patent Fees and Royalties

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 Permits

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 Taxes

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

7.11 Laws and Regulations

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees,

agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

- C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 Record Documents

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 Safety and Protection

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.
- B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work.
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
- H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 Hazard Communication Programs

- A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 Emergencies

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 Submittals

A. Shop Drawing and Sample Requirements

1. Before submitting a Shop Drawing or Sample, Contractor shall:
 - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.
 - b. determine and verify:
 - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal.
 - 2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
 - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.
3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. Submittal Procedures for Shop Drawings and Samples: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. Shop Drawings

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. Samples

- a. Contractor shall submit the number of Samples required in the Specifications.
- b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. Engineer's Review of Shop Drawings and Samples

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.
3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.
5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.
6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.
8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. Resubmittal Procedures for Shop Drawings and Samples

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.
2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-

off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

- E. Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs
 - 1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
 - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
 - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
 - c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.
 - d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance and resubmit an acceptable document.
 - 2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.
- F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 Contractor's General Warranty and Guarantee

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.
- B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
 - 1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective: and
 - 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.
- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 - 1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 - 2. normal wear and tear under normal usage.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with

the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer.
 2. Recommendation by Engineer or payment by Owner of any progress or final payment.
 3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner.
 4. Use or occupancy of the Work or any part thereof by Owner.
 5. Any review and approval of a Shop Drawing or Sample submittal.
 6. The issuance of a notice of acceptability by Engineer.
 7. The end of the correction period established in Paragraph 15.08.
 8. Any inspection, test, or approval by others; or
 9. Any correction of defective Work by Owner.
- E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 Indemnification

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 Delegation of Professional Design Services

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.
- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
 - 1. Checking for conformance with the requirements of this Paragraph 7.19.
 - 2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
 - 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 Other Work

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work.

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Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 Coordination

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors.
 - 2. An itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. The extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 Legal Relationships

- A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
 2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 Communications to Contractor

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 Replacement of Engineer

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 Furnish Data

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 Pay When Due

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 Lands and Easements; Reports, Tests, and Drawings

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

- C. Article 5 refers to Owner’s identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 Insurance

- A. Owner’s responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 Change Orders

- A. Owner’s responsibilities with respect to Change Orders are set forth in Article 11.

9.08 Inspections, Tests, and Approvals

- A. Owner’s responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 Limitations on Owner’s Responsibilities

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.

9.10 Undisclosed Hazardous Environmental Condition

- A. Owner’s responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 Evidence of Financial Arrangements

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner’s obligations under the Contract (including obligations under proposed changes in the Work).

9.12 Safety Programs

- A. While at the Site, Owner’s employees and representatives shall comply with the specific applicable requirements of Contractor’s safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER’S STATUS DURING CONSTRUCTION

10.01 Owner’s Representative

- A. Engineer will be Owner’s representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner’s representative during construction are set forth in the Contract.

10.02 Visits to Site

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor’s executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents.

Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 Resident Project Representative

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 Engineer's Authority

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer's authority as to design drawings, calculations, specifications, certifications, and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer's authority as to changes in the Work is set forth in Article 11.
- E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 Determinations for Unit Price Work

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 Decisions on Requirements of Contract Documents and Acceptability of Work

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 Limitations on Engineer’s Authority and Responsibilities

- A. Neither Engineer’s authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer’s review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 Compliance with Safety Program

- A. While at the Site, Engineer’s employees and representatives will comply with the specific applicable requirements of Owner’s and Contractor’s safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 Amending and Supplementing the Contract

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer’s recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive.

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off.
 3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and
 4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 Work Change Directives

- A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.
- B. If Owner has issued a Work Change Directive and:
1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 Field Orders

- A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 Owner-Authorized Changes in the Work

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set

forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

- B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price, or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 Unauthorized Changes in the Work

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 Change of Contract Price

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 - 1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03).
 - 2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
 - 3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).
- C. Contractor's Fee: When applicable, the Contractor's fee for overhead and profit will be determined as follows:
 - 1. A mutually acceptable fixed fee; or
 - 2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent.
 - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent.
 - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under

Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

- d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C.
- e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
- f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 Change of Contract Times

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 Change Proposal

- A. Purpose and Content: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.
- B. Change Proposal Procedures
 - 1. Submittal: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. Supporting Data: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.
 - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
 - b. Change Proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. Engineer's Initial Review: Engineer will advise Owner regarding the Change Proposal and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
 4. Engineer's Full Review and Action on the Change Proposal: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 5. Binding Decision: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- C. Resolution of Certain Change Proposals: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. Post-Completion: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 Notification to Surety

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 Claims

- A. Claims Process: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:
 - 1. Appeals by Owner or Contractor of Engineer’s decisions regarding Change Proposals.
 - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents.
 - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
 - 4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- B. Submittal of Claim: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor’s knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. Review and Resolution: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.
- D. Mediation
 - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
 - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.
 - 3. Owner and Contractor shall each pay one-half of the mediator’s fees and costs.
- E. Partial Approval: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. Denial of Claim: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter

to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

- G. Final and Binding Results: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 Cost of the Work

- A. Purposes for Determination of Cost of the Work: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. Costs Included: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.
 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts,

rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.
5. Other costs consisting of the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.
 - c. Construction Equipment Rental
 - 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
 - 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
 - 3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.
 - g. The cost of utilities, fuel, and sanitary facilities at the Site.
 - h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
 - i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.
- C. Costs Excluded: The term Cost of the Work does not include any of the following items:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
 - 2. The cost of purchasing, renting, or furnishing small tools and hand tools.
 - 3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
 - 4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
 - 5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
 - 6. Expenses incurred in preparing and advancing Claims.
 - 7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. Contractor's Fee

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
 - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
 - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
 - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
 - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.
2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. Documentation and Audit: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. Cash Allowances: Contractor agrees that:
 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.
- C. Owner's Contingency Allowance: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the

unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.
- E. Adjustments in Unit Price
 - 1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
 - 2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
 - 3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 Access to Work

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 Tests, Inspections, and Approvals

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except those costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner.
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work.
 - 3. by manufacturers of equipment furnished under the Contract Documents.
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

- A. Contractor's Obligation: It is Contractor's obligation to assure that the Work is not defective.
- B. Engineer's Authority: Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. Notice of Defects: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. Correction, or Removal and Replacement: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. Preservation of Warranties: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. Costs and Damages: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental

authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 Acceptance of Defective Work

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 Uncovering Work

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 Owner May Stop the Work

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not

give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 Owner May Correct Defective Work

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses, and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

- A. Basis for Progress Payments: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. Applications for Payments
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
 - 2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials

and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. Review of Applications

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information, and belief:
 - a. the Work has progressed to the point indicated.
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work.
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto.
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work.
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

- e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement.
 - b. the Contract Price has been reduced by Change Orders.
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07 or has accepted defective Work pursuant to Paragraph 14.04.
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. Reductions in Payment by Owner

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement.
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site.
 - c. Contractor has failed to provide and maintain required bonds or insurance.
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible.
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities.
 - f. The Work is defective, requiring correction or replacement.
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07 or has accepted defective Work pursuant to Paragraph 14.04.
 - h. The Contract Price has been reduced by Change Orders.

- i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause.
 - j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work.
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or
 - l. Other items entitle Owner to a set-off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 Substantial Completion

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 Partial Use or Occupancy

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.
 - 2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 Final Inspection

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 Final Payment

A. Application for Payment

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents.
 - b. consent of the surety, if any, to final payment.
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects or will so pass upon final payment.
 - d. a list of all duly pending Change Proposals and Claims; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. Engineer's Review of Final Application and Recommendation of Payment: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Notice of Acceptability: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. Completion of Work: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

- E. Final Payment Becomes Due: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 Waiver of Claims

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim or appealed under the provisions of Article 17.

15.08 Correction Period

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such adjacent areas.
 - 2. correct such defective Work.
 - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.
- D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so, provided in the Specifications.

- E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 Owner May Suspend Work

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 Owner May Terminate for Cause

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents.
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not

limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 Owner May Terminate for Convenience

- A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work.
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost bid.
- B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 Contractor May Stop Work or Terminate

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise

for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 Methods and Procedures

- A. Disputes Subject to Final Resolution: The following disputed matters are subject to final resolution under the provisions of this article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and
 - 2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.
- B. Final Resolution of Disputes: For any dispute subject to resolution under this article, Owner or Contractor may:
 - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions.
 - 2. agree with the other party to submit the dispute to another dispute resolution process; or
 - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 Giving Notice

- A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
 - 1. in person, by a commercial courier service or otherwise, to the recipient's place of business.
 - 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
 - 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 Computation of Times

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 Cumulative Remedies

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 Limitation of Damages

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 No Waiver

- A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 Survival of Obligations

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 Controlling Law

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 Assignment of Contract

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 Successors and Assigns

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 Headings

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

END OF SECTION

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**SECTION 00 73 00
SUPPLEMENTARY CONDITIONS**

PART 1 GENERAL

1.1 SUPPLEMENTARY CONDITIONS

- A. The provisions of the Supplementary Conditions as described herein change, amend, or supplement the General Conditions and shall supersede any conflicting provisions of this CONTRACT. All provisions of the General Conditions which are not changed, amended, or supplemented, remain in full force.

1.2 INSURANCE

- A. The CONTRACTOR shall purchase and maintain such insurance as will protect it from claims set forth below which may arise out of, or result from, the CONTRACTOR's execution of the WORK, whether such execution be by the CONTRACTOR, any SUBCONTRACTOR, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:
1. Claims under workmen's compensation, disability benefit and other similar employee benefit acts.
 2. Claims for damages because of bodily injury, occupational sickness or disease, or death of employees.
 3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than employees.
 4. Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) by any other person; and
 5. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting there from.
- B. Evidence of Contractor's Insurance: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- C. Evidence of Owner’s Insurance: After receipt from Contractor of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner in this Contract (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

1.3 CONFLICTS

- A. The General Conditions of the Contract shall govern in the event of any conflict with any other provisions of the Contract Documents unless notice to the contrary shall have been issued by the Owner. In the event of conflict, the Supplementary General Conditions control over the General Conditions and the Contract controls over the Supplementary and General Conditions. The Engineer has no authority to amend the General Conditions, orally or in writing, either expressly or by implication.
- B. The following principles shall govern the settlement of disputes which may arise over conflicts in the Contract Documents: (a) as between figures given on drawings and the scaled measurements, the figures shall govern; (b) as between large-scale drawings and small-scale drawings, the larger scale shall govern; (c) as between drawings and specifications, the requirements of the specifications shall govern; and (d) as between the contract and the specifications, the requirements of the contract shall govern. Conflicts noted shall be reported to the Design Professional.

1.4 ACCEPTANCE AND FINAL PAYMENT

- A. When the work provided for under this CONTRACT shall have been completed by the Contractor, and all parts thereof have been approved by the ENGINEER according to the CONTRACT, the ENGINEER shall, within ten (10) days unless otherwise provided, make final inspection and advise the Contractor as to preparing a final estimate, showing the value of work as soon as the necessary measurements and computations can be made, all prior certificates or estimates upon which payments have been being made approximated only, and subject to correction in the final payment. The amount of the final estimates, less any sums that may have been deducted or retained under the provisions of this CONTRACT, will be paid to the Contractor within sixty (60) days after approval by the Engineer, provided that the Contractor has properly maintained and operated the PROJECT as specified under these Specifications, and provided, that it has furnished to the Owner a sworn affidavit in form satisfactory to Owner's attorney to the effect that all bills are paid and no suits are pending in connection with the work done or labor and material furnished under this CONTRACT.

1.5 SUBSURFACE AND PHYSICAL CONDITIONS

- A. If a Geotechnical Report is included in the project, it will be listed as an Appendix.
- B. All excavation is considered unclassified excavation.

END OF SECTION

**SECTION 00 73 16
STANDARD INSURANCE
REQUIREMENTS**

Prior to the Commencement of Work, the Contractor shall provide a Certificate of Insurance Indicating the Following Coverages and Liability Limits.

The following coverage must apply:

1. General Liability Insurance (CGL):

Commercial general liability on an occurrence coverage form. The limits of liability shall not be less than:

\$1,000,000 each occurrence (combined single limit for bodily injury and property damage).

\$1,000,000 for personal and advertising injury liability.

\$2,000,000 general aggregate.

\$2,000,000 aggregate on products and completed operations.

Liability policy shall name the Owner and all parties required by contract as additional insured using the additional insured endorsements **CG 2010 7 04 & CG 2037 7 04** or equivalent endorsements. These endorsements should be attached to the certificate of insurance. The additional insured coverage afforded will apply on a “**primary and noncontributory**” basis.

2. Automobile Liability Insurance:

\$1,000,000 Combined single limit each accident for bodily injury and property damage. Include coverage on all owned, hired, and non-owned automobiles.

3. Umbrella/Excess Liability insurance:

A minimum of \$2,000,000 each occurrence in excess of the liability insurance is required.

Additionally, the subcontractor shall maintain the coverage during the period of construction, and for two years following owner’s acceptance of the project.

4. Workers Compensation (Statutory) and Employer’s Liability:

\$1,000,000 each accident for bodily injury by accident.

\$1,000,000 each employee for bodily injury by disease.

\$1,000,000 policy limit for bodily injury by disease.

5. City of Jefferson (and any applicable Authority) should be shown as an additional insured on General Liability, Auto Liability and Umbrella Liability policies.

6. The cancellation should provide 10 days' notice for nonpayment and 30 days' notice of cancellation.

CITY OF JEFFERSON, GA – CENTRAL CITY WRF PHASE 1 IMPROVEMENTS

**City of Jefferson
147 Athens Street
Jefferson, GA 30549**

Insurance Company should be licensed to do business by the Georgia Department of Insurance.

7. Certificates of Insurance, and any subsequent renewals, must reference specific proposal/contract by project name and project/proposal number.
8. All insurance coverages required to be provided by the Contractor will be primary over any insurance program carried by the COUNTY.
9. Contractor shall incorporate a copy of the insurance requirements as herein provided in each and every subcontract with each and every Subcontractor in any tier and shall require each and every Subcontractor of any tier to comply with all such requirements. Contractor agrees that if for any reason Subcontractor fails to procure and maintain insurance as required, all such required Insurance shall be procured and maintained by Contractor at Contractor's expense.
10. No Contractor or Subcontractor shall commence any work of any kind under this Contract until all insurance requirements contained in this Contract have been complied with.
11. The Contractor shall agree to waive all rights of subrogation against the COUNTY, its officers, officials, employees, and volunteers from losses arising from work performed by the contractor for the COUNTY.

END OF SECTION

**CITY OF JEFFERSON – CENTRAL CITY WRF
 PHASE 1 IMPROVEMENTS**

06/06/2024

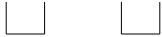
DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
 Project Name and Address
 (Owner) and all parties required by contract are included as additional insured with regards to General Liability per CG2010(10/01) & CG2037 (10/01) or equivalent, Automobile Liability and Umbrella Liability. Coverage is Primary and non-contributory over any insurance held by the additional insureds. A Waiver of Subrogation, per CG2404 (05/09) or equivalent, in favor of the additional insureds and a (30)day notice of cancellation, except 10 days for non-payment of premium applies on all policies.

CERTIFICATE HOLDER	CANCELLATION
Hall County	<p>SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.</p> <p>AUTHORIZED REPRESENTATIVE</p> <p style="text-align: right;">Signature of Agents Authorized Representative</p>

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ACORD 25 (2016/03)

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POLICY
NUMBER:

COMMERCIAL GENERAL
LIABILITY CG 20 10 10 01

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED – OWNERS, LESSEES OR
CONTRACTORS – SCHEDULED PERSON OR
ORGANIZATION**

This endorsement modifies insurance provided under the

following: COMMERCIAL GENERAL LIABILITY

COVERAGE PART

SCHEDULE

Name of Person or Organization:

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

A. Section II – Who Is An Insured is amended to include as an insured the person or organization shown in the Schedule, but only with respect to liability arising out of your ongoing operations performed for that insured.

B. With respect to the insurance afforded to these additional insureds, the following exclusion is added:

2. Exclusions

This insurance does not apply to "bodily injury" or "property damage" occurring after:

- (1) All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the site of the covered operations has been completed; or
- (2) That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

**CITY OF JEFFERSON – CENTRAL CITY WRF
PHASE 1 IMPROVEMENTS**

06/06/2024

CG 20 10 10

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Page 1 of



POLICY
NUMBER:

COMMERCIAL GENERAL
LIABILITY CG 20 37 10 01

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED – OWNERS, LESSEES OR
CONTRACTORS – COMPLETED OPERATIONS**

This endorsement modifies insurance provided under the

following: COMMERCIAL GENERAL LIABILITY

COVERAGE PART

SCHEDULE

Name of Person or Organization:
Location And Description of Completed Operations:
Additional Premium:

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

Section II – Who Is An Insured is amended to include as an insured the person or organization shown in the Schedule, but only with respect to liability arising out of "your work" at the location designated and described in the schedule of this endorsement performed for that insured and included in the "products-completed operations hazard".

**CITY OF JEFFERSON – CENTRAL CITY WRF
PHASE 1 IMPROVEMENTS**

06/06/2024

**CG 20 37 10
01**

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2000

**Page 1 of
1**



POLICY
NUMBER:

COMMERCIAL GENERAL
LIABILITY CG 24 04 05 09

WAIVER OF TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US

This endorsement modifies insurance

provided under the following:

COMMERCIAL GENERAL LIABILITY

COVERAGE PART

PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART

SCHEDULE

Name of Person or Organization:

Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

The following is added to Paragraph 8. **Transfer Of Rights Of Recovery Against Others To Us** of Section IV -Conditions:

We waive any right of recovery we may have against the person or organization shown in the Schedule above because of payments we make for injury or damage arising out of your ongoing operations or "your work" done under a contract with that person or organization and included in the "products-completed operations hazard". This waiver applies only to the person or organization shown in the Schedule above.

**SECTION 01 11 00
SUMMARY OF WORK**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work to be done under this Contract shall include the furnishing of all materials, equipment, labor and means of construction necessary for the construction of the City of Jefferson, Georgia - Central City WRF Phase 1 Improvements, and all other work as shown on the Contract Drawings and/or as specified herein. Substantial completion in 450 consecutive calendar days after the Notice to Proceed is issued.
- B. Major work includes installation of new disc filter system with canopy, upgrade of plant site pump station, new LAS screen structure, new mechanical bar screen with conveyor, new triplex Central City 1 submersible pump station, miscellaneous improvements to the LAS site and WRF site.
- C. Work shall include clean-up and dress-up and all repair work necessary to restore pavement, lawns, and finished areas as closely as possible to their original condition following installation of the work.
- D. All work pertaining to any requirements contained herein shall be included in the overall proposal submitted unless such cost is designated as a separate pay item in the Bid Schedule.
- E. Contractor shall be responsible for obtaining and paying for all necessary local and state licenses, permits and taxes.
- F. The Contractor will be required to deliver all equipment, pipe, valves, and other materials to the location of installation. Care shall be exercised in handling all materials and equipment, and the Contractor will be held responsible for all breakage or damage to same.

1.2 WORK AND MATERIALS BY THE OWNER

- A. The Owner will furnish all water for construction operations and for testing.
- B. The Contractor shall make his own arrangements to convey the water from the Owner's tap to points of construction.
- C. The Owner shall provide personnel to operate all necessary valves in existing system and will oversee all necessary taps and connections to existing lines made by the Contractor's personnel.

1.3 OR APPROVED EQUIVALENT CLAUSE

- A. Whenever a material or article required is specified or shown on the Contract Drawings by using the name of the proprietary product or of a particular manufacturer or vendor, any material or article which will meet design criteria and is equal in function and durability, as determined by the Engineer, will be considered acceptable.

1.4 COMPLIANCE OF WORK WITH SPECIFICATIONS

- A. The Contractor will be supplied with three sets of Drawings and Specifications. Of these sets, one complete set shall always be available on the job site.
- B. Should any portion of the Drawings and/or Specifications be obscure or in dispute, it shall be referred to the Engineer and he shall decide as to the true meaning and intent. He shall have the right to correct errors and omissions at any time when those corrections are necessary for the proper fulfillment of the Drawings and Specifications.
- C. The Contractor shall furnish the Engineer with every reasonable facility for ascertaining whether or not the work performed, and materials used are in accord with the requirements and intent of the Specifications and Drawings. The Contractor shall give the work the constant attention necessary to facilitate the progress thereof and shall cooperate with the Engineer and with other contractors in every way possible.
- D. The Contractor shall employ only competent and skilled personnel on the work. At all times when the work is in progress, the Contractor shall have a competent Superintendent or Foreman present with authority to receive orders, execute the work and to promptly supply materials, tools, plant equipment and labor as may be required. Should the Engineer so demand, the Contractor shall immediately remove any Superintendent, Foreman or worker whom the Engineer considers incompetent, undesirable, or both.
- E. The Project Engineer shall be authorized to inspect all work done and all materials furnished, including the preparation, fabrication and manufacture of the materials to be used. The Project Engineer shall be authorized to alter or waive the requirements of the Specifications. He may reject materials and suspend the work.
- F. No work shall be done, nor materials used without suitable supervision and/or inspection by the Engineer or his representative. Failure to reject defective work and/or materials shall not in any way preclude later rejection when that defect is discovered or obligate the Owner to final acceptance.
- G. Inspection of the work shall not relieve the Contractor of his obligation to fulfill his contract. Defective work shall be made good even if such work and/or materials have been previously inspected by the Engineer or his representative and accepted or included in an estimate for payment. All rejected work and/or materials shall immediately be removed and replaced with materials and work in accord with the Specifications and Drawings. If the Contractor fails to remove the defective work and/or materials within ten days after having been ordered to do so, the Owner shall have the right and authority

to stop the Contractor and suspend the work at once and to supply personnel and material to remove and replace that defective work and/or materials at the expense of the Contractor.

1.5 CONFLICTING REQUIREMENTS

- A. In case of conflict between the requirements in the Technical Specifications, that requirement which is in compliance with all the applicable codes, and which is, in the opinion of the Engineer, more advantageous to the Owner, shall govern. This shall apply to all requirements indicated by the Technical Specifications of the Contract Documents.

1.6 EROSION CONTROL MONITORING

- A. The contractor shall comply with the requirements of the State of Georgia General NPDES Permit for Storm Water Discharges from Construction Activities, General Permit No. GAR 100000. The cost of the work from the Notice of Intent to the Notice of Termination and all other activities related to the Erosion and Sedimentation Control Program shall be included in the Lump Sum Proposal Item for Erosion Control Monitoring in the Proposal Schedule.

END OF SECTION

**SECTION 01 21 00
ALLOWANCES**

PART 1 GENERAL

1.1 SCOPE

- A. The General Contractor shall include with the bid price the following allowance items and amounts for this Contract.
- B. The Contractor's handling costs on the site, labor, installation costs, overhead, profit and other expenses contemplated for the original allowance shall be included in the contract price and not in the allowance. The Contractor shall cause work covered by these allowances to be performed for such amounts and by such persons as the Owner/Engineer may direct, but he will not be required to employ persons against whom he makes a reasonable objection. If the cost, when determined and approved by the Owner/Engineer, exceeds, or falls below the allowance, the Contract Sum shall be adjusted accordingly through a Change Order. The contractor is not entitled to overhead, profit, or mark-up on unutilized allowance funds.

1.2 SCHEDULE OF ALLOWANCE ITEMS (PART 3 IN BID FORM)

- A. Unforeseen Utility Conflicts (Bid Item 1):
 - 1. The General Contractor shall include in the bid price the following amount for correction of unforeseen utility conflicts and utility relocations as determined by the Owner and Engineer.
 - 2. **Total Allowance Item 1 = \$50,000.00**
- B. Owner Contingency (Bid Item 2):
 - 1. Owner Contingency is the lump sum amount shall be used for payment for additional Work performed at the discretion and direction of the Owner and the Engineer which is not included in the other Bid Items on the Bid Form.
 - 2. **Total Allowance Item 2 = \$300,000.00**
- C. Spare Parts Allowance (Bid Item 3):
 - 1. This is the lump sum amount to be used for payment for the Spare Parts provided at the discretion and direction of the Owner and the Engineer which is not included in the other Bid Items on the Bid Form. A cost proposal for each item of additional work shall be prepared by the Contractor in accordance with the General Conditions for the Engineer's review as required by the General Conditions and other Sections of the Specifications. The total amount of the allowance funds paid to the Contractor shall be the total amount agreed to and ordered performed, which shall not necessarily be the total amount shown in the Bid Schedule.

2. Total Allowance Item 3 = \$ 20,000

D. Metal Canopy System (Bid Item 4):

1. This is a lump sum amount to be used for payment for the materials, labor, design and installation of the metal canopy system over the proposed filters. This allowance item also includes the cost of preparation of shop drawing submittals. Design parameters are presented in the Drawings.
2. A cost proposal for this item of work shall be prepared by the Contractor in accordance with the General Conditions for the Engineer's review as required by the General Conditions and other Sections of the Specifications. The total amount of the allowance funds paid to the Contractor shall be the total amount agreed to and ordered performed, which shall not necessarily be the total amount shown in the Bid Schedule.
3. **Total Allowance Item 4 = \$ 125,000**

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

**SECTION 01 22 00
MEASUREMENT AND PAYMENT**

PART 1 GENERAL

1.1 SCOPE

- A. The Bid Schedule lists each item of the Project for which payment will be made. No payment will be made for any items other than those listed in the Bid Schedule.
- B. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the Bid Schedule, and which are not specified in this Section to be measured or to be included in one of the items listed in the Bid Schedule, shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum or unit prices bid for the various Bid items. The Contractor shall prepare the Bid accordingly.
- C. Work includes furnishing all labor, equipment, tools, and materials, which are not furnished by the Owner and performing all operations required to complete the work satisfactorily, in place, as specified and as indicated on the Drawings.

1.2 DESCRIPTIONS

- A. Measurement of an item of work will be by the unit indicated in the Bid Schedule.
- B. Final payment quantities shall be determined from the record drawings. The record drawing lengths, dimensions, quantities, etc., shall be determined by a measurement by the Engineer for any Unit Price Bid items after the completion of all required work. The precision of final payment quantities shall match the precision shown for that item in the Bid Schedule.
- C. Payment will include all necessary and incidental related work not specified to be included in any other item of work listed in the Bid Schedule.
- D. Unless otherwise stated in individual Sections of the Specifications or in the Bid Schedule, no separate payment will be made for any item of work, materials, parts, equipment, supplies, or related items required to perform and complete the work. The costs for all such items required shall be included in the price bid for item of which it is a part.
- E. Payment will be made by extending unit prices multiplied by quantities provided and then summing the extended prices to reflect actual work. Such price and payment shall constitute full compensation to the Contractor for furnishing all labor, equipment, tools and materials not furnished by the Owner and for performing all operations required to provide to the Owner the entire Project, complete in place, as specified and as indicated on the Contract Drawings.

1.3 CITY OF JEFFERSON – CENTRAL CITY WRF PHASE 1

Part 1-Base Bid

- A. Bid Item No. 1a: General Construction of the Central City WRF Phase 1 per Contract Documents including all work shown on the Drawings and as specified, exclusive of those items listed below in Part 2 and Part 3 of the Bid. The work includes but is not limited to construction of new headworks facility at the existing LAS site, demolition of the Central City Pump Station 1, construction of a new Central City Triplex Pump Station 1 including modifications to yard piping in the area of the station, new 10 inch force main, new hydraulic control structure at LAS treatment pond, demolition and abandonment of the portions of the existing LAS screen structure and Parshall flume, new disk filters at the WRF, upgrades to the Site Pump Station including all electrical, instrumentation, mechanical, site work, piping, plumbing, paint, earthwork, and any appurtenances as necessary for completion of the work included in the Contract Documents. The Contractor shall provide all necessary coordination with the equipment suppliers.

Part 2 - Allowance Costs

- A. Bid Item 1- Allowance for correction of unforeseen utility conflicts.
1. Unforeseen Utility Conflicts: This is the lump sum amount that shall be used for payment for additional Work performed as a result of unforeseen utility conflicts which is not included in the other Bid Items on the Bid Form. The Contingency or portion thereof shall not be paid to the Contractor except for additional work ordered in writing by the Engineer. A cost proposal for each item of additional work shall be prepared by the Contractor in accordance with the General Conditions for the Engineer's review as required by the General Conditions and other Sections of the Specifications. The total amount of Contingency funds paid to the Contractor shall be the total amount agreed to and ordered performed, which shall not necessarily be the total amount shown in the Bid Schedule.
- B. Bid Item 2- Owners Contingency
1. Owner Contingency: is the lump sum amount that shall be used for payment for additional Work performed at the discretion and direction of the Owner and the Engineer which is not included in the other Bid Items on the Bid Form. The Contingency or portion thereof shall not be paid to the Contractor except for additional work ordered in writing by the Engineer. A cost proposal for each item of additional work shall be prepared by the Contractor in accordance with the General Conditions for the Engineer's review as required by the General Conditions and other Sections of the Specifications. The total amount of Contingency funds paid to the Contractor shall be the total amount agreed to and ordered performed, which shall not necessarily be the total amount shown in the Bid Schedule.
- C. Bid Item 3 – Spare Parts Allowance:

1. This is the lump sum amount that shall be used for payment for the Spare Parts provided at the discretion and direction of the Owner and the Engineer which is not included in the other Bid Items on the Bid Form. A cost proposal for each item of additional work shall be prepared by the Contractor in accordance with the General Conditions for the Engineer's review as required by the General Conditions and other Sections of the Specifications. The total amount of the allowance funds paid to the Contractor shall be the total amount agreed to and ordered performed, which shall not necessarily be the total amount shown in the Bid Schedule.

D. Bid Item 4 – Metal Canopy Allowance:

1. This is the lump sum amount that shall be used for payment for the metal canopy system and installation over the proposed filters. A cost proposal for this item of work shall be prepared by the Contractor in accordance with the General Conditions for the Engineer's review as required by the General Conditions and other Sections of the Specifications. The total amount of the allowance funds paid to the Contractor shall be the total amount agreed to and ordered performed, which shall not necessarily be the total amount shown in the Bid Schedule.

Part 3- Unit Price Bids

A. Erosion Control General

1. Erosion and sediment control costs to be included in Part 3. All other temporary and/or permanent erosion and sedimentation control costs shall be included in the price bid for the item to which it pertains. When ordered by the Engineer, additional work or increases in the quantities of certain classes of work over those called out on the Drawings may be required. Quantities for payment shall be based upon actual quantity constructed and authorized by the Engineer.
2. No payment will be made for any portion of the Project for which temporary erosion and sedimentation controls are not properly maintained.

B. Bid Item 1 - Stone Stabilization:

1. This is the unit price per ton for the installation of stone stabilization where directed by the Engineer, in addition to that amount required as bedding or sand cushion to stabilize poor soil shown on the Drawings. The extent of stabilization stone shall be determined by the Engineer at the time when the stone is placed. Measurement will be on a volume basis and a unit stone weight of 100 pounds per cubic foot shall be used to calculate weight. The unit price includes all costs for the materials and labor for work in accordance with Contract Documents.

C. Bid Item 2- Silt Fence Type Sd1-S:

1. This is the unit price per foot for the installation of Type Sd1-S silt fence. This work is for silt fence and not included in the Base Bid Amount.

D. Bid Item 3- Inlet Protection

1. This is unit price for the installation of type Sd2-F protection. This work is not included in the Base Bid Amount.

E. Bid Item 4- Stone Check Dam

1. This is unit price for the installation of a stone check dam .This work is not included in the Base Bid Amount.

F. Bid Item 5- Slope Protection

1. This item is lump sum price to install slope protection where shown on the drawings or directed by the Engineer. This work is not included in the Base Bid Amount.

G. Bid Item 6- Silt Fence Type Sd1-S Removal :

1. This is the unit price per foot for the removal of Type Sd1-S silt fence. This work is at the direction of the Engineer is for silt fence not included in the Base Bid Amount.

H. Bid Item 7 - Construction Exits:

1. This is the unit price for each installation. All costs for construction exit, including installation, maintenance, repair, and removal shall be included in the Unit Price for this Bid Item.

I. Bid Item 8 - Permanent Grassing:

1. No separate payment will be made for temporary grassing. Include costs in Part 1, Bid Item 1a.
2. All costs for permanent grassing, including seed bed preparation, topsoil, seeding, fertilizing, mulching as well as temporary measures, shall be included in the unit price.

J. Bid Item 9- Relining of Stone Drainage Ditch:

1. This is a lump sum price for additional rip rap not included in the Base Bid Amount.

K. Bid Item 10 - Erosion Control Monitoring:

1. This is the lump sum unit price for the regulatory required site monitoring and stormwater sampling for the entire life of the project. All costs are included in the Unit Price for this Bid Item.

L. Bid Item 11 – Concrete Washout Area:

1. This is the unit price for each installation. All costs for concrete washout area,

including installation, maintenance, repair, and removal shall be included in the Unit Price for this Bid Item.

M. Bid Item 12- Gravel Road Repair and Replacement:

1. This is a unit price to repair and replace existing gravel roadways at the direction of the Owner or the Engineer. This is not to be included in the Base Bid Amount.

N. Bid Item 13- Asphalt Milling and Replacement:

1. This is a unit price to mill existing asphalt and replacement in kind. This is not included in the Base Bid amount. This work will be done at the direction of the Engineer at the end of the project.

1.4 WATER LINE OR FORCE MAIN TESTING

- A. No separate payment will be made for pressure testing of piping and/or disinfection (for water lines) and shall be included in the Base Bid.

1.5 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Material and equipment not properly stored.
6. Defective Work not accepted by Owner.
7. Material remaining on hand after completion of work.

1.6 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

- A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings or preliminary operation and maintenance manuals are acceptable to Engineer.
- B. Final Payment: Will be made only for products incorporated in work; remaining products, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.7 CLEARING AND GRUBBING

- A. No separate payment shall be made for clearing and grubbing. Include cost in Base Bid amount.

1.8 EARTHWORK

- A. Earth Excavation:
 - 1. NO separate payment will be made for earth excavation. The cost of such work and all costs incidentals thereto shall be included in the price bid for the item to which the work pertains.
 - 2. NO separate payment will be made for providing sheeting, bracing, shoring and timbering.
- B. Rock Excavation: NO separate payment will be made for any rock excavation required for the construction of this project.
- C. Foundation Excavation:
 - 1. Costs for additional undercutting, foundation preparation, removal and disposal of unsuitable material, and replacement with crushed stone where shown on the Drawings or specified, shall be included in the Unit Price for Item 3 of the Bid.
 - 2. No separate payment will be made for concrete backfill of trenches beneath structures. The cost of this work and all costs incidentals thereto shall be included in Lump Sum price for the Base Bid.
 - 3. Additional costs of corrective work, made necessary by unauthorized excavation of earth or rock, shall be borne by the Contractor.
- D. Dewatering: NO separate payment will be made for dewatering required to accomplish the work.
- E. Backfilling: NO separate payment will be made for backfilling or excavation, hauling and placement of borrow material. The cost of all such work and all costs incidentals thereto shall be included in the Lump Sum price for the Base Bid.

1.9 TRENCH EXCAVATION AND BACKFILL

- A. No separate or additional payment shall be made for any special or unique method, means, techniques or equipment necessary for the Contractor's compliance with these Specifications, regulatory requirements, permits, laws or regulations which govern this Project.
- B. Trench Excavation: No separate payment shall be made for trench excavation. All costs shall be included in the Unit Price for this Bid Item.

- C. Sheeting, Bracing and Shoring: No separate payment will be made for providing sheeting, bracing, shoring and timbering.
- D. Trench Rock Excavation: NO SEPARATE PAYMENT WILL BE MADE FOR TRENCH ROCK EXCAVATION.
- E. Dewatering Excavations: All costs of equipment, labor and materials required for dewatering shall be included in the Base Bid Amount. No separate payment will be made.

1.10 PAVEMENT REPLACEMENT

- A. Payment for pavement replacement, due to construction activities and not paid for under specific bid item, shall be included in the Base Bid Amount.

1.11 MAINTENANCE OF TRAFFIC

- A. No separate payment shall be made for maintenance of traffic required for construction. All costs shall be included in the Base Bid Amount.

1.12 BY-PASS PUMPING AND TEMPORARY PIPING SYSTEMS

- A. NO separate payment shall be made for temporary bypass pumping equipment and/or temporary piping systems (process, plant water, potable or chemical). All costs for labor, materials, equipment and operations of bypass pumping and temporary piping systems to be included in the Base Bid Amount.

END OF SECTION

**SECTION 01 23 00
ALTERNATES**

PART 1 GENERAL

1.1 SCOPE

- A. The following items are to be included as Alternate Work under the Contract, and a price for each shall be entered in the Bid Form (Section 00 41 43) in the spaces provided for Bid Alternates.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section specifies administrative and procedural requirements for Alternates.
- B. Definition: An alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in Contract Documents.
- C. Coordination: Coordinate related work and modify or adjust adjacent work as necessary to ensure that the Work performed by each accepted Alternate is complete and fully integrated into the Project.
- D. Include as part of each Alternate, miscellaneous devices, accessory object, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- E. The Bidder shall quote all-inclusive deductive or added costs for proposed Bid Alternates to the Project scope listed on the Bid Form. The Bidder shall provide a quote for all proposed Bid Alternates. Quoted Bid Alternates shall include the costs for all work, including Contractor's direct and indirect costs and fees, proposed to be added or deleted from the scope of the Project and all work, including all costs and fees, required to fully execute the proposed substitute Project scope.
- F. Owner reserves the right to accept or reject any Bid Alternate. The Owner may, at its option, exercise alternate(s) no later than project award. Any alternate will be incorporated into the to the Work to be performed under the Contract Documents, any of them, or any combination of them, at the Alternate pricing as listed on the Bid Form – Section 00 41 43.

- G. Acceptance or non-acceptance of any Bid Alternates by the Owner shall have no effect on the Contract Period, Date of Substantial Completion, or Date of Final Completion.

PART 2 SCHEDULE OF ALTERNATIVES

2.1 SCOPE OF BID ALTERNATIVES

- A. The Bidder shall be responsible for determining from the Bid and Contract Documents the full scope of the proposed Bid Alternates briefly described below including the stipulated elements and any and all required associated work.

2.2 ADD /DEDUCT BID ALTERNATES

- A. Alternate- 46 61 41 Disk Filters.

PART 3 EXECUTION (Not Used)

END OF SECTION

**SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.1 PRE-CONSTRUCTION CONFERENCE

- A. The Engineer shall schedule the pre-construction conference prior to the issuance of the Notice to Proceed.
- B. Representatives of the following parties are to attend the meeting:
 - 1. Owner.
 - 2. Engineer.
 - 3. Contractor and superintendent.
 - 4. Major subcontractors.
 - 5. Representatives of governmental or regulatory agencies when appropriate.
- C. The agenda for the pre-construction conference shall consist of the following as a minimum:
 - 1. Distribute and discuss a list of major subcontractors and a tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Designation of responsible personnel and emergency telephone numbers.
 - 4. Processing of field decisions and change orders.
 - 5. Adequacy of distribution of Contract Documents.
 - 6. Schedule and submittal of shop drawings, product data and samples.
 - 7. Pay request format, submittal cutoff date, pay date and retainage.

1.2 COORDINATION WITH PROJECT ENGINEER

- A. During the work under this Contract, the Contractor shall be responsible for keeping the Project Engineer informed of his work schedule and of his requirements concerning staking and inspection as herein specified.
- B. If any work subject to inspection or testing by the Project Engineer is installed without notification in time for such testing or inspection to be done, that work shall be subject to removal and replacement by the Contractor at no additional cost to the Owner.
- C. The Contractor shall not put workers on the job or perform any work on any portion of the project without prior knowledge of the Project Engineer that such work is to be done,

the place of work, and the scheduled starting time. A minimum 24-hour notification to the Project Engineer is required.

1.3 PROGRESS MEETINGS

- A. Contractor shall schedule and hold periodic progress meetings at least every month just prior to submittal of the monthly partial payment request and at other times as requested by Engineer or required by progress of the work. Contractor, Engineer, and all Subcontractors active on the site shall be represented at each meeting. Contractor may at his discretion request attendance by representatives of his suppliers, manufacturers, and other Subcon-tractors.
- B. Contractor shall preside over the meetings and provide for keeping and distribution of the minutes. The purpose of the meetings will be to review the progress of the work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.
- C. The Contractor shall provide a list of all subcontractors to the Engineer, for information only, at the Pre-Construction Conference. If the Contractor makes any additions or changes to this list, the Contractor shall resubmit the amended list to the Engineer and Owner immediately.

1.4 CONSTRUCTION SCHEDULE

- A. The Contractor shall submit to the Engineer an Estimated Construction Progress Schedule in accordance with Section 01 32 13.
- B. The Schedule shall show the anticipated dates of commencement and completion of each of the various types of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due the Contractor in accordance with the Progress Schedule.
- C. The construction costs employed in making up these Schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis of additions to or deductions from the Contract price.

1.5 PROJECT LAYOUT

- A. The Engineer will furnish the Contractor with a list of coordinates for the various project structures, as well as benchmark locations and elevations. The Contractor shall be responsible for verifying these elevations and locations and for laying out the Work. The cost of this survey shall be the responsibility of the Contractor.
- B. At request, the Engineer will provide digital files to the Contractor.

1.6 SAFETY REQUIREMENTS

- A. All construction work on public rights-of-way shall be done in accordance with the rules and regulations of the agency having control. All safety equipment and markings shall be furnished by the Contractor.
- B. Work done on such rights-of-way shall be done only with the written consent of and in strict accordance with the Specifications of the right-of-way Owner.
- C. It shall be the responsibility of the Contractor to notify the right-of-way Owner's field engineer before doing any work within the right-of-way.
- D. All construction work shall be performed in accordance with established construction safety standards, and the Contractor shall be responsible for the safety of his employees and the public. All applicable local, state, and Federal regulations, including the Department of Labor, Occupational Safety and Health Administration, (OSHA), 29 CFR Part 1926, Subpart P, latest edition shall be adhered to by the Contractor.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION

**SECTION 01 31 13
PROJECT COORDINATION**

PART 1 PART 1 GENERAL

1.1 SUMMARY

- A. Contractor shall be solely responsible for coordination of all the work. Contractor shall supervise, direct, and cooperate fully with all subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials or equipment are required to ensure completion of the work within the contract time and in accordance with the Contract Documents.
- B. Contractor shall cooperate with and coordinate their work with the work of any other contractors, subcontractors, utility service companies, and the Owner's employees performing additional work related to the project at the site.
- C. Contractor shall not be responsible for damage done by contractors not under their jurisdiction and will not be liable for any such loss or damage unless it is through the negligence of the Contractor.
- D. Contractor shall also coordinate their work with the work of others to assure compliance with schedules.
- E. Contractor shall attend and participate in all project coordination or progress meetings and report on the progress of all work and compliance with schedules.

END OF SECTION

**SECTION 01 32 13
CONSTRUCTION SCHEDULES**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Promptly after award of the contract, the Contractor shall prepare and submit to the Engineer estimated construction progress schedules for the Work, with sub-schedules of related activities, which are essential to its progress.
- B. Submit revised progress schedules periodically.

1.2 RELATED WORK

- A. Section 01 33 00 – Submittals.
- B. Section 01 30 00 – Administrative Requirements

1.3 FORM OF SCHEDULES

- A. Prepare schedules in the form of a horizontal bar chart.
- B. Provide separate horizontal bars for each trade or operation.
- C. Horizontal time scale: Identify the first workday of each week.
- D. Scale and spacing: To allow space for notations and future revisions.
- E. Minimum sheet size: 11” by 17”.
- F. Format of listings: The chronological order of the start of each item of work.
- G. Identification of listings: By major specification section numbers.

1.4 CONTENT OF SCHEDULES

- A. Construction Progress Schedule:
 - 1. Show the complete sequence of construction by activity.
 - 2. Show the dates for the beginning, and completion of, each major element of construction.
 - 3. Show projected percentage of completion for each item, as of the first day of each month.

- B. Submittals Schedule for Shop Drawings, Product data and samples. Show:
 - 1. The dates for Contactor’s submittals.
 - 2. The dates approved submittals will be required from the Engineer.
 - 3. Products Delivery Schedule Dates.
 - 4. Provide sub-schedules to define critical portions of prime schedules.

1.5 PROGRESS REVISIONS

- A. Indicate progress of each activity to date of submission.
 - 1. Show changes occurring since previous submission of schedules:
 - 2. Major changes in scope.
 - 3. Activities modified since previous submission.
 - 4. Revised projections of progress and completion.
 - 5. Other identifiable changes.
- B. Provide a narrative report as needed to define:
 - 1. Problem areas, anticipated delays, and the impact on the schedule.
 - 2. Corrective action recommended, and its effect.

1.6 SUBMISSIONS

- A. Submit initial schedules within 15 days after award of Contract.
- B. The Engineer will review schedules and return review copy within 15 days after receipt.
- C. If required, resubmit within 7 days after return of review copy.
- D. Submit revised progress schedules at construction meetings or with each application for payment.

1.7 DISTRIBUTION

- A. Distribute copies of the reviewed schedules to:
 - 1. Job site file.
 - 2. Subcontractors.
 - 3. Other concerned parties.
- B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION

**SECTION 01 33 00
SUBMITTAL PROCEDURES**

PART 1 GENERAL

1.1 SCOPE

- A. The work under this Section includes submittal to the Engineer of shop drawings, product data and samples required by the various Sections of these Specifications.
- B. Within 45 days after Notice to Proceed is issued, the Contractor shall submit one (1) electronic copy in PDF format of all anticipated shop drawings and/or manufacturers' descriptions sheets for all materials and/or equipment for the approval of the Engineer.
- C. The submittals process for this project will be digital.
- D. Definitions: Submittals are categorized as follows:
 - 1. Shop Drawings:
 - a. Shop drawings shall include technical data, drawings, diagrams, procedures and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions and training, measurements, and similar information as applicable to the specific item for which the shop drawing is prepared.
 - b. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, Specification Section, schedule, or room numbers shown on the Contract Drawings.
 - c. Minimum assembly drawings sheet size shall be 11 x 17 inches.
 - d. Minimum detail sheet size shall be 8 1/2 x 11 inches.
 - e. Scale: As required.
 - 2. Product Data:
 - a. Product data includes standard printed information on materials, products, and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.
 - b. Collect required data into one submittal for each unit of work or system and mark each copy to show which choices and options are applicable to the Project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and

seals, notation of field measurements that have been checked and special coordination requirements.

3. Samples:
 - a. Samples include both fabricated and un fabricated physical examples of materials, products, and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.
 - b. Provide a full set of optional samples where the Engineer's selection is required. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.
4. Miscellaneous submittals:
 - a. Related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, Project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the work.

1.2 SPECIFIC CATEGORY REQUIREMENTS

- A. General: Except as otherwise indicated in the individual work sections, comply with the general requirements specified herein for each indicated category of submittal. Submittals shall contain:
 1. The date of submittal and the dates of any previous submittals.
 2. The Project title.
 3. The submittal number as indicated as follows:
 - a. Submittal Identification and Packaging: Shop drawing submittals to the Engineer shall be numbered beginning with 1, with the applicable Specification Section in parenthesis after the submittal number. Should any submittal be returned for resubmittal, that resubmittal shall be numbered 1.1 and so on.
 - b. The Contractor shall identify as an activity in the schedule, all major equipment submittals as well as those involving complex reviews and long lead deliveries. Submittal schedule information shall be updated monthly with the Contractor's updated Project schedule.

4. Field dimensions clearly identified as such.
5. Wiring and control diagrams.
6. Support calculations and other supporting information to describe the structure, machine, system, and its intended use.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards, such as ASTM or Federal specification numbers.
9. Notification to the Engineer in writing of any deviations to the requirements of the Contract Documents. The notification of deviation shall be clearly marked by the Contractor in the body of the submittal and stated in text in the Contractor's remarks on the transmittal document of the submittal. Indicate the reasons for the deviations and the benefits to the Project.
10. Identification of revisions on re-submittals.
11. An 8 x 3 -inch blank space for Contractor and Engineer stamps.
12. A stamp, initialed or signed, certifying the Contractor's review of the submittal, and indicating the submittal's status relative to the requirements of the Contract Documents.

1.3 ROUTING OF SUBMITTALS

- A. Submittals and routine correspondence shall be routed as follows:
 1. Supplier to Contractor (through representative if applicable)
 2. Contractor to Engineer
 3. Engineer to Contractor and Owner
 4. Contractor to Supplier

1.4 SUBMITTAL LOG

- A. A submittal log shall be maintained by the Engineer and the Contractor as the complete listing of submittals.

PART 2 PRODUCTS

2.1 SHOP DRAWINGS

- A. Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to scale and large enough and in sufficient detail to show all pertinent features of the submitted item and its method of connection to the work.
- B. Affix the following Certification, signed by the Contractor, to each submittal:

“By this submittal, I hereby represent that I have determined and verified all field

measurements, field construction criteria, materials, dimensions, catalog numbers and pertinent data and I have checked and coordinated each item with other applicable approved drawings and all Contract requirements."

2.2 MANUFACTURER’S LITERATURE

- A. Where the content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.

2.3 SAMPLES

- A. Samples shall illustrate the material, workmanship, and established standards by which completed work is judged.
- B. Unless otherwise specifically directed by the Engineer, all samples shall be made of and derived from the proposed product to be furnished.
- C. Submit the number of samples that are desired by the Contractor to be returned plus one sample, which will be retained by the Engineer on site. Samples shall be reviewed and comments, if any, returned to the Contractor electronically with the status of the submittal indicated.

2.4 COLORS

- A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Engineer for review and selection.
- B. Submit the number of color and pattern charts that are desired by the Contractor to be returned plus three charts to be retained by the Engineer.
- C. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

2.5 CONSTRUCTION METHOD

- A. When specified or directed by the Engineer, submit proposed construction methods for those specific portions of the Work for review and approval.
- B. Include detailed written descriptions of the proposed construction.
- C. If required by the Specifications, submit working drawings to supplement the written description.
- D. The Engineer’s review and approval of construction methods will be in accordance with

approval process described herein.

- E. Such approval shall not relieve the Contractor from his responsibility with regard to fulfillment of the terms of the Contract.
- F. All risks associated with the proposed construction method shall remain with the Contractor.
- G. After review and approval, if the Contractor believes that modifications are necessary, submit a description of the required modifications in detail.
- H. Include reasons why the modifications are necessary.
- I. Do not use the modifications prior to review and approval by the Engineer.

2.6 MANUFACTURER’S INSTALLATION RECOMMENDATIONS

- A. Provide written, detailed, step by step preparation and installation instructions for the materials and products.

2.7 OPERATION AND MAINTENANCE MANUALS

- A. Comply with Section 01 78 23.

PART 3 EXECUTION

3.1 CONTRACTOR’S COORDINATION OF SUBMITTALS

- A. Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material and products, including the following procedures:
- B. Determine and verify all field dimensions and conditions, catalog numbers and similar data.
- C. Coordinate as required with all trades and all public agencies involved.
- D. Submit a written statement of review and certification of compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.
- E. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, all deviations from the Contract Documents. Clearly mark the deviation in the body of the submittal and state the deviation on the transmittal form of the submittal. Describe the benefits and reasons for the deviation.

END OF SECTION

**SECTION 01 35 23
SAFETY IN WASTEWATER WORKS**

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. The Contractor is responsible for conducting all work in a safe manner and shall take reasonable precautions to ensure the safety and protection of workers, property, and the general public.
- B. All Construction work shall be conducted in accordance with the latest applicable requirements of the Occupational Safety and Health Act, as well as any other local or state safety codes and regulations.
- C. The Contractor shall designate a trained and qualified employee who is to be responsible for ensuring that the work is performed safely and in conformance with all applicable regulations. The name and resume of the designated safety supervisor shall be submitted to the Engineer prior to commencing any construction work.
- D. The Contractor shall determine for himself the safety hazards involved in executing the work and the precautions necessary to conduct the work safely. If the Contractor is unsure as to any special hazards which may be unique to the various processes and facilities at the treatment plant, it shall be his responsibility to contact the Engineer and request such information in writing prior to beginning the work.
- E. The Contractor shall bear all risks associated with performing the work and shall indemnify the Owner and Engineer.

END OF SECTION

**SECTION 01 40 00
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section includes general requirements for quality control by the General Contractor.
- B. This section also contains new work and materials quality requirements.

1.2 RELATED WORK

- A. Submittals Section 01 33 00.

1.3 PROTECTION OF PROPERTY

- A. Existing Facilities
 - 1. Protect existing surfaces and facilities from damage resulting from the work unless the surfaces or facilities are being modified as part of this Contract.
 - 2. Protect existing paving, landscaping, and utilities from damage by mobile and stationary equipment, including vehicles delivering materials to the site.
 - 3. Protect adjacent structures from damage. Provide the following whenever required by law or necessary for safety:
 - a. Shoring
 - b. Bracing
 - c. Underpinning
 - d. Other measures necessary to those portions of adjacent structures that may be affected by the work.
- B. Utilities
 - 1. Known utilities are shown on Drawings using best available information.
 - 2. The locations of these utilities are not guaranteed, nor is there any guarantee that other utilities are not present.
 - 3. Protect utilities from damage and cause no interruption of service.
 - 4. Establish and maintain direct contact with Owner of each utility that may be affected by work and proceed with work that may affect a utility only with the cooperation and approval of the Owner of the utility.
 - 5. Before commencing construction, verify the location of utilities in vicinity of work.

C. Detection of Movement and Damage

1. Conduct a pre-construction inspection of existing facilities and structures in vicinity of work.
 - a. Document inspection by photographs, video recordings, sketches, and narratives assembled into an inspection report.
 - b. Submit three (3) copies of the inspection report to the Engineer for approval.
 - c. Upon approval, the Engineer will sign and date the report and return one copy to the Contractor, indicating agreement that the report represents an accurate description of existing conditions.
2. Establish a system of reference points on or about structures that may be affected by excavation performed as part of work.
 - a. Survey the applicable reference points at least weekly whenever there is excavation in the vicinity.
3. Submit to the Engineer a copy of each movement detection survey within 24 hours after the survey is made.

D. Damage Repair

1. Repair damage to surfaces or facilities that are to remain in place as soon as possible after discovery.
2. Use repairs shall result in conditions equal or greater in strength than the original conditions.
3. Make repaired surfaces identical in color and texture to adjacent existing materials. Where materials cannot be matched, refinish surrounding area to give a uniform appearance acceptable to Engineer.
4. Replace shrubs, cultivated vegetation, and trees damaged by the work and not shown to be removed in kind.
 - a. Replace trees larger than 3 inches diameter, measured at a height of 3 feet above the ground swell, with trees of 3 inches in diameter.
 - b. Replace other vegetation with the same species and size as that damaged, unless otherwise approved by the Engineer.

1.4 SAFETY AND FIRE PROTECTION

A. Comply with Federal, State, and local safety and fire codes.

1. Where there are conflicting requirements, the more stringent shall apply.

B. Fire Protection

1. The storage of flammable material on site shall be kept to a minimum. Such material that is on-site shall be properly handled and stored.
 - a. Store gasoline and other flammable liquids in Underwriters Laboratories listed safety containers in conformance with the National Board of Fire Underwriters recommendations.
 - b. Do not store flammable liquids in buildings.
2. Except as otherwise provided, do not permit fires to be built or open salamanders to be used in work.
3. Comply with published standards of the National Fire Protection Association as they pertain to general construction practices such as cutting and welding.
4. Provide a sufficient number of approved, non-freeze, portable fire extinguishers distributed throughout the project.

1.5 MANUFACTURED GENERAL REQUIREMENTS

A. Manufactured and Fabricated Products

1. Design, fabricate and assemble in accordance with the best engineering and shop practices.
2. Manufacture like parts to be interchangeable, with standard sizes and gauges.
3. Two or more items of the same kind shall be identical and by the same manufacturer.
4. Provide products which are suitable for the service conditions in which they are installed.
5. Adhere to equipment capacities, sizes, and dimensions shown or specified unless variations are specifically approved by the Engineer.
6. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.6 APPROVAL OF MATERIALS

A. Incorporate only new materials and equipment into the Work.

1. The Engineer shall inspect and approve all materials and equipment incorporated into the Work.
2. Do not deliver material to the site or incorporate it into the Work without prior approval of Engineer.
3. Provide all facilities and labor for handling and inspecting materials and equipment for the project.

4. Submit samples, if directed by the Engineer, for testing to demonstrate that they conform to the specifications.
- B. Provide, store, pack, and ship samples as directed by the Engineer or per manufacturer recommendations. This shall be at the Contractor's sole expense.
- C. Submit data and samples sufficiently early to permit their review and approval.
 - a. Approval is required before the items are incorporated into the Work.
 - b. Failure to submit samples or data in a timely manner shall not be an acceptable basis of claim for additional costs or time.
- D. Provide samples of workmanship or finish as directed by the Engineer. Samples may be used to:
 - a. Demonstrate the proficiency of workers or
 - b. Facilitate the choice among several textures, types, finishes, and surfaces.
- E. Use materials and equipment in the work that corresponds to approved samples or other data.

1.7 MANUFACTURER'S INSTALLATION INSTRUCTIONS

- A. Provide manufacturer's written installation instructions to all parties involved.
 - a. Maintain one set of complete instructions at the job site during installation and
- B. Handle, install, connect, clean, condition, and adjust products in strict accordance with the manufacturer's instructions and the Contract Documents. Perform all work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.8 DEFECTIVE WORK

- A. All materials furnished and work done by the Contractor at any time during the progress of the work shall be subject to the inspection of the Engineer, who shall have full power to accept or reject any part thereof.
- B. The Contractor shall remedy any defective or unsatisfactory work or material at no additional cost to the Owner. In the event the Contractor fails to initiate corrections after written notice, the Engineer shall have full right to have same done and to bill the Contractor for cost thereof.

1.9 COMPETENT LABOR

- A. The Contractor shall employ only competent and skilled personnel on the work. Either

the on-site project manager or the field superintendent, as listed in the Contractor’s statement of qualifications, must be on site full time for the duration of the project. The on-site project manager or the field superintendent shall have the authority to receive orders and execute the Work. Should there be a change from the listed on-site project manager and/or field superintendent, the Contractor is to submit resume of proposed personnel to Engineer for approval.

1.10 TESTING AND INSPECTION

- A. Equipment testing will be performed in accordance with Section 01 79 00 – Facility Testing and Start-up of these specifications. Payment for testing not specifically stated to be paid for by the Owner is to be included in the construction costs bid for the item to be tested.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION

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**SECTION 01 45 23
TESTING LABORATORY SERVICES**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Testing laboratory inspection, sampling and testing is required for:
 - 1. Soils Compaction
 - 2. Concrete
 - 3. Earthwork
 - 4. Asphalt and concrete paving.
- B. Related Requirements in other parts of the project.
- C. Inspection and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities: conditions of the contract.

1.2 TESTING LABORATORY AND PAYMENTS

- A. Owner has preselected the testing laboratory service company. The costs for the testing shall be paid for by the Owner and is not part of this contract. The testing laboratory for this project is GeoSystems Engineering, Inc. Roswell, Georgia 30076.

1.3 QUALIFICATIONS OF LABORATORY

- A. Meet "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories.
- B. Meet basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for concrete and steel as used in construction."
- C. Authorized to operate in the State in which the Project is located.

1.4 LABORATORY DUTIES

- A. Promptly submit written report of each test and inspection: One copy each to the Engineer, Owner, Contractor, and one copy to Record Documents file. Each report shall include:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Testing laboratory name, address, and telephone number.

4. Name and signature of laboratory inspector.
 5. Date and time of sampling or inspection.
 6. Record of temperature and weather conditions.
 7. Date of test.
 8. Identification of product and specification section.
 9. Location of sample or test in the project.
 10. Type of inspection or test.
 11. Results of tests and compliance with contract documents.
 12. Interpretation of test as required by the Engineer or the Owner.
- B. Provide reports summarizing all testing performed. Each report shall tabulate all testing data and should have a section that highlights any inconsistencies with any material supplied or work performed on the job during that period. Each report shall be submitted to the Engineer promptly.

1.5 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

- A. Laboratory is not authorized to:
1. Release, revoke, alter or enlarge on requirements of Contract Documents.
 2. Approve or accept any portion of the work.
 3. Perform any duties of the contractor.

1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with laboratory personnel; provide access to work site.
- B. Secure adequate quantities of representational samples of materials proposed to be used and which require testing.
- C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.
- D. Furnish copies of products test reports as required.
- E. Furnish incidental labor and facilities:
1. To provide access to work to be tested.
 2. To obtain and handle samples at the project site or at the source of the product to be tested.

3. To facilitate inspections and tests.
 4. For storage and curing of test samples.
- F. Contact the testing laboratory when testing or samples are required by the testing laboratory. Contractor shall provide 24-hour advance notice to allow for laboratory assignment of personnel and scheduling of tests.
1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.
- G. Where the test results indicate a failure to meet the specified requirements, the Contractor shall pay all costs for re- testing with no reimbursement from the Owner.

END OF SECTION

**SECTION 01 45 33
SPECIAL INSPECTION SERVICES**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Special testing is required by Building Code to verify the materials are properly constructed. Examples include, but not limited to:
 - 1. Reinforcement prior to concrete installation
 - 2. Field welding
 - 3. Inspection of masonry wall
 - 4. Fire suppression systems
 - 5. Plumbing
- B. Related Requirements in other parts of the project.
- C. Owner or County will provide these services.

1.2 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with special inspections personnel; provide access to work site.
- B. Contractor shall provide 24-hour advance notice to allow for special inspections.
- C. Where the inspection results indicate a failure to meet the specified requirements, the Contractor shall pay all costs for the inspection with no reimbursement from the Owner.

END OF SECTION

**SECTION 01 45 34
DELIVERY STORAGE AND HANDLING**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide, transport, handle, store and protect material and equipment used on this project as specified herein.

1.2 TRANSPORTATION AND HANDLING

- A. Arrange product deliveries in accordance with the approved construction schedule. Coordinate to avoid conflict with work and conditions at the project site.
 - 1. Deliver products in undamaged condition and in the manufacturer's original containers or packaging with identifying labels intact and legible.
 - 2. Materials and equipment delivered to the site shall be crated, boxed, or otherwise completely enclosed and protected during shipment, handling, and storage.
 - 3. Boxes, crates and other protection shall be labeled.
 - 4. Inspect shipments immediately upon delivery.
 - a. Ensure compliance with requirements of Contract Documents and approved submittals.
 - b. Ensure that products are properly protected and undamaged.
- B. Handle products and packaging using methods designed to prevent damage.
- C. Equipment and materials damaged during delivery shall be replaced by the Contractor at no expense to the Owner.

1.3 PROTECTION DURING STORAGE

- A. Provide covered, weather-protected structures to store products and equipment. Examples of suitable enclosures include buildings or trailers which have a concrete or wooden floor, a roof, and fully closed walls on all sides.
 - 1. Provide a clean, dry, non-corrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment.
 - a. Protect mechanical and electrical equipment from contamination by dust, dirt, water, atmosphere moisture, chemicals, insects, animals, vandals, or other sources of damage.
 - b. Store equipment in strict accordance with the manufacturer's instructions. Include heating and moisture control when required. Maintain temperature and humidity within the ranges recommended in manufacturers' instructions.

- Lubricate equipment during storage if recommended.
2. Replace corroded, damaged, or deteriorated equipment and parts before project acceptance.
 3. Do not include improperly stored equipment and materials in payment estimates.
 4. Ensure that all seals and labels remain intact and legible during storage.
 5. Store fabricated products above the ground or floor and on blocking or skids.
 - a. Prevent soiling or staining.
 - b. Cover products which are subject to deterioration with impervious sheet coverings.
 - c. Provide adequate ventilation to avoid condensation.
 6. Provide heated storage for materials subject to damage by freezing or low temperatures.
 7. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
 - a. Store cement, sand, and lime under roof and off the ground.
 - b. Keep material completely dry at all times.
- B. Handle and store all material and equipment in a manner to prevent warping, twisting, bending, breaking, cracking chipping, spalling, rusting, staining, and any injury, theft, dampness, corrosion, or damage of any kind whatsoever.
1. Store structural steel, miscellaneous steel and reinforcing steel off the ground and away from water or otherwise prevent accumulations of dirt or grease and corrosion.
 2. Store steel beams with the webs vertical.
- C. Remove all material which, in the sole opinion of Engineer, is damaged from the project site. The Contractor shall receive no compensation for either the damaged material or its removal.
- D. Arrange stored items in a manner to provide easy access for inspection.
1. Make periodic inspections of stored products.
 2. Ensure that products are maintained under specified conditions, and free from damage or deterioration.
- E. Protect installed products from damage due to traffic, fallen objects, incidental contact by equipment or other materials during placement, and any other subsequent construction operations. Remove protection prior to testing.
- F. Correct storage and handling issues that do not conform to these specifications within seven days after receiving written notice to do so.

1. If the Contractor fails to act within the specified length of time, the Owner and/or Engineer may correct all deficiencies identified in the written notice and deduct the costs associated with these corrections from Contractor's payments.
2. The Owners costs shall include labor, equipment usage, administration, clerical, engineering, and any other costs associated with making the necessary corrections.

1.4 EQUIPMENT DELIVERY, STORAGE, AND HANDLING ON SITE

- A. Do not deliver equipment to the project site more than one month prior to installation without written authorization from Engineer.
- B. Store instruments and equipment with moving parts such as gears, electric motors, etc. in a temperature and humidity-controlled building approved by the Engineer until such time as the equipment is to be installed.
 1. Store such equipment fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
 2. Rotate the moving parts of all equipment in storage at least once weekly to ensure proper lubrication and to avoid metal-to-metal "welding."
 - a. When equipment is installed, start the equipment at a minimum of half load on a weekly basis.
 - b. Operate equipment for a sufficient length of time to ensure that the equipment does not deteriorate from lack of use.
 - c. Change lubricants when installation is complete and as frequently as required thereafter during the period between installation and acceptance.
 - d. Mechanical equipment to be used in the work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed, and lubricated prior to testing and startup.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.1 SCOPE

- A. This Section includes requirements for the installation, maintenance and removal of temporary utilities, controls, facilities, and construction aids during construction.

1.2 SANITARY FACILITIES

- A. The Contractor must provide portable toilet facilities during construction activities. The Contractor shall pay all costs for sanitary facilities. Owner's facilities will not be available for Contractor's use.

1.3 PARKING AND WORK AREAS

- A. The Contractor must park equipment, construction, and private vehicles, in a safe manner off all travel lanes.
- B. Areas on the plant site can be utilized for materials storage. Any additional areas needed must be provided off-site by the Contractor at its sole expense.

1.4 EROSION CONTROL

- A. The Contractor shall comply with the requirements of the State of Georgia General NPDES Permit for Storm Water Discharges from Construction Activities, General Permit No. GAR100002. The cost of the work from the Notice of Intent to the Notice of Termination and all other activities related to the Erosion and Sedimentation Control Program shall be included in the overall cost of the project. No separate payment will be made for this work.
- B. All erosion and sedimentation control measures and Best Management Practices (BMPs) must be in conformance to the State of Georgia Erosion and Sedimentation Control Act of 1975, as currently amended. All erosion and sedimentation control measures must be installed in accordance with the Manual for Erosion and Sedimentation Control in Georgia, as currently amended.
- C. At a minimum, the General Permit includes having BMP plan on site, initial inspection for BMP record keeping, rain measurement, repairs, etc.
- D. Contractor is responsible for all sampling to comply with the General Permit.
- E. All Erosion and Sedimentation control measures must be installed prior to initiation of construction activity.

1.5 TEMPORARY UTILITIES

- A. Potable Water: Potable water will be available from the Owner for drinking from a cooler, etc. Contractor shall pay for all costs to transfer water from source to point of use.
- B. Telephone: Telephone service is not available from the Owner. Contractor shall pay all costs to establish a separate telephone service.
- C. Internet: Contractor must maintain an e-mail account over the duration of the Contract.
- D. Temporary light and power
 - 1. Contractor may use existing 110-volt outlets for operation of hand tools, where such outlets are available and functional; however, the existence of an outlet does not guarantee that it is functional, and the Owner will not be responsible for repairing non-functioning outlets.
 - 2. Contractor shall provide all additional temporary light and power necessary to complete the work, including 220-volt service for welding. Make necessary arrangements with the local electric company for temporary electric service and pay all expenses in connection therewith.
 - 3. Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. For connection of power tools and equipment, provide outlets equipped with ground-fault circuit interrupters, reset button and pilot light.
 - 4. Provide grounded extension cords. Use “hard service” cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if more than one length is required.
 - 5. Provide general service incandescent lamps as required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures were exposed to moisture.
- E. Temporary heat
 - 1. Provide all heat as may be necessary for proper execution and protection of the work.
- F. Non-potable water
 - 1. Owner will allow the Contractor to withdraw non-potable water for structure water tightness testing and process start-up.

1.6 DUST CONTROL

- A. The Contractor shall always provide dust control, including holidays and weekends, as required to abate dust nuisance on and about the site which is a result of construction activities. Dust control shall be by means of sprinklered water or by other approved methods, except that chemicals, oil, or similar palliatives shall not be used.
- B. Quantities and equipment for dust control shall be sufficient to effectively prevent dust nuisance on and about the jobsite; and when weather conditions warrant, sprinkling equipment shall be always on hand for immediate availability.
- C. The Engineer shall have authority to order dust control work whenever conditions warrant, and there shall be no additional cost to the Owner, therefore. Dust control shall be effectively maintained whether the Engineer orders such work.
- D. Complaints from the public relating to construction shall be reported to the Engineer and shall be acted on immediately.
- E. Where earthwork operations are in progress, keep exposed earth surfaces dampened continuously. Also, keep dirt accessways and roads dampened continuously.
- F. If portions of the site are temporarily inactive or abandoned for whatever reason, provide dust control and abatement continuously during such periods of inactivity.
- G. Where dust resulting from construction activities has collected on public sidewalks and streets, hose down such sidewalks and streets to abate flying dust particles. Clean all sidewalks and streets of accumulated dirt and dust.

1.7 MUD CONTROL

- A. The Contractor shall take measures to prevent tracking of mud onto public streets, drives, and sidewalks.
- B. All egress from the site shall be maintained in a dry condition, and any mud tracked onto streets, sidewalks, or drives shall be immediately removed, and the affected area shall be cleaned. The Engineer may order such work at any time the conditions warrant.
- C. Where trucks will leave a muddy site and enter paved road surfaces, the Contractor shall maintain a suitable truck wheel-washing facility and crew. All trucks, or other vehicles leaving the site, shall be cleaned of mud and dirt, including mud and dirt clinging to exterior body surfaces of vehicles.
- D. All trucks coming to the jobsite or leaving the jobsite with materials or loose debris shall be loaded in a manner that will prevent dropping of materials or debris on streets. Spillage resulting from hauling operations along or across any public traveled way shall be removed immediately.

1.8 TEMPORARY VENTILATION

- A. Provide temporary ventilation of construction areas. Exhaust air to outdoor discharge. Locate exhaust air discharge to an elevation sufficient to prevent personnel contact with the exhaust air.

1.9 BYPASS PUMPING

- A. The Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting the existing sewer flow where required. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The Contractor shall employ the services of Godwin Pumps, Rain for Rent, or approved equal. The vendor shall provide at least 5 references of projects of a similar size and complexity as this project performed by his firm within the past 3 years. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
- B. Equipment: All pumps used shall be fully automatic self-priming units that do not require the use of foot valves or vacuum pumps in the priming system. The pumps shall be diesel powered unless approved otherwise by the Engineer. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.
 - 1. The Contractor shall provide the necessary stop/start controls for each pump.
 - 2. The Contractor shall include one standby pump of each size utilized to be maintained on site.
 - 3. Back-up pumps shall be on-line, isolated from the primary system by a valve.
 - 4. Discharge Piping: In order to prevent accidental spillage of flows all discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Under no circumstances will glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the Engineer.
- C. Design Requirements:
 - 1. Bypass pumping systems shall have sufficient capacity to pump a peak flow as required for the system being bypassed. Bypass shall be capable of passing a solid 3" diameter sphere. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired. Bypass pumping systems operating for more than 24 hours will require overnight monitoring by the contractor or a wireless monitoring system; Alarm Agent by RACO or equal.

2. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
3. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performance of work.
4. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing system pressure on discharge.

D. Performance Requirements:

1. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and backup units as required), conduits, all necessary power and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.
2. The Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.
3. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, which will not cause damage to sewers and that will protect public and private property from damage and flooding.
4. The Contractor shall protect water resources, wetlands and other natural resources.

E. Field Quality Control and Maintenance:

1. Test: The Contractor shall test the system for 4 hours during peak flows before dismantling existing pump system.
2. Inspection: Contractor shall inspect bypass pumping system every two hours to ensure that the system is working correctly.
3. Maintenance Service: The Contractor shall insure that the temporary pumping system is maintained 24/7 when operating.

4. Extra Materials:
 - a. Spare parts for pumps and piping shall be kept on site as required.
 - b. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

1.10 FENCING

- A. Maintain existing fencing during construction until completion of the work. Erect temporary fencing to maintain security around the job site or where permanent fencing must be removed to allow for construction.

1.11 CUTTING AND PATCHING OF PAVEMENT

- A. Contractor is responsible for all cutting and patching pavement during construction. Always maintain passable plant roads. Install pavement patches as required to match the adjacent material.

END OF SECTION

**SECTION 01 52 13
FIELD OFFICE**

PART 1 GENERAL

1.1 TEMPORARY OFFICES FOR CONTRACTOR

- A. Temporary offices shall be established on the job site and adequately furnished, and maintained in a clean, orderly condition by the Contractor. The Contractor or his authorized representative shall be present in the field office at all times while work is in progress. Instructions received there from the Engineer shall be considered as delivered to the Contractor.
- B. The office shall be provided with janitor service, restroom, heating and air conditioning equipment, electrical wiring, outlets, and fixtures suitable to light tables and desks adequately.
- C. At this office, maintain complete field file of shop drawings, Contract Documents and Record Drawing mark-ups.

1.2 FIRE EXTINGUISHERS

- A. Provide portable UL-Rated Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide portable UL-Rated Class ABC dry chemical extinguishers or a combination of NFPA recommended Classes for the exposure. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

- A. Fill and grade site for temporary structures to provide surface drainage.

3.2 INSTALLATION

- A. Construct temporary field office on proper foundations and provide connections for utility services.
- B. Secure portable or mobile buildings when used.
- C. Provide steps and landings at entrance doors.
- D. Mount thermometer at convenient outside location, not in direct sunlight.
- E. Potable water and sewer service connections are the responsibility of the Contractor.

3.3 MAINTENANCE

- A. Provide periodic maintenance and cleaning for temporary structures, furnishings, equipment, and services.

3.4 REMOVAL

- A. Remove temporary field offices, contents and services at a time when they are no longer needed.
- B. Remove foundations and debris; grade the site to required elevations and clean the area.

END OF SECTION

**SECTION 01 65 00
MATERIALS AND EQUIPMENT**

PART 1 GENERAL

1.1 SCOPE

- A. These requirements apply, in general, to all equipment and piping. They supplement the detailed equipment specifications, but in case of conflict, the detailed equipment specifications shall govern.

1.2 COORDINATION

- A. The Contractor shall resume full responsibility for the coordination of the installation of all equipment, materials and products furnished under these Contract Documents. The Contractor shall be completely responsible for verification that all structures, piping and equipment components furnished by him and/or his Subcontractors and Suppliers are compatible. The Contractor shall start up each equipment system and shall make all necessary adjustments to place each system in proper operating condition.

1.3 ADAPTATION AND LOCATION OF EQUIPMENT

- A. Equipment shall be readily adaptable for installation and operation in the structures to be constructed under these Contracts. No responsibility for alteration of a planned structure to accommodate other types of equipment will be assumed by the Owner. Equipment, which requires alteration of the structures, will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations. All such alterations shall be made at the Contractor's expense.
- B. The Contractor shall install the work in such manner that the equipment, piping, vents, conduit, panels, ductwork, etc., be as neatly installed and out-of-the-way as physically possible. All equipment, piping, ductwork, conduit, etc., shall be installed to provide needed maintenance and passage space.

1.4 PATENT ROYALTIES

- A. All royalties and fees for patents covering materials, articles, apparatus, devices, or equipment shall be included in prices bid by the Contractor.

1.5 WORKMANSHIP AND MATERIALS

- A. All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall be new and shall not have been in service at any time prior to delivery, except as required by tests. All bolts, nuts, fastening, pipe and fittings shall be manufactured in conformance with the

United States system of measurement.

- B. Materials shall be suitable for service conditions. Iron castings shall be tough, close grained, gray iron free from blowholes, flaws, or excessive shrinkage and shall conform to ASTM A48, Class 30 minimum. Plugging of defective castings shall not be permitted. Castings shall be annealed to remove internal stresses prior to machining and shall have the mark number and heat number cast on them.
- C. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads.
- D. All replaceable or expendable elements such as filters, screens, drive belts, fuses, indicator lamps, etc., shall be easily accessible and replaceable without need of dismantling equipment or piping. All such items shall be of a standard type that is readily available from multiple suppliers.
- E. Threaded openings for drains or vents in pump volutes, compressor or fan scrolls, air receivers, and heat exchangers which are plugged during normal operation shall be provided with stainless steel plugs.

1.6 LUBRICATION AND LUBRICATION FITTINGS

- A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during start-up or shutdown and shall not waste.
- B. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quality by the Contractor to fill all lubricant reservoirs and to replace all lubricants consumed during testing, start-up, and initial operation. The Contractor shall provide sufficient quantities of lubricants to lubricate all equipment for one year of normal service before final acceptance of the equipment will be made by the Owner.
- C. Where special run-in oil or storage lubricants are used, they shall be flushed out and replaced with the required service lubricant by the Contractor.
- D. Tag each piece of equipment with cloth tag showing proper type lubricant, period between lubrication, date of lubrication, and worker's initials. Have space for ten lubrication notations.
- E. Except for rotating shaft couplings, all lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards. Fittings shall be accessible from safe, permanent platforms or portable high-pressure grease gun. Connection from a remote fitting to the point of use shall be with minimum 3/16-inch stainless steel tubing, securely mounted parallel to equipment and protected where exposed.

1.7 DRIVE UNITS

- A. Except when specified otherwise in the detailed equipment specifications, 87 percent of the nameplate horsepower rating of each drive motor shall be at least equal to the theoretical brake horsepower required to drive the equipment under full load, including all losses in speed reducers and power transmission.
- B. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor.
- C. Drive units shall be designed for 24-hour continuous service and shall be constructed so that oil leakage around shafts is precluded.

1.8 GEAR MOTORS

- A. Gear Motors shall be rated AGMA Class II and shall bear an AGMA nameplate.

1.9 GEAR REDUCERS

- A. Each gear reducer shall be totally enclosed, oil-lubricated, with antifriction bearings throughout. Worm gear reducers shall have a service factor of at least 1.25. Shaft-mounted gear reducers shall be rated AGMA Class II. Other helical, spiral bevel, and combination bevel-helical gear reducers shall have a service factor of at least 1.40. Each gear reducer shall bear an AGMA nameplate, or the manufacturer shall certify that the gear reducer is designated and rated in accordance with AGMA standards.

1.10 CHAIN DRIVES

- A. Chain drives shall utilize roller chain having an ultimate strength of not less than 10 times the maximum working loads.

1.11 V-BELT DRIVES

- A. Each V-belt drive shall include a sliding base or other suitable tension adjustment. Fixed ratio V-belt drives shall have a service factor of at least 1.5 based on motor nameplate horsepower.

1.12 COUPLINGS

- A. Couplings between motors drives or between drives and the driven equipment shall have a service factor of not less than 1.25 based on motor nameplate horsepower. Couplings between drives and the driven equipment shall have a service factor not less than that of the drive based on motor nameplate horsepower. All couplings rotating at speeds less than 900 rpm shall be of all steel construction. In general, couplings shall be of the tapered grid steel spring type or the crowned gear type.

1.13 OVERTORQUE PROTECTION

- A. All low speed, high torque drives for equipment such as mechanical screens, conveyors, and clarifier and thickener mechanisms shall be protected against excessive torque by means of a suitable over torque protection device. Acceptable devices shall include torque switches, shear pins, shear keys and full-release torque couplings. Torque limiting couplings using sliding surfaces or friction to limit torque shall not be used.

1.14 SAFETY GUARDS

- A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 gauge or heavier galvanized or aluminum-clad sheet steel or ½-inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water. All safety guards shall comply with OSHA General Industry Standards, Part 1910, Subpart O, Machinery and Machine Guarding. Provide tachometer access on shaft ends. The safety guards shall be painted yellow in accordance with Section 09 91 00, Painting.

1.15 ANCHOR BOLTS

- A. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Two nuts and two washers shall be provided with sufficient threads to permit a nut and washer to be installed on the concrete side of the concrete form or supporting template, but in no case shall bolts be threaded less than 2 (two) inches. Anchor bolts used in anchoring rotating or vibrating equipment shall be provided with suitable lock washers.
- B. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit a minimum of one (1) inch of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Individual, embedded anchor bolts for heavy equipment shall be centered in a steel pipe sleeve having an inside diameter approximately two (2) times the bolt diameter and an embedded length approximately eight (8) times the bolt diameter.
- C. Bolts specified to be bent shall be bent cold. Bend radius shall not be less than twice the bolt diameter. Unless otherwise shown or specified, anchor bolts shall be embedded in concrete a minimum distance of fifteen (15) times the bolt diameter. Unless otherwise shown or specified, all anchor bolts shall be at least ½ inch diameter.
- D. All embedded anchor bolts or anchor bolt materials shall be ASTM A 193, Grade B8, ASTM A276, Type 304, or IFI-104, Grade 304 stainless steel threaded per ANSI B1.1. Nuts shall be heavy hex nuts, ANSI B18.2, semi-finished pattern, and shall be ASTM A194, Grade 8 or IFI-104, Grade 304 stainless steel. Flat washers shall be 18-8 stainless

steel and shall conform to ANSI B27.2

- E. Expansion anchors shall be used to anchor equipment to existing concrete. Expansion anchors shall be stainless steel, Type 304 and shall be of the wedge type for use in bottomless holes. Expansion anchors shall conform to the applicable requirements of Federal Specification FF-S-325. Installation methods shall be in conformance with the manufacturer's recommendations for maximum pullout and shear strength, but in no case shall the depth of the hole be less than eight (8) bolt diameters or three (3) inches, whichever is greater. The minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall not be less than five (5) times the diameter of the hole in which it is installed. The minimum distance between adjacent anchors shall not be less than ten (10) times the diameter of the hole in which it is installed.

1.16 EQUIPMENT BASES

- A. Equipment shall be installed on a raised reinforced concrete base. The base shall be a minimum of four (4) inches in height and shall extend beyond the equipment baseplate approximately two (2) inches on all sides.
- B. The electrical contractor shall be instructed concerning electrical conduit locations prior to pouring the concrete base.
- C. Unless otherwise specified, a cast iron or welded steel baseplate shall be provided for each pump, compressor, and any other item of equipment which is to be installed on a concrete base. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components and adequate grout holes. Baseplates for pumps shall have a raised lip all around and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with epoxy or non-shrink grout as specified in the grouting section.
- D. On direct-coupled equipment, motor and driven equipment shall be doweled to a common base with a minimum of two (2) dowels each.

1.17 ALIGNMENT OF MOTORS AND EQUIPMENT

- A. After machine base grouting, all machines mounted on baseplates or soleplates shall be laser aligned. All equipment with a motor horsepower less than or equal to 5 is exempt.
- B. Machines supported on integral feet or support pads shall be leveled, grouted and aligned in the following order: driven machine; intermediate bearings or machines; and driver. All machines shall be aligned without any connections to piping, electrical and instrumentation systems.
- C. Upon completion of all field connections, alignment shall be rechecked to demonstrate no change. If change has occurred, the Contractor shall eliminate any external forces affecting machine alignment and repeat the alignment process. All machine alignment

parameters shall be rechecked after the equipment has been brought to operating temperature by operation at specified conditions.

- D. Where required by other sections in the Contract Documents, factory authorized installation technicians representing the equipment manufacturer shall witness final alignment work. All alignment work shall be independently checked using the shaft and coupling spool method described in the “Shaft Alignment Handbook 2nd Edition”.
- E. After completion of all alignment work and acceptance in writing, by factory installation technicians, all machines shall be doweled in place using tapered stainless steel dowels.
- F. Alignment work shall be performed by journeyman millwrights skilled in this type of work under the supervision of a technician trained in the use of the laser alignment by the manufacturer of the alignment equipment. The use of laborers, carpenters or apprentices for this work will not be acceptable.
- G. All final results of the alignment work shall be subject to inspection and verification by the Engineer.
- H. Equipment shall be installed in such a way that no strain is transmitted to the equipment by piping systems or adjacent equipment.

1.18 GROUTING

- A. A special epoxy, non-shrink grout shall be used in the placement of all pumps, motor, and equipment baseplates or bedplates, column baseplates, other miscellaneous baseplates, and other grouting applications as shown on the Drawings.

1.19 WELDING AND BRAZING

- A. All welds shall be sound and free from embedded scale and slag. All butt welds shall be continuous and where exposed to view shall be ground smooth. All continuous welds shall be gas and liquid tight. Welds in piping shall have full penetration and shall be smooth on the inside of the pipe. Intermittent welds shall have an effective length of at least two (2) inches and shall be spaced not more than six (6) inches apart.
- B. All welding of steel and aluminum, including materials, welding techniques, general safety practices, appearance and quality of welds, and methods of correcting defective work, shall conform to the latest requirements of AWS Specifications. Structural steel welding shall conform to the requirements of the AWS Structural Welding Code. The general recommendations and requirements of the AWS Structural Code shall also apply to welded aluminum structures. The welding process and welding operators must meet qualification tests and welding performance tests in accordance with the latest provisions of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. Welding process and qualification procedures for welding of pipe shall conform to the latest requirements of ANSI B31.1, Section 327, Welding, and Section 328, Brazing and Soldering. All welding qualification tests shall be witnessed by the

Engineer, except as provided herein. All costs associated with the qualification or testing of welder and welding operators shall be borne by the Contractor.

- C. Actual welding procedures to be used in field assembly and installation of equipment furnished under this Contract shall be submitted to the Engineer for approval prior to beginning the work. Reports certifying that the welding procedures, welders and welding operators that the Contractor intends to use are qualified as specified above shall also be submitted to the Engineer prior to beginning the work. In case of welder qualifications for shop welding and for carbon steel field welding, welders presenting certified qualification papers validated within the preceding six (6) month period and acceptable to the Engineer will not be required to take the qualification tests. In case of field welding of stainless steel or aluminum, all welders shall be required to take the qualification tests regardless of past experience or availability of certified qualification papers.
- D. Field welding practices shall conform to OSHA construction standards, Part 1926, Subpart J, Welding and Cutting. Shop welding practices shall conform to OSHA General Industry Standards, Part 1910, Subpart Q, Welding, Cutting, and Brazing.
- E. Welding electrodes for structural steel shall conform to the standard recommendations of the AISC. Welding electrodes for stainless steel shall conform to applicable AWS Specifications and shall be as recommended by “Welded Austenitic Chromium-Nickel Stainless Steel, Techniques and Properties”. Published by the International Nickel Company, New York, New York. Welding electrodes for aluminum shall conform to applicable AWS Specifications.
- F. Each welder and welding operator must identify his/her welds with his/her assigned symbol.
- G. Welders performing unsatisfactory work shall be removed from the welding process.
- H. The Owner may inspect any weld by radiographic or other means. Welds not in accordance with the requirements specified herein shall be repaired or replaced at the Contractor’s expense. Excessive porosity, nonmetallic inclusions, lack of fusion, incomplete penetration, and cracking shall constitute grounds for rejection of welds.

1.20 ERECTION AND SETTING

- A. In erection and setting of all fabricated equipment, the Contractor shall exercise care to ensure that each item of equipment is adequately supported so as not to bend or distort under its own weight until adequate foundation support and anchorage are provided. Where lifting lugs, angles or clips are provided on equipment, they shall be used in erecting and setting equipment. Erection and setting of equipment and structural steel shall conform to the requirements of OSHA Construction Standards.
- B. During placement and prior to any grouting or connection of adjacent piping the equipment shall be leveled and aligned true to level, plumb, alignment, and grade with all parts bearing or fitting the structure or equipment accurately and securely. It shall not

be permitted to cock out of alignment, redrill, reshape or force fit any fabricated items.

- C. The Contractor shall take all measurements necessary to properly fit his work in the field, and he shall be governed by and responsible for these measurements and the proper working out of all details. The Contractor shall be responsible for the correct fitting of all work in the field and the accurate placement of all anchor bolts installed by him.
- D. The Contractor shall bring all parts to be erected or assembled into close contact. Before assembly, all surfaces to be in contact with other shall be thoroughly cleaned. Drift pins may be used only for bringing members into position, never to enlarge or distort holes. Torching or burning of holes or cutting of fabricated items to correct misalignment or shop errors shall not be permitted. Enlargement of holes necessary to make field connections shall be done only with the Engineer's approval by reaming with twist drills and in a manner acceptable to him.
- E. All equipment shall be furnished with suitable eyebolt lifting lugs or lifting angles to facilitate handling.

1.21 VIBRATION TESTS

- A. Unless specified otherwise in the detailed equipment specifications, each pump, motor or similar item of stationary rotating equipment having a rated power in excess of 50 Hp or an operating speed in excess on 1,800 rpm shall be tested in the field for acceptable vibration levels. Vibration testing shall be performed by an experienced, factory-trained and authorized vibration analysis expert (not a sales representative) retained by the Contractor for this work. Each unit or pump system shall be tested separately without duplicate equipment running. All field-testing shall be done in the presence of the Engineer. The engineer shall be furnished with four (4) certified copies of vibration test data for each test performed.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

**SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS**

PART 1 GENERAL

1.1 GUARANTEE OF WORK

- A. All work shall be guaranteed against defects in workmanship and material for a period of one year after the date of acceptance by the Owner. Refer to the General Conditions for details.

1.2 PUNCH LIST

- A. The Engineer and Owner will perform a Punch List inspection after Substantial Completion.
- B. The punch list is the basis for establishing Final Completion for the Work. The schedule for completing and/or correcting punch list activities shall be no longer than 30 consecutive calendar days for intermediate milestones and 60 consecutive calendar days for final contract completion but shall be scheduled to conclude on or before the contract completion date and it shall be initiated immediately upon Substantial Completion. The overall Contract duration is based upon a 60-day period following the contractual date for Substantial Completion to establish the contractual date for Final Completion. Later delivery of Substantial Completion shall not revise the Final Acceptance date. Assessment of liquidated damages for late Substantial Completion shall not relieve assessment of liquidated damages for Final Acceptance should Final Acceptance be established beyond the contractual completion date.

1.3 PROJECT RECORD DRAWINGS

- A. Project Record Drawings shall be submitted to the Engineer prior to Final Acceptance for Payment is recommended.
- B. Legibly marked drawings to record actual construction including, but not limited to:
 - 1. Measured horizontal and vertical locations of underground utilities.
 - 2. Field changes of dimensions and details.
 - 3. Details not on original Contract Drawings.
 - 4. Changes made by Change Order.
 - 5. Location of Facilities.
 - 6. Location of Utilities.

7. Use of different products or materials.
8. Other matters not originally specified or documented.

END OF SECTION

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**SECTION 01 74 23
CLEAN-UP**

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section covers general cleaning which the Contractor shall be required to perform both during construction and before final acceptance of the project unless otherwise shown on the Drawings or specified elsewhere in these specifications.

1.2 GENERAL

- A. The Contractor shall clean the work site of all trash and foreign object debris on a daily basis.

1.3 HAZARD CONTROL

- A. The Contractor shall store volatile wastes in covered metal containers and remove from premises daily.
- B. The Contractor shall prevent accumulation of wastes which create hazardous conditions.
- C. Burning or burying rubbish and waste materials on the site shall not be allowed.
- D. Disposal of volatile wastes into sanitary or storm sewers is not permitted.

1.4 DISPOSAL OF SURPLUS MATERIALS

- A. Unless otherwise shown on the Drawings, specified, or directed, the Contractor shall dispose of all surplus excavated materials and materials and equipment from demolition, legally off the site, and shall provide his own suitable, off-site spoil area, or on a site designated by the Owner.
- B. The Owner shall have the opportunity to inspect any materials removed prior to disposal by the Contractor. If said materials are determined to be salvageable by the Owner, the Contractor shall transport, and unload said material to an area designated by the Owner.

1.5 FINAL CLEANING

The Contractor shall:

- A. Schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.
- B. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.

- C. Employ experienced workmen or professional cleaners for final cleaning.
- D. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces and of concealed spaces.
- E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.
- F. Repair, patch, and touch up marred surfaces to specified finish to match adjacent.
- G. Brom clean paved surfaces; rake clean other surfaces of grounds.
- H. Clean screens on air intake vents.
- I. Upon completion of the work, Contractor shall remove from the site all plant, material, tools, and equipment belonging to him, and leave the site with an appearance acceptable to the Engineer.
- J. The Contractor shall thoroughly clean all equipment and materials installed in this project.
- K. Restoration of Landscape Damage: Any landscape feature scared or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. The Engineer will decide what method of restoration shall be used.
- L. Post-Construction Cleanup or Obliteration: The Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction.

END OF SECTION

**SECTION 01 78 23
OPERATING AND MAINTENANCE DATA**

PART 1 GENERAL

1.1 SCOPE

- A. The Contractor shall provide (1) electronic copy in a PDF format of a complete and comprehensive reference manual containing operating and maintenance data to enable operators and plant engineers to correctly operate, service, and maintain for each piece of equipment and accessories covered by these Specifications. The data contained in the manual should explain and illustrate clearly and simply all principles and theory of operation, operating instruction, maintenance procedures, calibration procedures and safety precautions and procedures for the equipment involved. Safety precautions and procedures shall be stressed.

PART 2 PRODUCTS

2.1 SUBMITTAL

- A. Before the Work is 80 percent complete, the Contractor shall submit one electronic copy in PDF format of each manual, complete in detail as specified below. The Engineer will notify the Contractor, in writing, of any deficiencies in the manual and will return the manual for completion and/or correction. The Contractor shall submit one electronic copy in PDF format of any revised or additional data required to complete the manual or as required by the Engineer.
 - 1. Submittal shall include:
 - a. The date of submission and the dates of any previous submissions.
 - b. The Project Title: City of Jefferson, Ga – Central City WRF Phase 1
 - c. Numerical submittal numbers, starting with 1.90, 2.90, etc. Revisions to be numbered 1.91, 1.92, etc.
 - d. The names of: Contractor, Supplier & Manufacturer
 - e. Identification of the product, with the Specification section number, permanent equipment tag numbers and applicable Drawing Number.
- B. At the time of the inspection for Project completion, the Engineer will notify the Contractor of any revisions, corrections or incomplete data required for the satisfactory completion of the Operating and Maintenance Manual. The Engineer will not recommend final acceptance of the Work until the Operating and Maintenance Manual is complete and satisfactory to the Engineer.

2.2 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

- A. A complete, detailed listing of all equipment, components and accessories showing component name, manufacturer, model number and quantity information shall be furnished for each component as outlined below:
1. Equipment function, normal operating characteristics and limiting conditions for all equipment furnished.
 2. Detailed assembly, installation, alignment, adjustment and checking instructions for all equipment furnished.
 3. Detailed operating instructions for start-up, calibration, routine and normal operation, regulation and control, shutdown and emergency conditions for all equipment furnished.
 4. Detailed lubrication instructions and schedules for all equipment furnished including identification of lubricant (description, specification, and trade name of at least two (2) manufacturers), and diagrams illustrating lubrication points.
 5. Detailed guide to "troubleshooting" for all equipment furnished.
 6. Detailed parts lists identified by generic title, materials of construction and part number (actual manufacturer's number, not supplier's) list of recommended spare parts identified as specified above, and predicted life of parts subject to wear, and an exploded view of each equipment assembly for all equipment furnished.
 7. Detailed disassembly, overhaul and reassembly instructions for all equipment furnished.
 8. Electrical and instrumentation schematics for all equipment furnished, including motor control centers, control panels, instrument panels and analyzer panels.
 9. List of all special tools supplied and description of their use for all equipment furnished. Special tools include any tool not normally available in an industrial hardware or mill supply house.
 10. Detailed preventative maintenance procedures and schedules for all equipment furnished.
 11. Detailed list of settings for relays, pressure switches, temperature switches, level switches, thermostats, alarms, relief valve, rupture discs, etc.
 12. One (1) copy of all record shop drawings and engineer data for all equipment furnished.
 13. Performance and characteristic operating curves for all equipment furnished.

14. List of names and addresses of nearest service centers for parts, overhaul and service.
15. One (1) copy of any instructions and parts list attached to equipment when delivered.
16. Procedures for storing, handling, and disposing of any chemicals or products used with the equipment or system.
17. The supplier's operation and maintenance information will address the equipment furnished, with specific details on operation and maintenance practices. General data is not acceptable.

PART 3 EXECUTION

3.1 ASSEMBLY OF OPERATING AND MAINTENANCE MANUAL

- A. Each electronic copy of the manual shall be assembled each with title page and table of contents.
- B. All copies of shop drawings, figures and diagrams shall be reduced to either 8-1/2 x 11-inches, or to 11-inches in the vertical dimension and as near as practical to 17-inches in the horizontal dimensions. Text, figures, and drawings shall be clearly legible and suitable for dry process reproductions.
- C. No separate payment will be made for the Operating and Maintenance Manual and the cost of said manual shall be included in the Contract Price.

END OF SECTION

SECTION 01 79 00
FACILITY TESTING AND START-UP

PART 1 GENERAL

1.1 DESCRIPTION

- A. Perform a field-testing program for mechanical equipment, systems, processes, digital process control systems, and electrical facilities.

1.2 DEFINITIONS

- A. System – Integrated operating unit consisting of mechanical and electrical equipment, piping, valves, structures, controls, and instrumentation which operate together to perform a specific function.
- B. Process Materials – Liquid or chemicals which are conveyed or treated by systems.
- C. Prerequisites – Items of work or submittals required prior to beginning each test.

1.3 QUALITY ASSURANCE

- A. Submit Manufacturer Proper Installation Certificate prior to Preliminary Testing. The form is located at the end of this Section.
- B. Comply as follows:
 - 1. Preliminary Test
 - a. The purpose of this phase of tests is to demonstrate that all of the equipment and systems when energized will perform the functions required by the Contract Documents, the approved Contractor’s Drawings, and the Operation and Maintenance Manuals for each item of equipment or system.
 - b. This phase of tests must demonstrate that the equipment or system has been installed, rotates when energized, sequences properly, and activates alarms, as required. Neither fluids nor process materials need to be utilized during this phase of testing.
 - c. The quality of workmanship and installation shall be examined for deficiencies which shall be logged in a punch list of items of work to be completed prior to the Prefinal Test. Specific tasks include (as applicable):
 - (1) Conduct adjustment, testing and calibration of all controls, switches, drives, and other instrumentation and control associated with the piece of equipment.
 - (2) Demonstrate that alignment and clearances are properly adjusted.

- (3) Demonstrate that the equipment can be started, operated in all local modes, and stopped locally as required.
 - (4) Verify proper operation of hard-wired interlocks.
 - d. Conduct additional testing required by the manufacturer to verify proper installation of the equipment.
 - e. When local codes or laws require approval and inspection of the work by other agencies or organizations before installation or operation, such approval shall be obtained. Submit one signed original and three copies of the approval to the Engineer.
 - f. In accordance with the Construction Schedule and with approval of the Engineer, schedule the Preliminary Tests a minimum of five (5) days before the Prefinal Tests are scheduled to begin.
 - g. Tests to be provided by the Contractor, and tests to be provided by an Independent Testing Company, shall be performed, and recorded prior to the Preliminary Tests in order to avoid delays of the scheduled testing procedures.
 - 2. Prefinal Test
 - a. The purpose of this phase of tests is to demonstrate that all equipment and systems have been installed in accordance with the Contract Documents, Operations and Maintenance Manuals, and the Contractor's Drawings which have been approved; all integrated equipment and systems operate as complete units; all punch list items developed in the Preliminary Tests have been corrected and the results of this Test shall contribute toward a unanimous, satisfactory recommendation from the Owner Inspection, Operations, and Maintenance personnel that the system is ready for Start-up.
 - b. Specific tasks include (as applicable):
 - (1) Demonstrate proper operation of the equipment in Local mode under actual or simulated operating conditions for a set period of time.
 - (2) Simulate alarm conditions to demonstrate operation of hard-wired interlocks.
 - (3) Complete vibration testing (if required).
 - (4) Check equipment for:
 - Overheating
 - Excessive vibration
 - Excessive noise

- Overcurrent
 - (5) Confirm operation of Emergency Stop / Lockout
 - (6) Demonstrate proper operation of automatic controls, if supplied by the manufacturer.
3. Startup Tests
- a. The purpose of this phase of tests is to demonstrate that the unit process within a system operate together to perform the required functions for an extended period of time, under actual operating conditions, with process liquids and chemicals. In addition, this test will verify that all systems and elements of the Work are fully operational and ready to be turned over to the Owner.
 - b. Deficiencies noted in the Prefinal Tests shall be corrected before starting the Startup Tests.
4. Record Forms
- a. Test data record forms shall be provided for each system and item of equipment tested. The form and format of the forms shall be submitted for approval. Completed test forms shall contain the following minimum identifications, data, and quality.
 - b. Project identification.
 - c. Test stage identification, Preliminary or Prefinal.
 - d. Sequence number of the test, i.e., First Test, Second Test...Final Test.
 - e. Date test began, and date when completed.
 - f. Identification of testing facility, e.g., Contractor, Independent Testing Co., Manufacturer.
 - g. All data shall be typewritten or neatly hand lettered, not long hand, and shall clear and bold to permit photocopying without loss of clarity.
 - h. All test data record forms, or the Title Sheet of a multiple page test report shall bear the signature of the person conducting the tests or the chief person of a test team. Signatures shall be augmented by typewritten or digital facsimiles.

1.4 TEST EQUIPMENT

- A. All test instruments, gauges, meters, and auxiliary equipment shall be provided by the Contractor and the Independent Testing companies and, where required, by

manufacturers field service personnel. All test equipment must have been tested and calibrated within 6 months of their use under this contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREREQUISITE ACTIVITIES

- A. Unless specified otherwise, perform the following prerequisite items of work, prior to beginning Preliminary Tests:
 - 1. Verify that there is no visible corrosion or mechanical damage to the equipment.
 - 2. Verify that all mountings are secure and level, all piping attached, all belts and drives are installed and tensioned correctly, and all safety features are in place.
 - 3. Verify that all control and power circuits to the equipment are energized.
 - 4. Bump motors to verify correct rotation.
 - 5. Perform megger tests on all motors and electrical equipment.
 - 6. Verify operation of valves.
 - 7. Inspect valving and verify proper open or shut positions.
 - 8. Check all feed and drain lines.
 - 9. Deliver manufacturer's Certifications and Contractor Compliance Forms in accordance with Section 01 33 00.
 - 10. Verify that all equipment has been properly lubricated in accordance with manufacturer requirements.
 - 11. Other activities as specified in this Section.
- B. Unless specified otherwise, perform the following items of work prior to beginning Prefinal Tests:
 - 1. Correct punch list items from Preliminary Test.
- C. Unless specified otherwise, perform the following items of work prior to beginning the Start-up Tests:
 - 1. Correct punch list items from Prefinal Test.
 - 2. Verify that adequate chemicals and/or process liquids are in place for the respective

equipment and systems.

3. Verify that equipment, piping, tanks, sumps, or wet wells do not leak when filled with clear potable water.
4. Complete disinfection procedures as required for potable water systems.
5. Complete all training activities required for each system, facility, and equipment.
6. Complete all SCADA testing including demonstration of remote/auto programs for all systems and processes.

3.2 START-UP TESTING

- A. All equipment, piping, structures, and facilities associated with the systems identified above shall satisfactorily complete Prefinal testing and associated deficiencies shall be corrected before Start-up testing shall begin. All costs associated with start-up testing or re-testing shall be the responsibility of the Contractor.

3.3 ACCEPTANCE OF THE WORK AND SPECIFIC TESTS

- A. The Owner will accept each system and process after successful completion of each Startup Test and 30 days operational period is complete. Failures resulting from mechanical, electrical or process performance will be corrected at the Contractors expense and the 30-day operational period will be repeat until such time as the 30-day operational period has successfully been completed without failures.

END OF SECTION

MANUFACTURERS CERTIFICATE OF PROPER INSTALLATION

PROJECT NAME: CITY OF JEFFERSON, GA – CENTRAL CITY WRF PHASE 1

THE UNDERSIGNED HEREBY ATTESTS THAT HE HAS EXAMINED THE EQUIPMENT INSTALLATION AND THE INSTALLATION IS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

EQUIPMENT: _____
MANUFACTURER: _____
ADDRESS: _____

By: _____
(Type Name and Title)
_____/s/_____
(Signature) (Date)

CERTIFICATE MUST BE SIGNED BY A REPRESENTATIVE (START-UP TECH, FIELD SERVICE REPRESENTATIVE, ETC.) OF THE EQUIPMENT MANUFACTURER. IN THE EVENT THE MANUFACTURER IS NOT THE SUPPLIER, THEN A PRINCIPAL PERSON OF THE SUPPLIER MUST ALSO SIGN THIS FORM.

SUPPLIER: _____
ADDRESS: _____

By: _____
(Type Name and Title)
_____/s/_____
(Signature) (Date)

**SECTION 01 79 01
MANUFACTURER’S FIELD SERVICES AND TRAINING**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide the manufacturer’s services for installation supervision, inspection of equipment installation and training required by these Contract Documents.

1.2 SUBMITTALS

- A. Furnish complete training materials, including operation and maintenance data.

1.3 MANUFACTURER FIELD SERVICES

- A. Provide manufacturer’s trained representative to provide installation supervision as identified in specific Sections of these specifications.
- B. Provide manufacturer trained representative to inspect equipment installation, assist with equipment start-up and testing in accordance with Section 01 79 00.

1.4 TRAINING REQUIREMENTS

- A. Manufacturer’s qualified representative shall conduct training.
 - 1. Consider the time required to perform specified services in excess of that stated in the Specifications as incidental work.
- B. Schedule manufacturer’s onsite services to avoid conflicts with others working onsite.
- C. Ensure that all conditions necessary to allow successful testing are met before scheduling services.
- D. Days of service must be approved by Engineer to fulfill the specified minimum services.
- E. Unless specified otherwise, manufacturer’s onsite services shall include as a minimum:
 - 1. Installation assistance which includes observation, guidance, and instruction of the contractor’s team during assembly, erection, and installation.
- F. Equipment inspection, checking, and adjustment.
 - 1. Make equipment function as warranted by manufacturer.
 - 2. Manufacturer shall provide written approval of installation.
- G. Correct assembly, installation, and operating problems.

1. Revisit the site as often as required.
2. Make acceptable to Engineer.

H. Train personnel in the proper operation and maintenance of equipment.

1.5 TRAINING SCHEDULE

- A. Begin all training after Prefinal Testing, Section 01 79 00, and complete the training no less than thirty (30) days prior to Startup Testing.
- B. List equipment and systems that require training and show:
 1. Estimated date to complete installation.
 2. Proposed training dates. Allow for multiple sessions as several shifts are involved.
- C. Adjust training schedule when deemed necessary by the Owner to ensure training of appropriate personnel.
 1. Provide full participation by manufacturers' representatives.Adjust schedule for interruptions in operability of equipment.

1.6 TRAINING PLAN

- A. Training Plan. Submit the following for each course:
 1. Title and objectives.
 2. Training schedule.
 3. Prerequisite training and experience of attendees.
- B. Recommended types of attendees (e.g., managers, engineers, operators, maintenance).
 1. Course description and outline of course content.
 2. Duration.
 3. Location (e.g., training center of site).
 4. Format (e.g., lecture, self-study, demonstration, hands-on).
 5. Instruction materials and equipment requirements.

1.7 TRAINING PERSONNEL

- A. Provide experienced and competent personnel to conduct the specified training.
 1. Personnel shall be familiar with the operation and maintenance manuals submitted in accordance with Section 01 78 23.

2. Provide both classroom and onsite, hands-on training to plant personnel.
3. Address all aspects of operation and maintenance including systems, subsystems, and components.

B. Training Sessions

1. PowerPoint presentation training is required as part of each training session. The presentation shall depict equipment, controls, and operational techniques.
2. The presentation will be held in a classroom setting. Provide minimum of 30-minute presentation.
3. Provide two (2) digital copies of each presentation to the Owner. Provide “thumb drives” for each copy.
4. Following the presentation, hands-on equipment instruction is required.
5. All digital information to be compatible with Microsoft software.

PRODUCTS (NOT USED)

EXECUTION (NOT USED)

END OF SECTION

**SECTION 02 01 00
MAINTENANCE OF PLANT OPERATIONS**

PART 1 GENERAL

1.1 DESCRIPTION

- A. The intent of this Specification is to have the Contractor schedule and perform the Work in a manner such that the Owner can keep the existing WRF treatment plant facilities in continuous dependable operation and meet all regulatory requirements. This Section also presents an outline for the start-up sequence of the new facilities. The Contractor shall adhere to the constraints listed in this Section.
- B. The Contractor shall:
 - 1. Perform all construction necessary to complete connections, tie-ins and shutdowns to existing facilities.
 - 2. Keep existing facilities in operation unless otherwise specifically permitted in these Specifications or approved by the Owner.
 - 3. Perform all construction activities so as to avoid interference with operations of the facility and the work of others.

1.2 GENERAL CONSTRAINTS

- A. Any temporary work, facilities, roads, walks, protection of existing structures, piping, blind flanges, valves, equipment, bypass pumping, line-stopping, temporary generators, temporary power, temporary equipment, etc. that may be required within the Contractor's work limits to maintain continuous and dependable plant operation shall be furnished by the Contractor at no extra cost to the Owner.
- B. Sediment control features and other similar requirements shall be in place prior to starting any shutdown work.
- C. If bypass pumping is necessary, the Contractor shall provide 100 percent back-up pump capacity available on-site.
- D. Contractor shall be responsible for any cleanup resulting from spills during the bypass or tie-in operations.
- E. The Contractor shall schedule the Work in such a manner so that the plant is maintained in continuous operation. All shutdowns shall be approved by the Owner. If, in the opinion of the Engineer, a shutdown is not required for the Contractor to perform the Work, the Contractor shall use alternate methods to accomplish the Work. All shutdowns shall be coordinated with and scheduled at times suitable to the Owner. Unless noted otherwise, the Contractor shall provide a minimum of 7 days' notice of any system or partial system shutdown.

- F. Shutdowns shall not begin until all required materials are on-hand and ready for installation and the written shutdown plan has been approved by the Owner. At a time approved by the Owner, the shutdown period will commence, and the Contractor shall proceed with the Work continuously, start to finish, until the Work is completed, and the system is tested and ready for operation. If the Contractor completes all required Work before the specified shutdown period has ended, the Owner may immediately place the existing system back in service.
- G. The Owner shall have the authority to order the Work to be performed during a scheduled shutdown stopped or prohibit Work which would, in his opinion, unreasonably result in stopping the necessary functions of the plant operations. The Owner reserves the right to cancel scheduled shutdowns if conditions warrant.
- H. All operations of existing equipment, valves and gates required for the Work shall be done by the Owner. Owner does not guarantee that valves, stop logs, gates, etc., are or will be 100 percent water or gas tight. Contractor shall provide, at no additional cost to the Owner, all temporary caps, plugs, dewatering, pumping and other measures required to perform the Work.
- I. Insofar as possible, all equipment shall be tested and in operating condition before the final tie-ins are made to connect new equipment to the existing facility.
- J. Owner will require continuous access to all plant operational areas. Gates, roads and pathways required for vehicle and personnel access shall be maintained such that they are serviceable. If construction activities require interruption of normal access to any area, the Contractor shall provide temporary means for the Owner access. Contractor shall coordinate access interruptions with the plant and provide at least 7 days' notice of such interruptions. If vehicle support is required in an area that is blocked by construction activity, the Contractor shall provide such access to the Owner upon request.

1.3 SUBMITTALS

- A. Submit information for each shutdown described herein and all others required to complete the Work. Submittal shall include detailed description of shutdown, shutdown time-line, detailed breakdown of work to be completed prior to and during shutdown, materials required and availability, proposed manpower, proposed method of protecting existing equipment, list of valves, gates and equipment that will require operation by the Owner and any other details to adequately describe the proposed shutdown.
- B. Submittals must be approved before shutdown can begin. Submit information at least 14 days prior to start of proposed shutdown.
- C. General Shutdown Requirements:
 - 1. Pre-Shutdown Meetings shall be held prior to any shutdown. The meetings shall be conducted at least one week prior to the schedule shutdown and the day before the shutdown.

2. Simultaneous shutdowns of more than one facility, except as specifically indicated or allowed by the Owner, will not be permitted.
3. Insofar as possible, all equipment to be incorporated into existing facilities shall be ready for installation before the existing facilities are shutdown.
4. If the work during the shutdown periods is not done satisfactorily, or as planned, or within the time required or approved by the Engineer, the Owner may order the Contractor to work a 24-hour, 7-day week work schedule with a full crew, or he may order the Contractor to place the facility back in service and reschedule the shutdown or, he may order the work required to place the facility back in service done with other forces. If the work is done by other forces, the Owner's costs will be deducted from the amounts due to the Contractor. In no case shall the Owner be required to make additional payment for overtime work or redoing the work caused by the Contractor's failure to complete the work in the allotted time.

END OF SECTION

**SECTION 02 06 13
GEOTECHNICAL REPORT**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Refer to Appendix A for geotechnical information. This information is provided to the Contractor for information only and is not considered part of the Contract Documents. The Contractor may perform separate investigations, at no cost to the Owner, to confirm or provide additional information.

END OF SECTION

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**SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES**

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 01 33 00 Submittals Procedures
- B. Section 03 20 00 Concrete Reinforcing
- C. Section 03 30 00 Cast-In-Place Concrete

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only. All publications shall be the latest edition.

- 1. American Concrete Institute (ACI):

- 117 – Standard Tolerances for Concrete Construction and Materials.
- 301 – Specifications for Structural Concrete for Buildings.
- 302.1 – Guide for Concrete Floor and Slab Construction.
- 318 – Building Code Requirements for Structural Concrete.
- 347 – Recommended Practice for Concrete Formwork.
- SP- 4 – Formwork for Concrete.

1.3 SUBMITTALS

- A. All formwork shop drawings and related computations shall be furnished the Owner's Consultant for record purposes only. Shop drawings shall cover all formwork required. They shall show general arrangement of forms, sizes and grades of lumber, placement; construction and control joints and their method of forming; locations of inserts, tees, sleeves, and other related items. Drawings or descriptions of shoring and reshoring methods proposed for floor and roof slabs, spandrel beams, and other horizontal concrete members shall also be furnished.
- B. Provide product data on hydrophilic and PVC waterstops.

PART 2 PRODUCTS

2.1 CONCRETE FORMS

Formwork shall be designed for loads, lateral pressure and allowable stress in accordance with ACI 301, ACI 347, ACI SP-4. Design, engineering and construction of the formwork shall be responsibility of the Contractor.

- A. Forms shall be of plywood or of tongue and groove lumber and shall be of grade and type suitable to obtain the finish required as recommended in ACI 347 and ACI SP-4. Forms constructed of tongue-and-groove lumber shall be lined when used for exposed surfaces. Form lining, where used, shall be of tempered fiberboard of not less than 1/8-inch thickness. Metal forms, and other types of manufactured forms, shall not be used unless their use has been authorized by the Engineer. Form ties shall be of the cone nut threaded rod, or standard snap tie type, and designed so that when removed no metal will be left closer than 1 inch from the finished wall face. The cavities left in faces of concrete work by removal of form ties shall be pointed up with non-staining, non-shrink mortar. Form ties shall have a working strength of not less than 3,000 lbs. when fully assembled and shall be as approved by the Engineer.
- B. Permanent forms for elevated slabs shall be metal deck forms.
- C. Concrete form release shall be a non-residual, non-staining chemical type form release such as EZ Strip or Debond Form Locating, as manufactured by L & M Construction Chemicals, Inc., or approved equal.

2.2 FORM TIES

- A. Form ties shall be of factory-fabricated, adjustable-length, removable end, permanently embedded body type and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders.
- B. Form ties shall be designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.
- C. Provide ties that, when removed, will leave holes not larger than 1 inch and no smaller than 1/2 inch in diameter in the concrete surface. Form ties for exposed concrete shall be of the conewasher type. The cones shall be made of approved wood or plastic.
- D. Form ties in structures exposed to hydrostatic pressure and any liquid containment structures shall have waterstops that are an integral part of the form tie and embedded portion of the ties shall terminate not less than 1-1/2 inches from the formed face.
- E. Gang form ties shall be filled from one end with a compressible plug a minimum of 1-1/2 inches from the edge of wall and shall have a bentonite plug in the center of the wall.
- F. Common wire will not be allowed for form ties.

2.3 ACCESSORIES

- A. CHAMFER STRIPS. Unless noted otherwise on the Drawings all exposed corners of beams, columns, walls, slabs, etc. shall have 3/4 inch chamfers including opening for doors, windows, and other similar opening.

- B. ACCESSORIES. Form accessories shall be of commercially manufactured types suitable for the formwork and intended usage.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.
- B. All surfaces of forms and embedded materials shall be cleaned of any accumulated mortar or grout from previous concreting.
- C. All items which are to be embedded in concrete and which must be built into formwork shall be located and readied for installation prior to placement of any concrete. Coordinate all items with the various trades.

3.2 INSTALLATION

- A. Construction and erection of formwork shall be in accordance with ACI 347, ACI SP-4 and as specified herein.
- B. All formwork, supports, braces, shoring, etc. shall be of sufficient strength to properly support the concrete, the construction loads, and any superimposed loads and to maintain the work in perfect alignment until the formwork can be safely removed. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Chamfer strips shall be placed in the corners of forms and on the edges of formed joints to produce beveled edges on permanently exposed surfaces. To maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork prior to hardening of the concrete. Positive means of adjustment (wedges or jacks) of shoes and struts shall be provided, and all settlement shall be taken up during concrete placing operation. Temporary openings shall be provided at the base of column forms and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed. At construction joints, contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by no more than one inch. The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint and to maintain a true surface. All forms shall be clean and free of sawdust, dirt and debris before concrete placement.
- C. All items to be embedded in the concrete shall be properly located and braced to the formwork. Blockouts or openings necessary for future work shall be properly built into the formwork. Coordinate the location of embedded items and blockouts with other trades involved in the project. Blockouts shall be approved by the Owner's consultant.
- D. Install waterstops continuously without displacing reinforcement. Heat seal joints watertight.

- E. After cleaning forms and before placing either the reinforcement or the concrete, the surfaces of the forms shall be covered with a coating material that will effectively prevent absorption of moisture and prevent bond with the concrete and will not stain the concrete surfaces. A field-applied form release agent or sealer or a factory-applied nonabsorptive liner may be used. Manufacturer's recommendations should be followed in the use of coatings, sealers, release agents, and liners, but independent investigation by the Contractor of their performance is recommended before use. Where surface treatments and finishes are to be applied to formed concrete surfaces, adhesion of such surface treatments and finishes shall not be impaired or prevented by use of the coating, sealer, release agent, or liner. Excess form coating material shall not be allowed to stand in puddles in the forms, nor shall such coating be allowed to come in contact with hardened concrete against which fresh concrete is to be placed, or with reinforcement.
- F. The Contractor shall set and maintain concrete forms to ensure that, after removal of the forms and prior to patching and finishing, no portion of the concrete work will exceed any of tolerances specified. Variations in floor levels shall be measured before removal of supporting shores. The Contractor shall be responsible for variations due to deflection, when the latter results from concrete quality or curing other than that which has been specified. The tolerances specified shall not be exceeded by any portion of any concrete surface; the specified tolerance for one element of the structure to exceed its allowable variations.
- G. Flush with water or use Compressed air to remove foreign matter from the formwork. Ensure that the water debris drain to exterior through clean-out ports.
- H. During cold weather, remove ice and snow from within forms. Do not use deicing salts or water to clean out forms unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other, means to remove foreign matter.

3.3 EDGES AND CORNERS

- A. Chamfer strips shall be placed in forms to bevel all salient edges and corners except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Unless otherwise noted, bevels shall be 3/4" wide.

3.4 TOLERANCES

- A. Vertical or Horizontal wall surface tolerances shall be within 1/4" in 10 feet or a maximum of 1" on walls over 40 feet high. Wall thickness tolerances shall be within 1/4" minus or 1/2" plus from plan dimensions.
- B. Slab finish tolerances shall be within 1/8" in 10 feet. Slab thickness tolerances shall be within 1/4" minus or 1/4" plus from plan dimensions.
- C. Anchor bolt placement shall be within 1/8-inch center to center of any two anchor bolts in a group, within 1/4 inch center to center of adjacent groups, and 1/4 inch within specified elevation.

3.5 FORM REMOVAL

- A. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

- B. Forms shall not be removed until the member supported thereby has acquired sufficient strength to safely support its own weight, and the load imposed on it. Tie rod clamps shall be loosened 24 hours after concrete has been placed. Standard snap ties shall be removed when forms are stripped; care shall be taken to avoid spoiling concrete surface. Cutting ties back from the face of the wall will not be permitted. Under normal conditions, the time elapsing before the forms may be stripped shall be not less than that shown in the following schedule from the completion of the concrete pour: the use of the schedule shall not relieve the Contractor from his responsibility for the safety of the structure. Wood forms shall be completely removed from all portions of the work so that no material will remain for termite infestation.
 - 1. Slab Edges on Grade: 2 Days
 - 2. Columns and Pedestals: 7 Days
 - 3. Walls and Vertical Faces Not Supporting Other Work: 2 Days
 - 4. Beams and Elevated Slabs: 14 Days

- C. In no case shall forms for wall or columns be removed in less than 24 hours from the completion of the pour. Form work supporting weight of concrete, such as beams and elevated slab shall remain until the concrete has attained a minimum of 80% of the 28 day design strength.

END OF SECTION

**SECTION 03 20 00
CONCRETE REINFORCING**

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 01 33 00 Submittals Procedures
- B. Section 03 10 00 Concrete Forming and Accessories
- C. Section 03 30 00 Cast-In-Place Concrete

1.2 SCOPE

- A. The work covered by this Section of Specifications consists of furnishing all materials and equipment and performing all labor necessary for furnishing and installing all reinforcing steel, as indicated on the Drawings, as specified, and as required for completion of all work under this Contract.

1.3 SUBMITTALS

- A. The Contractor shall furnish to the Engineer, for checking and approval, the reinforcing steel schedules including bending and placing details for reinforcing steel which shall show bar size, spacing, bending, tagging identification, special details, and placement drawings. Create rebar shop drawing in accordance with ACI 315 latest edition. No manufacture or fabrication shall commence until such drawings have been approved.

1.4 PRODUCT HANDLING

- A. Delivery: Deliver reinforcement to the job site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Storage: Store reinforcement above the surface of the ground upon wooden platforms, skids, or other supports in a manner which will prevent damage and accumulation of dirt, excessive rust, and surface deterioration. The surface of the ground beneath all stored reinforcement shall be covered with plastic sheeting to further assure isolation from dirt and dust.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Reinforcing steel shall be furnished by domestic steel mills.
- B. Reinforcing bars: Comply with ASTM A615.
- C. Welded wire fabric: Comply with ASTM A185.

- D. Supports for reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:
1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
 2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support legs.
 3. For exposed to view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot dip galvanized or plastic protected legs.

2.2 FABRICATION

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions as indicated on the Drawings, with fabrication tolerances complying with CRSI Manual. In case of fabricating errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Steel bar reinforcement shall be cold bent to shapes indicated on the Drawings. Bending shall be done in the shop before shipment unless otherwise specified. Bending details for steel bar reinforcement shall conform to the requirements of the ACI Building Code (ACI 318 latest edition) unless otherwise indicated on the Drawings or specified. Steel bar reinforcement shall be bent, bundled, and tagged in accordance with details furnished by the fabricator.
- C. Steel bar reinforcement shall be furnished full length unless otherwise indicated on the Drawings or approved by the Engineer. Splices, where permitted, shall be well distributed or located at points of low tensile stress. Splices and dowels, except when used in cantilever wall or slab construction shall lap not less than 30 times the diameter of the bar. Splices and dowels used in cantilever wall or slab construction shall lap 40 diameters. Splices in horizontal reinforcement shall be staggered. The minimum clear distance between spliced bars, except when bar clamps are specified, shall be 1 1/2 bar diameters, but in no case less than 1 inch, nor less than 1 1/2 times the maximum size of coarse aggregate.
- D. Hooks of 180 degrees shall have a radius of bend on the axis of the bar of not less than three bar diameters plus an extension of four bar diameters at the free end. Hooks of 90 degrees shall have a radius of bend on the axis of the bar of not less than four bar diameters plus an extension of twelve bar diameters at the free end.
- E. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work.
1. Bar lengths, depths, and bends exceeding specified fabrication tolerances.
 2. Bend or kinks not indicated on Drawings or final Shop Drawings.

3. Bars with reduced cross section due to excessive rusting or other cause.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine the foundation, formwork, and the conditions under which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General

1. Comply with the specified standards for details and methods of reinforcement placement and supports, and as herein specified.
2. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
3. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required.
4. Place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
5. Install welded wire fabrics in as long lengths as practicable. Lap adjoining pieces at least one full mesh.
6. Provide sufficient numbers of supports and of strength to carry reinforcements. Do not place reinforcing bars more than 2" beyond that last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
7. Place reinforcing steel in the locations shown on the Drawings and held securely in place during the placing of concrete. The pushing of short bars into new concrete work will not be permitted. Bar reinforcing in walls shall be spaced the proper distance from the face of the wall by the use of approved rebar support. Bar reinforcing in slabs or beams shall be spaced the proper distance from the bottom of the slabs or beams by use of approved precast concrete mortar blocks or stainless steel chairs. Vertical stirrups shall always pass around main tension members and be securely attached thereto. Bar spacing, covering, minimum clearance, bond and anchorage shall conform to the requirements of the ACI Building Code (ACI 318)

latest edition, except as otherwise indicated on the Drawings or specified.

8. Prior to the placing of concrete, all mortar and other foreign matter which may reduce or destroy bond shall be removed from the reinforcement. No concrete shall be deposited until the placement of the reinforcing has been approved by the Engineer.

3.3 BAR COVER

- A. Reinforcing bars shall be fabricated, tied, and supported to ensure a protective concrete cover as shown on the structural drawings.

3.4 LAP SPLICES

- A. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. See splice schedule on Drawings. Bars marked continuous shall be lapped as required by splice schedule, and at corners, corner bars shall be provided.

3.5 OPENINGS IN CONCRETE

- A. Openings 12 inches and larger through concrete walls and slabs shall have a minimum of 8 extra diagonal bars in each face of the wall or slab of the same size as the largest bar in the wall or slab. The length of extra diagonal bars at openings shall be as shown on the Drawings, or as directed by the Engineer.

3.6 MISCELLANEOUS

- A. Concrete walls, slabs, and other concrete work shown on the Drawings to have no reinforcing, shall have a minimum area of steel bar reinforcing equal to 0.003 times the cross sectional area of the concrete work.

END OF SECTION

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

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures
- B. Section 03 10 00 Concrete Forming and Accessories
- C. Section 03 20 00 Concrete Reinforcing

1.2 SCOPE

- A. The work covered by this Section consists of furnishing all materials and equipment and performing all labor necessary for the complete construction of all cast-in-place concrete work as shown on the Contract Drawings and as specified.
- B. The work shall include the installation of all sleeves, inserts, piping, hangers, anchors, frames and all other items to be built into the concrete work and all other work and appurtenances, for proper execution of the work.
- C. All items of work shall be inspected and approved by the Engineer before any concrete is placed.

1.3 GENERAL REQUIREMENTS

- A. Concrete shall be composed of cement, fine aggregate, coarse aggregate, and water proportioned and mixed to produce a plastic workable mix in accord with the requirements of this Section.
- B. Concrete shall be classified as Class "A" or "B"; shall have normal setting characteristics; shall have 28 day compressive strengths (two-cylinder average strength) not less than those listed below. High early strength cement may be used under special conditions and its use must be approved by the Engineer. Concrete containing high early cement shall have a 7 day compressive strength not less than those listed below.
 - 1. Class "A" concrete shall have a compressive strength of not less than 4,000 psi and shall be used for all reinforced concrete work, unless otherwise indicated.
 - 2. Class "B" concrete shall have a compressive strength of not less than 3,000 psi and shall be used for concrete duct bank, pipe thrust block and all other work as indicated on the Drawings.
- C. Concrete shall comply with all provisions of ACI 350-01, or latest edition.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Admixture shall be added to Class "A" and Class "B". The admixture shall be Master Builders' "Pozzolith", or approved equal, and shall be added in accord with the admixture manufacturer's printed instructions. A standard dispenser shall be used to introduce the admixture into the mix, and the services of the admixture manufacturer's representative to install and establish the operation of the dispenser shall be furnished by the Contractor. Plasticizing agents or other moisture reducing agents should be used to increase concrete workability for low W/C ratio mixes. Air-entraining admixtures shall conform to "Specification for Air-Entraining Admixtures for Concrete", ASTM C260.
- B. Fine aggregate shall be natural and consisting of hard, strong, durable, and uncoated particles having fineness modulus of not less than 2.30 nor more than 3.00; variation in fineness modulus shall be limited to +0.20 from the average of all tests. Aggregate shall satisfy the requirements of Federal Specifications SS A 281b, Class 1, Grade A, or ASTM C33, and have gradation as follows:

<u>Sieve Size</u>	<u>Percent Passing, By Weight</u>
No. 4 Sieve	94 to 100
No. 16 Sieve	50 to 85
No. 50 Sieve	10 to 30
No. 100 Sieve	2 to 10

- C. Coarse aggregate shall be washed gravel or crushed stone consisting of hard, strong, durable, and uncoated particles, and shall contain neither vegetable matter nor soft, friable, thin, and elongated particles in quantities considered deleterious by the Engineer. Coarse aggregate shall satisfy the requirements of Federal Specifications SS A 281b, Class 2, Grade A, or ASTM C33; and have gradation as follows:

<u>Sieve Size</u>	<u>Percent Passing, By Weight</u>
1 to 1/2" Sieve	95 to 100
2" Sieve	25 to 60
No. 4 Sieve	0 to 10
No. 8 Sieve	0 to 5

- D. Cement shall satisfy the requirements of ASTM C150; cement for normal Class "A" and "B" concrete shall be Type IA or IIA; cement for high early strength Class "A" concrete shall be Type IIIA. Type III cement shall be used only if its use is approved by the Engineer. In lieu of Type IA, IIA or IIA cement, Type I, II or III cement may be used with approved air entrainment add mixtures as specified below.
- E. Ground granulated blast-furnace slag shall not be used in Class "A" concrete.

2.2 LIMITING REQUIREMENTS FOR CLASS “A” AND CLASS “B”

- A. Total Water Content for Class "A": Total water content of concrete shall not exceed 5.40 gallons of water per hundred pounds of cement in the mix, i.e., W/C less than 0.45 by weight.
- B. Slump for Class "A" and Class "B": Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Unless otherwise authorized by the Engineer, slump shall not exceed 4", before the addition of admixtures.
- C. Air-Entrainment for Class "A": The minimum air-entrainment shall be 5 percent, plus or minus 1 percent.
- D. Total Water Content for Class "B": The total water content of concrete shall not exceed 6.90 gallons of water per hundred pounds of cement in the mix, i.e., water content less than 0.57 by weight.

2.3 DESIGN MIX

- A. Design mix for each classification of concrete to be used in the work shall be prepared and tested by the independent, commercial, testing laboratory selected by the Contractor and approved by the Engineer for the testing of materials. Design mix shall be on the basis of 95% of 28-day two-cylinder averages being greater than the required design strength. The design mix shall be prepared using samples of the cement, admixture (if required), and the aggregates to be used in the work. Not fewer than eight (8) cylinders shall be made from the design mix for each classification of concrete; two (2) shall be tested at 7 days, two (2) tested at 14 days, two (2) tested at 28 days and two (2) shall be tested at 56 days. Cylinders shall be made and tested in accord with ASTM C31 and C39.
- B. If the design mix, based on trial batches, does not have sufficient data to establish a standard deviation, it shall not be considered acceptable if the concrete resulting from the design mix does not produce an average 28-day compressive strength at least 1,200 psi higher than specified for Class A concrete.

2.4 PROPORTIONING

- A. Proportioning of material shall be accomplished in a manner which will produce a workable mixture having a slump within the required limits and having minimum water content.
- B. The exact portion of materials to be used in concrete shall be as determined by the Laboratory Design Mix, and as directed by the Engineer. The equipment necessary to positively determine and control actual amounts of materials entering into the concrete shall be furnished by the Contractor. The proportions of materials used in the mix shall be changed whenever, in the opinion of the Engineer, a change is necessary to obtain the required strength and the desired density for uniformity and workability. In structures intended to be watertight, good workability will be considered to be of primary

importance.

- C. All materials shall be measured by weight, except for water, which may be measured by volume. One (1) bag of Portland cement shall be considered to weigh 94 lbs., and one (1) gallon of water to weigh 8.33 lbs.
- D. Cement content for each class of concrete shall be as follows and each cubic yard of concrete shall contain not less than the following quantities:

Class "A" _____	564 lbs. (6 Bags)
Class "B" _____	520 lbs. (5.53 Bags)

- E. In calculating the total water content of mixes, the amount of water borne on the surfaces of the aggregate particles shall be included. The amount of water to be used in the mix shall, in all cases, be the least amount necessary to produce a plastic mix having the required strength and the desired density, uniformity, workability, and characteristics within the required slump limits.
- F. The total volume of aggregates to be used in each cubic yard of concrete, and the proportion of fine aggregate to coarse aggregate, shall be that necessary to produce a dense mixture having the required workability, as determined by the Laboratory Design Mix, and as directed by the Engineer.

PART 3 EXECUTION

3.1 MIXING

- A. Concrete may be proportioned and mixed by the Contractor on the job site or may be proportioned and mixed at a central plant.
- B. When concrete is proportioned and mixed at the job site, the Contractor shall provide the equipment necessary to positively determine and control the actual amounts of materials entering into the mix. Mixing shall be done in a batch mixer of approved design and shall ensure a uniform distribution of the material throughout the mass. The entire contents of the drum shall be discharged before recharging. The volume of the mixed material, per batch, shall not exceed the rated capacity of the machine.
- C. The Contractor shall, during the mixing and placing of concrete, have no fewer than two concrete mixers on the site so as to maintain continuity of the placing in the event of mechanical failure of one of the mixers. The mixing of each batch shall continue not less than 1 1/2 minutes after all materials are in the mixer, during which time the mixer shall rotate at a peripheral speed of not fewer than 200 feet per minute.
- D. When concrete is proportioned and mixed at a central plant, plant layout and equipment shall be subject to approval by the Engineer. Concrete shall be proportioned, mixed, and transported under the following conditions:

1. The Contractor shall furnish the services of a representative of an approved testing laboratory, who shall be present at the central mix plant when Class "A" concrete is proportioned and mixed for the work, and shall control proportioning and mixing operations, except when otherwise approved by the Engineer.
2. Loading tickets shall be initialed by the laboratory representative, and the time of loading stamped thereon. Tickets shall be handed to the inspector upon arrival of the mixer trucks at the job site, and before placing the load.
3. Concrete shall be transported to the job site in approved mixer trucks, which will mix the concrete en route.
4. The mixing and handling of ready mix concrete, except as otherwise specified above, shall satisfy the requirements of ASTM C94. In the event the above conditions are not satisfied, the concrete will be subject to rejection.

3.2 BATCHING AND MIXING

- A. Concrete shall be furnished by an acceptable ready mixed concrete supplier and shall conform to ASTM C94.
- B. The consistency of concrete shall be suitable for the placement conditions. Aggregates shall float uniformly throughout the mass and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.
- C. A delivery ticket shall be prepared for each load of ready-mixed concrete. A copy of each ticket shall be handed to the Engineer by the truck operator at the time of delivery. Tickets shall show the quantity delivered, the amount of each material in the outdoor temperature in the shade, the time at which the cement was added, and the numerical sequence of the delivery.

3.3 PLACING:

- A. Before concrete is placed, the depth and character of the foundations, the adequacy of forms and falsework, and the placing of steel and appurtenant work shall be inspected and must be approved by the Engineer; that approval, however, shall not relieve the Contractor from the responsibility to produce the finished work.
- B. Accumulated water and debris shall be removed from excavations and from form work into which concrete is to be placed; flow of water into those places shall be diverted into side drains or sumps and be removed without disturbing newly placed concrete. Forms, unless lined, shall be thoroughly wetted with water before concrete is placed so as to tighten joints and prevent leakage of the mix. Runways for buggies and wheelbarrows, if used, shall not be supported by form work. Concrete shall be conveyed in a manner which will not disturb forms.
- C. Concrete shall be placed in daylight; placing of concrete in a portion of the work shall

not be started if that portion of the work cannot be completed during daylight, unless otherwise specifically approved by the Engineer. That approval will not be given unless an adequate lighting system is provided, and that system is approved by the Engineer.

- D. Concrete shall not be placed when the atmospheric temperature is cooler than 35°F. If, after placing concrete, the atmospheric temperature becomes cooler than 35°F, the Contractor shall enclose, heat, and protect the concrete in a manner which will keep the air surrounding the fresh concrete at a temperature not cooler than 45°F for a period of 5 days after concrete is placed. The Contractor shall assume all risk connected with the cool weather placing and protecting of concrete, and should that concrete be unsatisfactory, it shall be rejected.
- E. Concrete shall be transported from the mixer to the point of deposit with a crane handled bottom dump concrete bucket, with concrete buggies, or with wheelbarrows. In the event the quality of the concrete as it reaches the forms, and the method and placing thereof, in the opinion of the Engineer, is not satisfactory, the Contractor shall change his method of operation so as to place concrete in a manner approved by the Engineer.
- F. Concrete shall be placed in a manner which will prevent the segregating of aggregates, displacing reinforcing, and coating and splattering chutes, and canvas tremies shall be arranged and used in a manner which will ensure that the concrete is placed in the manner specified. The placing of concrete within form work shall be regulated in a manner which will ensure that the pressure within the form work shall not exceed the design pressure of the form work. Concrete shall be placed in continuous horizontal layers, the thickness of which, in general, shall not exceed 12 inches. When placing concrete, each batch and each layer shall be placed immediately following the preceding batch and layer so that there will be no "cold joints" in the work. Care shall be used to fill each part of the forms; concrete shall be deposited to as near final position as possible. After concrete has taken its initial set, care shall be used to avoid jarring the form work and placing strain and vibration on the ends of projecting concrete reinforcements. If concrete must be dropped more than five feet (5'), it shall be deposited through a tremie.
- G. Concrete when placed shall be compacted with mechanical, internal vibrating equipment supplemented with hand spading with a steel slicing rod. Vibrating shall not be used to transport concrete within forms. Vibrating equipment shall maintain an impulse rate of not less than 5,000 impulses per minute, when submerged in concrete. Not less than one (1) spare vibrator shall be maintained on the job site as a relief. The duration of vibration shall be limited to that necessary to satisfactorily consolidate the concrete without causing objectionable segregation. The vibrator shall not be inserted into lower layers which have begun to set.
- H. Thin section work shall be thoroughly worked with a steel rod; faces shall be shaped, and mortar flushed to the surface of the form. Small diameter holes shall be drilled in form work beneath large wall sleeves and inserts to prevent the entrapment of air beneath those sleeves and inserts when concrete is placed.

- I. Concrete shall be placed and compacted in a manner which will form a dense, compact, impervious structure having smooth faces on exposed surfaces. Concrete found to be porous, plastered, and otherwise defective, in the opinion of the Engineer, shall be removed and replaced in whole, or in part, as directed by the Engineer, at no additional expense to the Owner.

3.4 CONSTRUCTION JOINTS

- A. Surface of concrete construction joints shall be cleaned and laitance removed.
- B. Immediately before new concrete is placed, all construction joints shall be wetted and standing water removed.
- C. Construction joints shall be located where shown and were directed by the Engineer. Concrete shall be placed continuously between construction joints so that the unit will be monolithic in construction. Not less than 72 hours shall elapse between casting of adjoining units, unless otherwise approved by the Engineer.
- D. Construction joints in footings and walls, required for proper execution of the work, but not shown on the Drawings shall be located where directed by the Engineer, and across regions of low shearing stress so as to least impair the strength and appearance of the work. Special provisions shall be made for joining successive units as shown and as directed by the Engineer.
- E. Construction joints in slabs, required for proper execution of the work but not shown on the Drawings, shall be located where directed by the Engineer. Special provisions, including concrete footings for construction joints in slabs on earth shall be made for joining successive units, as shown and as may be directed by the Engineer.
- F. Keys shall be constructed in construction joints where shown, and as directed by the Engineer. Keys and water stops shall be placed in those construction joints which will be subject to water pressure.

3.5 EXPANSION JOINTS

- A. Expansion joints shall be constructed as detailed on the drawing and in the locations shown.

3.6 BONDING

- A. The surfaces of recently poured concrete work shall be thoroughly roughened and made free from all foreign matter and laitance, the forms placed and tightened, and the surfaces of that concrete slushed with grout before placing new concrete work. New concrete shall be placed before grout has attained its initial set; bonding work shall be accomplished in a manner which will ensure complete bonding. Two to four inches (2" 4") of grout shall be applied to construction joints.

3.7 FINISHING

- A. Exterior concrete surfaces shall be finished to levels not shallower than 12 inches below finish grade levels; interior concrete surfaces and concrete surfaces exposed to view shall be finished.
- B. Interior of basins shall be finished to a level not less than 12 inches below water level. Concrete not exposed to view shall have edges tooled off and shall be pointed and spot finished to fill irregularities. Concrete to be painted or waterproofed shall be finished.
- C. When concrete has set sufficiently to permit, forms and form ties shall be carefully removed. Depressions resulting from removal of form ties, and other holes and rough places, shall be thoroughly wetted with water and pointed with non-staining, non-shrink sand cement mortar.
- D. After pointed surfaces have sufficiently set, surfaces specified to be finished shall be kept wet with water and shall be rubbed with a carborundum stone of medium fineness, or other equally as good abrasive, to bring the surface to a smooth texture and to remove all form and other marks. The paste formed by the rubbing may be rubbed down by floating with a canvas, carpet faced, or cork float, or may be rubbed down with dry burlap.
- E. Recesses from form ties shall be filled flush with mortar. Fins and other surface projections shall be removed from all formed surfaces except exterior surfaces that will be in contact with earth backfill.
- F. Slabs, pavement, curbs, and other unformed surfaces shall be screeded and given an initial float finish followed by additional floating or belting. Unformed surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float, or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance with no unnecessary working on the surface.
- G. Initial floating shall be followed by belting or a second floating at the time of initial set. The belting or second floating shall produce a finish of uniform texture and color. The completed finish for unformed surfaces shall be the finish produced by the belting or second floating.

3.8 CURING AND PROTECTING

- A. Concrete shall be protected from loss of moisture by water saturation or membrane curing for at least 7 days after placement.
- B. Water saturation of concrete surfaces shall begin as quickly as possible after initial set of the concrete. Unformed surfaces shall be covered with polyethylene film, tarpaulins, or sand to retain the water. Water shall be applied as often as necessary to keep the concrete saturated for the entire curing period.

- C. Two (2) coats of an acrylic copolymer solution may be used in lieu of water curing. The curing compound shall be Dress & Seal, as manufactured by L & M Construction Chemicals, Inc., or another approved equal. When the concrete surface is to have another surface applied to it, L & M cure shall be used. All curing membranes shall be applied in strict accordance with the manufacturer's recommendations.
- D. Concrete shall be protected against freezing for at least 7 days after placement.

3.9 WATERTIGHTNESS

- A. Concrete required to be watertight shall be proportioned, mixed, and placed in strict accordance with this Section.
- B. All concrete structures for holding and transporting water, and pits below ground level, shall be tested and shall be watertight; a drop in the water level of more than 1 1/4" in 24 hours will not be permitted when water holding structures are filled. All exposed surfaces of water holding structures and interiors of pits below groundwater level shall be free from visible damp spots and seepage before acceptance.

3.10 SILICONE JOINT SEALANT

- A. Provide silicone joint sealant that exceeds both Federal Specifications TT-S-001543A Class A (one-part silicone sealants) and TT-S-00230C Class A (one-component sealants) that were written for construction sealants requiring extremely high movement capability.
- B. Install silicone joint sealant in accordance with manufacturer's recommendations.
- C. Dow Corning 7 888 meets the above specifications and is represented locally by Fred R. Hiller Company (770) 451-4551.

3.11 BACKER ROD

- A. Provide cylindrical flexible sealant backings composed of closed cellular material, as defined in ASTM C1330 for use with cold applied sealants.
- B. Install in accordance with manufacturer's recommendations.
- C. HBR7, manufactured by Nomaco, Inc., meets the above specifications and is represented locally by Fred R. Hiller Company (770) 451-4551.

3.12 IMPERFECT AND DAMAGED WORK

- A. All imperfect and damaged work shall be satisfactorily removed; new work and materials, which are in accordance with the requirement of the Drawings and construction Specifications shall be furnished and installed at no additional expense to the Owner. Removal of concrete work and installation of subsequent work and materials shall be accomplished in a manner which will not impair the strength of the structure.

3.13 REPAIRING DEFECTIVE CONCRETE

- A. Defects in concrete surfaces, such as honeycombs or cracks, shall be repaired to the satisfaction of the Engineer.
- B. Concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured.

3.14 CLEANING UP

- A. Upon completion of work, all forms, equipment, protective covering and rubbish resulting there from shall be removed from the premises. Finished concrete surfaces shall be left in a condition satisfactory to the Engineer.

3.15 CONCRETE FLOORS AND SLABS

- A. All piping which will be under floors and slabs shall be tested and retested until there are no leaks before constructing concrete slabs.
- B. The subgrade for slabs on earth shall provide a solid bearing and shall be brought to a true and even plane. Where floor drains occur, floors shall be pitched thereto, as shown. The concrete shall have a comparatively dry consistency, and shall be screeded level, or to the proper grade. After compacting and vibrating the concrete, the surface shall be prepared to receive the specified finish. All floors, walks, platforms, stairs and other slab work shall have a wood float finish. Settling basin and tank floors shall have a smooth steel troweled finish. After screeding to the required grade while the concrete is still green, but has hardened sufficiently to bear the finisher's weight, the concrete surface shall be floated with wood float to a true and even plane, have no visible coarse aggregate, and be sufficiently rough to prevent slipping.

3.16 STORAGE

- A. Cement shall be stored in suitable moisture-proof enclosures. Cement which has been caked or lumpy shall not be used.
- B. Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6" of aggregate piles in contact with the ground shall not be used.
- C. Reinforcing steel shall be carefully handled and shall be stored on supports which will keep the steel from contact with the ground.

3.17 SAMPLING AND TESTING

- A. Cement aggregates shall be tested by a recognized testing laboratory which has been selected by the Contractor and accepted by the Engineer. The testing laboratory shall prepare written reports of such tests which shall certify that the material covered by the

report complies in all respects with these Specifications. The tests and reports shall be made on each shipment of cement and on each bin or stockpile of aggregates used in the work. When aggregate is being furnished from the same source, tests subsequent to the initial tests may be suspended when specifically, authorized by the Engineer. These tests, however, may be resumed when requested by the Engineer. When specifically authorized by the Engineer, mill test certificates shall be submitted for cement shipments. Certified test reports and certificates shall be submitted to the Engineer in duplicate.

- B. The Contractor shall determine the source, kind and quality of cement and aggregates to be used in the work well in advance of the scheduled start of the work, in order to permit proper sampling and testing. He shall be fully responsible for delays in the progress of the work due to delays in sampling, testing and reporting on cement or aggregates. No cement or aggregates shall be incorporated in the work prior to receipt and acceptance of certified test reports or certificates by the Engineer. The cost of sampling and testing cement aggregates will be borne by the Contractor.

- C. Concrete cylinder for testing purposes shall be made in accord with the procedure described in ASTM C31. Compression tests shall be made at the age of 7 days, 14 days and two (2) at 28 days by the testing laboratory in accord with the procedure described in ASTM C39, and as required by the Engineer. After beginning work, the number of tests shall be as listed in the following table but shall not be less than one for each type of concrete for each pour. Each test shall consist of at least 8 specimens. Two (2) cylinders shall be held in reserve and tested at 56 days, if required.

<u>Total Cu. Yds. Concrete Placed</u>	<u>Minimum Number of Tests</u>
1 to 1/2" Sieve	95 to 100
2" Sieve	25 to 60
No. 4 Sieve	0 to 10
No. 8 Sieve	0 to 5

- D. Slump test of concrete shall be made in the field by the Contractor for each pour with an accurately made sheet iron test cone, and in accord with the procedure described in ASTM C143. The slump of concrete shall be not less than 3 inches, or more than 4 inches, before the addition of admixtures.

END OF SECTION

**SECTION 03 62 00
NON-SHRINK GROUTING**

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures
- B. Section 03 10 00 Concrete Forming and Accessories
- C. Section 03 20 00 Concrete Reinforcing
- D. Section 03 30 00 Cast-In-Place Concrete

1.2 GENERAL

- A. The work covered by this Section of the Specifications consists of furnishing all equipment, materials, labor, and performing all operations required for the installation of non-shrink cementitious grouts at locations shown on the Contract Drawings or as directed by the Engineer.
- B. Non-shrink cementitious grouts are used for static and low dynamic loading associated with column baseplates, sole plates, pumps, anchor bolts or in areas in conjunction with high operating temperatures.
- C. The following codes and standard specifications establish the minimum requirements for cementitious grouts. Referenced test methods, specifications and recommended practices are to be used to verify material properties and identify acceptable practices applicable to cementitious grouts:
 - 1. ASTM C109 Standard Test Method for Compressive Strength of Hydraulic-Cement Mortars (using 2 in or 50 mm cube specimens)
 - 2. ASTM C230 Standard Specifications for Flow Table in Tests of Hydraulic Cement
 - 3. ASTM C827 Standard Test Method for the Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
 - 4. ASTM C1090 Test Method for Measuring Change in Height of Cylindrical Specimens from Hydraulic-Cement Grout
 - 5. ASTM C1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- D. Submittals: The Contractor must submit the manufacturer's literature and certified test data to the Engineer prior to installation. The Engineer may choose to buy any submitted material in the open market at the Contractor's expense, without the Contractor or manufacturer's knowledge, and test the material at an independent lab to verify compliance with this Specification.

- E. Delivery, Storage and Handling: All materials shall be delivered to the job site in original, unopened packages, clearly labeled with the manufacturer's identification and printed instructions. All cementitious materials shall be stored and handled in accordance with the recommendations of the manufacturer and the American Concrete Institute.
- F. Project/Site Conditions: Refer to the manufacturer's literature or contact the manufacturer directly for any physical or environmental limitations required by the project.
- G. Warranty: The material manufacturer shall warranty that the non-shrink grout shall never go below its initial placement volume when tested in accordance with ASTM C827.
- H. Grout shall be Five Star7 Grout, Five Star7 Grout 100 or Five Star7 Instant Grout as manufactured by Five Star Products, Inc. Fairfield, CT (203)336-7900. No like, equivalent, or "or equal" items or no substitution is permitted.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Non shrink cementitious grout shall be a pre-proportioned product packaged according to ASTM C1107 requiring only the addition of potable water and shall not contain metallic substances or aluminum powder.
 - 1. Dimensional Stability/Compressive Strength: The gout shall meet the requirements of ASTM C1107 Grade C, when prepared according to manufacturer's instructions and tested at 40°F and 90°F (5°C and 32°C).
 - 2. Placability: The grout shall be capable of maintaining at least a flowable consistency for a minimum of 45 minutes at 70°F (21°C) measured under ASTM C230, using 5 drops in 3 seconds.
 - 3. Mixing Water: Water shall be clean and free of oils, acids, alkalis, organics and other deleterious materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Inspect concrete surfaces to receive grout and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints, impregnations and all loose material or foreign matter likely to affect the bond or performance of the grout.
- B. Inspect the baseplate or anchor system for rust, oil and other deleterious substances that may affect the bond or performance of the grout.
- C. Confirm newly placed concrete has been cured sufficiently to attain its design strength and limit further shrinkage.

3.2 PREPARATION

- A. Roughen all concrete surfaces by sandblasting or other mechanical means to assure bond. Loose or broken concrete shall be removed.
- B. All grease, oil, dirt, curing compounds, laitance and other deleterious materials that were identified in the inspection process shall be completely removed from the concrete and bottom of baseplate.
- C. Concrete surfaces shall be saturated with water.
- D. All standing water shall be removed just prior to placement of grout.
- E. Forms for grout shall be built of materials with adequate strength to withstand the placement of grout.
- F. Forms for grout shall be watertight. An approved form release agent shall be used for easy form release.
- G. Forms shall be 4 to 6 inches (100 to 150 mm) higher than the baseplate on one side of baseplate when using hydrostatic head pressure for placement.
- H. Air relief holes a minimum of 2" (6 mm) in diameter must be provided when required by the baseplate configuration to minimize the amount of air entrapped under the plate.

3.3 INSTALLATION

- A. Grout shall be mixed in accordance with manufacturer's recommendations. Carefully read and understand the manufacturer's instructions as printed on each unit.
- B. A mortar mixer with moving blades shall be used for mixing of grout. A wheelbarrow and a mortar hoe are acceptable for smaller quantities. Pre-wet the mixer and empty excess water before mixing begins.
- C. Non shrink cementitious grout shall be added to a premeasured amount of water that does not exceed the manufacturer's maximum.
- D. Mix the cementitious grout for 3 to 5 minutes for uniform consistency.
- E. Grout may be dry packed, flowed or pumped into place. All grouting shall take place from one side of a baseplate to the other to avoid trapping air.
- F. Retempering grout by adding more water after stiffening is not permitted.
- G. Hydrostatic head pressure shall be maintained by keeping the level of the grout in the headbox above the bottom of the baseplate. The headbox should be filled to the maximum level and the grout worked down to top of baseplate.

3.4 CURING

- A. The grout must be cut back to the lower edge of the baseplate after it has reached its initial set. A 45° angle or a vertical cut back is recommended.
- B. Equipment and tools shall be cleaned as recommended by the grout manufacturer.
- C. Grout shall be cured in accordance with manufacturer's specifications and recommendations. It shall be kept moist for a minimum of three days. The method needed to protect the grout will depend on temperature, humidity and wind. Wet burlap, a soaker hose, sun shading, ponding and, in extreme conditions, a combination of methods shall be employed.
- D. Grout shall be maintained above 40°F (5°C) for a minimum of three days or above 70°F (21°C) for a minimum of 24 hours to avoid damage from subsequent freezing.

3.5 FIELD QUALITY CONTROL

- A. Non shrink cementitious grouts should be tested for the 24-hour compressive strength under ASTM C109.

END OF SECTION

**SECTION 05 10 00
MISCELLANEOUS METALS**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide miscellaneous metal products and metal fabrications, including appurtenances, as specified, and as shown on the Contract Documents.
- B. This Section includes requirements for the following:
 - 1. Miscellaneous structural steel such as used for framing at overhead doors,
 - 2. Castings,
 - 3. Ladders,
 - 4. Stairs,
 - 5. Checkered safety plate,
 - 6. Handrail and railings,
 - 7. Miscellaneous items such as anchors, safety chains, fasteners, hardware, and accessories necessary to complete the work.

1.2 QUALITY ASSURANCE

- A. Provide components that are the standard product of a manufacturer regularly engaged in the production of the required materials and equipment.
 - 1. A single manufacturer shall provide all like items.
 - 2. The manufacturer shall be responsible for the design, construction, and proper operation of all components.
- B. Comply with applicable standards including, but not limited to the most recent edition of the following:
 - 1. American Association of State Highway Transportation Officials (AASHTO)
 - 2. American Society for Testing and Materials (ASTM)
 - a. ASTM A27, Steel Castings, Carbon, for General Application
 - b. ASTM A36, Carbon Structural Steel

- c. ASTM A53, Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. American Welding Society (AWS)
 - 4. American National Standards Institute (ANSI)
 - 5. American Water Works Association (AWWA)
 - 6. National Association of Architectural Metal Manufacturers (NAAMM)
 - 7. 29 CFR 1910, Occupational Safety and Health Administration (OSHA)
- C. Qualifications
- 1. Welders: Certified in accordance with AWS D1.1-92, Chapter 5.
 - 2. Vinyl Ester and Epoxy Anchor Manufacturers: Experience on at least three similar projects within the last 3 years.
 - 3. Vinyl Ester and Epoxy Anchor Installers: Trained and certified by manufacturer.
- D. Welding Procedures: Follow the requirements of AWS D1.1-92 and AWS D1.2-90.

1.3 SUBMITTALS

- A. Comply with Section 01 33 00.
- B. Submit the following information:
 - 1. Shop drawings:
 - a. Show size, finish, location, required hardware and accessories, and details for all fabricated metal work, threaded fasteners, and welds.
 - b. Show materials, construction and fabrication details, layout and erection diagrams and method of anchorage to adjacent construction.
 - c. Indicate welds, both shop and field, by symbols conforming to AWS Standards.
 - d. Prior to Submittal, coordinate Shop Drawings with related trades to ensure proper mating of assemblies.
 - e. Shop drawings for continually furnished items may be waived
 - (1) Submit a letter naming the manufacturer who will furnish these items
 - (2) Named manufacturer has a certified standard drawing on file with the

Engineer that contains the above information, and which has been approved by the Engineer.

2. Setting diagrams, erection plans, templates, and directions for the installation of backing plates, anchors, and other items.
3. Catalog descriptions of manufacturers' standard items. Show illustrated cuts of item to be furnished, scale details, capacities, dimensions, and similar information.
4. Working Drawings and calculations for Contractor designed hatches and gratings.
5. Metal fabrications, including welding and fastener information.
6. Anchors
 - a. Specific instructions for all phases of installation including hole size, preparation, placement, procedures, and instructions for safe handling of anchoring systems.
 - b. Vinyl Ester and Epoxy Anchors
 - (1) Manufacturer's past project experience data
 - (2) Test reports for each batch of vinyl ester or epoxy delivered to site.
 - (3) Current test data indicating that cured adhesive anchors meet or exceed design loads.
7. Welders: Evidence of certification.
8. Signed and sealed calculations for railings and rail accessories.
9. Samples
 - a. Handrail and railing assembly to show joints, bends, toe plate, posts, and anchorage.
 - b. Grating and checkered plates: 8 inches by 8 inches.
 - c. Stair treads and safety nosings, 8 inches long. Include color samples of abrasive nosings.
 - d. Epoxy Anchors: Two (2) self-contained epoxy adhesive cartridges for each batch of epoxy delivered to site, for independent testing.
 - e. Vinyl Ester Anchors: Two (2) self-contained adhesive cartridges for each batch of adhesive delivered to site, for independent testing.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, handle, and store the equipment in accordance with Section 01 45 34.
- B. Identify and match mark, if applicable, all materials, items and fabrications for installation or field assembly.
- C. Wherever practicable, deliver items to Contract site as complete units, ready for installation. Include all anchors, hangers, fasteners and miscellaneous metal items needed for installation.
- D. Provide adequate storage facilities at the Contract site for the protection and storage of all delivered materials.
 - 1. Handle and store in such a manner as to not damage factory finishes.
 - 2. Repair damaged finishes as required, at no cost to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS – GENERAL

- A. Structural Shapes and Bars
 - 1. Mild steel: ASTM A36, unless otherwise indicated.
 - 2. Corrosion resistant steel: ASTM A242.
 - 3. Stainless steel: ASTM A276, type 316.
 - 4. Aluminum:
 - a. ASTM B221 with alloy and temper of 6061, T6.
 - b. Structural members: ASTM B308 with alloy and temper of 6061, T6.
 - c. Handrail: alloy 6061 or 6063 and temper as provided by the manufacturer.
- B. Plate, Sheet, Strip
 - 1. Mild steel: ASTM A36.
 - 2. High strength steel: ASTM A242.
 - 3. Corrosion resistant steel: ASTM A264.
 - 4. Stainless Steel

- a. Over 1/8-inch thickness: ASTM A264 and type 316 in accordance with ASTM A240.
- b. Under 1/8-inch thickness: ASTM A167, type 316.
- 5. Aluminum: ASTM B209 with alloy and temper of 6061, T6.
- C. Pipe and Tube
 - 1. Mild Steel
 - a. ASTM A53, type S, Grade B, black.
 - b. When Used for Welding: Schedule 40 minimum.
 - c. Handrail posts: Schedule 80 minimum.
 - 2. Stainless:
 - a. Welded: ASTM A312, grade TP 316L, schedule 10S minimum.
 - b. Screwed Connections: ASTM A312, grade TP 316, schedule 40S
 - c. Press Fits: ASTM A312, grade TP 316, schedule 5S minimum.
 - 3. Aluminum:
 - a. ASTM B221 with alloy and temper of 6061, T6.
 - b. Wall thickness: Schedule 80, per ANSI H35.2 unless otherwise shown on the Drawings.
- D. Mild Steel Forgings: ASTM A235, class F

2.2 CASTINGS AND FORGINGS

- A. Materials
 - 1. Gray iron: ASTM A48, grade 25 except valve and curb boxes shall be minimum class 20.
 - 2. Malleable iron: ASTM A47, grade 35018.
 - 3. Ductile iron: ASTM A536, grade 60-40-18.
 - 4. Nodular iron: ASTM A220, grade 45008.
 - 5. Steel: ASTM A27, grade 65-35.

6. Aluminum: ASTM B108 with alloy and temper of 356.0, T6.

B. Fabrication

1. Provide uniform quality, true to pattern, strong, tough, of even grain, sound, smooth, without cold sheets, scabs, blisters and sand holes, cracks, or other defects.
2. Plugs filled holes and welding will not be allowed.
3. Provide thicknesses and configurations shown on the Standard Details.
4. Sand blast as required to remove scale and sand and achieve a uniform smooth clean surface.
5. Paint with asphaltic or coal tar paint meeting requirements of AWWA C203, where indicated.
6. Provide raised letters where indicated.

C. Valve boxes

1. Comply with Standard Details.
2. Use sliding type extension.
3. Lid shall be removable only by lifting straight up from the shaft shoulder.
4. Provide raised letters as indicated on the Drawings.

D. Electric and instrumentation manhole covers.

1. Provide intended covers of the solid top design with two drop handles.
2. The diameter shall be 36 ½-inches.
3. Provide raised cast letters, minimum 2-inches in height, on upper surface of cover as follows.
 - a. ELECTRIC HV for electric manholes carrying greater than 600 volts.
 - b. ELECTRIC LV for electric manholes carrying 600 volts and below.
 - c. INSTRUMENTATION for manholes on signal conduits
4. Manufacturers
 - a. Neenah Foundry Co.,

- b. Dewey Brothers, Inc.,
 - c. East Jordan Iron Works,
 - d. Or equal.
- E. Trench drain frames and grates
- 1. Gray or Ductile Cast iron
 - 2. Suitable for H-20 loading as defined by AASHTO.
 - 3. Provide in convenient lengths for handling. Make the width as shown on the Drawings.
 - 4. Total free open area of grate shall be approximately 0.7 square feet per linear foot.
 - 5. Provide standard support frames, including frame end pieces, with anchor lugs for installation in cast-in-place concrete.
 - 6. Manufacturers
 - a. Neenah Foundry Co.,
 - b. East Jordan Iron Works,
 - c. Or equal.

2.3 LADDERS

- A. Permanent fixed type ladders.
- 1. Construct of 6061-T6 Aluminum.
 - 2. Use all welded construction.
 - 3. Design, fabricate, and install in accordance with OSHA (1910.27) 31:4815-7, Requirements for Fixed Ladders.
 - 4. Provide required brackets, bolts, and anchors.
 - 5. Use serrated rungs.
- B. Provide ladders with an aluminum safety extension.
- 1. Design extension poles to meet requirements of ASTM B221. Use alloy and temper of 6061, T6.

2. Design castings to comply with ASTM B108. Use alloy and temper of 356, T6.
3. Use stainless steel hardware. Provide with safety extension for mounting to ladder.
4. Provide standard mill finish.

C. Manufacturer.

1. Washington Aluminum Company, Inc., Baltimore, Maryland
2. Or equal

2.4 STAIRS

A. Fabricate stairs from structural shapes and plate.

1. Steel
 - a. ASTM A-36
 - b. Hot dip galvanizes after fabrication.
2. Aluminum
 - a. 6061-T6
 - b. Comply with Aluminum Association Specifications and Guidelines for Aluminum Structures.

B. Design

1. Minimum clear width of not less than 22-inches or as shown on the Drawings.
2. Rise angle between 30 and 50 degrees or as shown on the Drawings.
3. Rise to tread run shall conform to Table D of OSHA (1910.24) 31.4806.

C. Treads and platforms

1. Provide a non-slip surface.
2. Use an ADA compliant nosing.
3. Galvanized metal stair systems:
 - a. Provide solid treads of checkered safety plate.
 - b. Make landing kick plates four inches high by ¼-inch thick plate.

4. Abrasive cast aluminum stair treads
 - a. Acceptable Manufacturers
 - (1) Wooster Products, Inc., Wooster, OH, Type 105
 - (2) American Safety Tread Company, Incorporated, Helena, AL, Style 804,
 - b. Provide width and length shown on the Drawings. Make at least ½ inch thick.
5. May use open aluminum grating for stair treads and platforms.
6. Provide landing kick plates 4-inches high by 1/4-inch thick.

2.5 CONCRETE STAIR NOSINGS

- A. Form abrasive safety nosings for concrete stair treads and landings from FS RR-T-650, nonskid tread.
 1. Make 3 to 8 inches wide but less than the concrete width,
 2. Use suitable anchoring devices.
- B. Provide bolted-on nonskid treads for all plain metal stair treads.

2.6 HANDRAILING AND KICKPLATES

- A. Fabricate railings, handrails and kickplates as indicated on the drawings.
 1. Fabricate from aluminum alloy.
 - a. Fabricate handrail and posts from minimum 1-1/2 inch inside diameter, schedule 40 aluminum pipe.
 - b. Use 6063-T-6 alloy and temper for top and intermediate railings, posts, returns and handrails.
 - c. Do not exceed 20 feet between splices for railing sections.
 - d. Grind all exposed welds smooth.
 - e. Fabricate flanges for posts from 3/8-inch minimum thickness plate.
 - (1) Weld to the bottom of the posts
 - (2) Fasten to the stringer or concrete with two 1/2-inch diameter stainless steel bolts.
 - f. Fabricate stand-offs from not less than 3/16-inch thickness plate.

2. Conform to OSHA requirements.
 3. Fabricate with all intersections and joints neatly fitted, fully welded and ground smooth and flush.
 - a. Heat and bend smoothly, without distortion.
 - b. Fabricate posts and stand-offs for pipe railing of the same material as the railing.
 - (1) Space evenly as shown,
 - (2) Provide anchor flanges.
 - c. Use quarter round bends and welded flanges to make handrails along walls return to the wall at each end.
 - d. Cope and continuously weld or mechanically connect members at all junctions.
 - e. Run top rails continuously over posts.
 4. Deliver all aluminum pipe railings, posts and handrails to the job protected by polyethylene tubing with a minimum wall thickness of 0.05-inches. Tubing shall remain during construction and shall be removed only when directed.
- B. Interior handrails at stairs
1. Use a single rail.
 2. Turn 90 degrees to terminate 1/8-inch from walls.
 3. Secure brackets to the walls with stainless steel expansion bolts.
 4. Grout hollow walls at attachment locations.
 5. Locate terminal brackets not more than eight inches from the end of the handrails.
 6. Make the maximum bracket spacing 6 feet on centers.
 7. Provide backing plates where brackets are to be attached to gypsum board constructed partitions.
- C. Frame, anchor and mount handrails and posts such that the complete structure is capable of withstanding a load of at least 200 pounds applied at any direction at any point on the top rail, exceeding or meeting OSHA requirements.
1. Do not space posts and mounts at more than 5 feet on centers.

2. Reinforce end posts as specified in this Section.

D. Coatings

1. Interior aluminum pipe railings and posts, and handrails
 - a. Provide a NAAMM, Architectural Class II, AAM10C22A31, clear natural coating.
2. Exterior aluminum pipe railings and posts, and handrails
 - a. Provide a NAAMM, Architectural Class I, AAM10C22A41, clear natural coating.

E. Safety Chain:

1. Stainless steel,
 - a. Type 316.
 - b. Minimum 9/32-inch thick.
 - c. Working load limit at least 2,000 pounds.
2. Provide chain with eye, snap hook, and staple across gaps formed by railing sections or other locations.

F. Contractor's Option: Use manufactured modular railings restricted to one of the following manufacturers. Prefabricated aluminum railings shall be generally as specified and as shown.

1. Universal "Uni-rail"
2. Moultrie "Wesrail"

2.7 CHECKERED SAFETY PLATE

A. Steel:

1. FS QQ-F-461, class k,
2. Flat back,
3. Standard four-way raised pattern,
4. Rolled from ASTM A36, grade A,
5. Thickness and span for 16ksi maximum fiber stress.

6. Hot dip galvanizes after fabrication.

B. Aluminum:

1. ASTM B221, with alloy and temper of 6063 T6,
2. Flat back.
3. Diamond pattern.
4. Thickness and span for 16 ksi maximum fiber stress.

2.8 MISCELLANEOUS ITEMS

A. Fasteners and Anchors

1. General
 - a. Use galvanized with galvanized material.
 - b. Use stainless steel with stainless steel and aluminum material.
 - c. Provide cadmium plated for use with all other materials.
2. Stainless Steel
 - a. Bolts: ASTM A193, grade B8M.
 - b. Nuts: ASTM A194, grade 811.
 - c. Washers: ANSI B18.22.1 and be of the same material as the bolts and nuts.
3. Expansion anchors
 - a. Comply with FS FF-S-325.
 - b. Concrete
 - (1) Wedge type: Group II, Type 4, Class 1 or 2.
 - (2) Self-drilling type: Group III, Type 1.
 - (3) Non-drilling type: Group VIII, Type 1 or 2.
 - c. Masonry
 - (1) Lag shield type: Group II, Type 1.
 - (2) Split shield type: Group II, Type 3, Class 3.
4. Vinyl Ester Adhesive Anchor Systems

- a. Use two-component type that is insensitive to moisture and designed to be installed in adverse freeze/thaw environments.
 - b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
 - c. Container Markings:
 - (1) Manufacturer's name
 - (2) Product name
 - (3) Batch number
 - (4) Product expiration date
 - (5) ANSI hazard classification
 - (6) ANSI handling precautions.
 - d. Anchor Rods:
 - (1) Stainless steel threaded rods,
 - (2) Sized by adhesive manufacturer for design loads required and adhesive system used.
5. Headed steel anchors:
- a. Fabricate from cold finished carbon steel as shown on the drawings.
 - b. Comply with ASTM A108.
- B. Aluminum Plank Grating: Removable type, fabricated panel sizes and thickness as indicated on Drawings. Where panel sizes are not indicated, limit panel weights to a maximum of 120 pounds each. Construction details in conformance with NAAMM Metal Bar Grating Manual.
- 1. Performance Criteria: Grating depth designed for maximum deflection of 1/4 inch under 100 psf uniform load.
 - a. Maximum Stress: 12,000 psi for clear span shown on Drawings.
 - b. Aluminum alloy 6063-T6 conforming to ASTM B221.
 - c. Anchor Clips: Galvanized steel or stainless steel saddle clips, number as recommended by manufacturer.
 - d. Aluminum Bearing Angle: Aluminum alloy 6061-T6 conforming to ASTM B308.
 - e. Fabrication Tolerances shall be in accordance with ANSI/NAAMM MBG

531-09 Metal Bar Grating Manual.

f. Finish: Gratings shall be A-41 Clear Anodized.

2. Acceptable Manufacturers:

a. Ohio Gratings, Inc.; Heavy Duty Light Series, Upset Pattern WACO

b. IKG Borden; HD-50 Style RU

c. Or equal.

C. Pipe Sleeves for Concrete Construction

1. Standard weight, black steel pipe,

2. Weld anchors to exterior to serve as a waterstop,

3. Size as required to accommodate passage of conduits, pipes, ducts and similar items.

D. Backing Plates

1. Use minimum 16-gauge galvanized steel .

2. Secure plates in position by welding to studs or with bolts in expansion shields as appropriate.

2.9 SHOP FINISHES

A. Galvanizing.

1. Iron and Steel: Hot-dip galvanized, ASTM A123, with average coating weight per square foot of 2.0 ounces and not less than 1.8 ounces per square foot.

2. Ferrous Metal Hardware Items: ASTM A153 with average coating weight of 1.3 ounces per square foot.

3. Touch-up Material for Galvanized Coatings: DRYGALV as manufactured by the American Solder and Flux company, Galvalloy, Galvion.

B. Ferrous metals other than galvanized steel, stainless steel, and cast iron shall be shop primed with one coat of primer compatible with the appropriate painting system specified in Section 09900.

C. Bituminous Coating: MS MIL-C-450.

PART 3 EXECUTION

3.1 FABRICATION

A. General

1. Fabricate items as indicated in the Contract Documents and as shown on approved Contractor's drawings.
 - a. Straighten any work bent by shearing or punching.
 - b. Press exposed edges and ends of metal smooth
 - c. Finish exposed surfaces to provide smooth, sharp, well-defined lines. Grind cut edges smooth and straight.
 - d. Conceal fastenings where practical. Flush countersink where exposed.
 - e. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
2. Construct connections and joints exposed to weather to exclude water.
3. Provide sufficient anchors to properly fasten of the work.
4. Provide the necessary rabbets, lugs, and brackets so the work can be assembled in a neat and substantial manner.
5. Drill metalwork and countersink holes as required for attaching hardware or other materials.
6. Fit and assemble in largest practical sections for delivery to site.
7. Weld connections and grind exposed welds smooth.
 - a. Miter corners.
 - b. When required to be watertight, make welds continuous.
8. Use fasteners as shown, scheduled or required by the application.
9. Provide cutouts, fittings, and anchors as required to coordinate assembly and installation with other work.
 - a. Provide anchors, welded to trim, (if required)
 - b. Space 6-inches from ends or corners and 24-inches on center typically, unless otherwise indicated.

B. Welding

1. Comply with AWS D1.1.
2. Use either A-233 Class E70 series electrodes or submerged arc Grade AWS-2.
3. Thoroughly wire-brush steel before fabrication to remove scale and rust.
4. Straighten by approved methods that will not injure the materials being worked.
5. Use continuous welding along the entire line of contact except where tack or intermittent welding is permitted. Where exposed, clean welds of flux and slag and grind smooth.
6. Use welders who are currently qualified as prescribed by AWS D1.1.

3.2 INSTALLATION

A. General

1. Install miscellaneous metal and appurtenances in accordance with the instructions of the manufacturer and in accordance with the Contract Documents.
 - a. Comply with the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings and the AISC Code of Standard Practice for Steel Buildings and Bridges, where applicable.
 - (1) Provide additional shims, washers, anchors, and corrective work as required to ensure that installation is firm, tight, anchored, in true alignment with neat fits, without distortions, unsightly fastenings, raw edges or protrusions.
 - (2) Touch up damaged painted areas and field coat at connecting ends as required, using same paint as shop paint. Touch up galvanized items with zinc dust coating.
2. Install plumb or level, accurately fitted, and free from distortion or defects.
3. Install rigid, substantial, and neat in appearance.
4. Erect steel in accordance with applicable portions of AISC Code of Standard Practice, except as modified herein.
5. Allow for erection loads and provide temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
6. Field weld components indicated. Perform field welding in accordance with AWS D1.1-92.

7. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.
 8. Apply primer or galvanize coating to welds, abrasions, and surfaces not in contact with concrete after erection.
- B. Erection Tolerances
1. Maximum Variation from Plumb: 1/4-inch per story, noncumulative.
 2. Maximum Offset from True Alignment: 1/4-inch
- C. Aluminum
1. Erect in accordance with the Aluminum Association specifications.
 2. Do not remove mill markings from concealed surfaces.
 3. After installed material has been inspected and approved, remove inked or painted identification marks from exposed surfaces not otherwise coated.
- D. Pipe Sleeves
1. Provide where shown on the drawings and where pipes pass through masonry.
 - a. May drill holes in lieu of sleeves in existing concrete walls.
 - b. Provide a center flange for water stoppage on sleeves in exterior or water-bearing walls.
 2. Use a modular mechanical seal to form a watertight seal in the annular space between pipes and sleeves.
- E. Safety Chain
1. Install quick links with anti-seize lubricant at mating threads.
 2. Install eye bolts with load applied to plane of eye.
 3. Do not use safety chains or accessories for overhead lifting or dynamic loading conditions.
- F. Non-slip stair nosings
1. Provide at the top of the stairs, in the concrete stair treads and at door sills.
 2. Install flush with the finished surfaces.
- G. Railing Installation

- a. Expansion Joints
 - b. Space at maximum interval of 54-feet on center.
 - (1) Locate joints within 12-inches of posts.
 - (2) Provide at structural joints. Locate expansion joints in rails that span expansion joints in structural walls and floors supporting the posts.
 - c. Use slip joint with internal sleeve.
 - (1) Extend 2-inches beyond each side of joint.
 - (2) Provide 1/2-inch gap to allow for expansion.
 - d. Fasten to one side using 3/8-inch diameter setscrew. Place setscrew at bottom of pipe.
2. Surface Mounting
 - a. Bolt post baseplate connectors firmly in place.
 - b. Use of shims, wedges, grout, and similar devices for handrail post alignment not permitted.
3. Posts and Rails
 - a. Set posts plumb and aligned to within 1/8-inch in 12 feet.
 - b. Set rails horizontal or parallel to slope of steps to within 1/8-inch in 12 feet.
 - c. Install posts and rails in same plane.
 - (1) Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail.
 - (2) Use offset rail on stairs and platforms if post is attached to web of stringers or structural platform supports.
 - d. Support 1 1/2-inch rails directly above stairway stringers with offset fittings.
4. Handrail Wall Brackets
 - a. Support wall rails on brackets
 - (1) Space at maximum 6 feet on centers for steel
 - (2) Space at maximum 5 feet on centers for aluminum
 - (3) Measure spacing on the horizontal projection.
 - b. Install wall anchor backing plates on solid blocking in stud walls.

5. Toeboard

- a. Provide at all handrails except where 4-inch or higher concrete curbs are installed or at gates.
- b. Accurately measure in field for correct length. Cut and secure to posts after handrail post installation.
- c. Dimension between bottom of toeboard and walking surface not to exceed 1/4-inch.
- d. Aluminum Toeboards: Provide expansion and contraction connections between each post.

6. Cleaning

- a. Wash railing system thoroughly using clean water and soap. Rinse with clean water.
- b. Do not use acid solution, steel wool, or other harsh abrasive.
- c. If stain remains after washing, restore in accordance with manufacturer's or fabricators recommendations, or replace stained handrails.

7. Prefabricated Railings

- a. Provide railing posts longer than needed and field cut to exact dimensions required.
 - (1) Install railing with a base that provides plus or minus 1/4-inch vertical adjustment inside the base fitting.
 - (2) If field adjustment exceeds plus or minus 1/4-inch, adjust the post length.
- b. Modifications to structure where handrail is attached are not permitted.
- c. Mount handrails only on completed walls. Do not support handrails temporarily by means not satisfying structural performance requirements.

H. Concrete Anchoring Systems

1. Begin installation only after concrete or masonry receiving anchors has attained design strength.
2. Do not install an anchor closer than six (6) times its diameter to either an edge of concrete or masonry, or to another anchor, unless specifically shown otherwise.
3. Install in accordance with manufacturer's specific quality control submittal

instructions.

- a. Hole diameters are critical to installation.
 - b. Use only drills recommended by anchor manufacturer.
 - c. Follow manufacturer's safe handling instructions.
4. Epoxy Anchors: Do not install when temperature of concrete is below 35 degrees F or above 110 degrees F.
- I. Where titanium equipment is in contact with concrete or dissimilar metals, provide full-face neoprene insulation gasket.
1. Use 3/32-inch minimum thickness.
 2. Provide 70 durometer hardness.

3.3 FIELD PAINTING

- A. Field prepare and paint required surfaces as specified in Section 09 91 00.
- B. Electrolytic Protection for Aluminum
1. Where in contact with dissimilar metals, or embedded in masonry or concrete, isolate surfaces per manufacturer's recommendation.
 2. Allow paint to dry before installation of the material.
 3. Protect painted surfaces during installation.
 4. Should coating become marred, prepare, and touch up in accordance with paint manufacturer's written instructions.

END OF SECTION

**SECTION 07 20 00
INSULATION**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide thermal insulation applied to exterior masonry walls, suspended ceilings, and perimeter of foundations, pipe insulation and appurtenances as specified and as shown on the Contract Documents.

1.2 QUALITY ASSURANCE

- A. Provide insulation that meets local codes and regulations for fire and smoke hazard.
- B. Manufacturer certified installer.

1.3 SUBMITTALS

- A. Comply with Section 01 33 00. Include the following information:
 - 1. Manufacturer's catalog information that describes each type of insulation provided. Include
 - a. Specifications
 - b. A complete bill of materials that identifies all materials of construction.
 - 2. Samples
 - a. 12-inch squares of insulated materials, labeled with manufacturers and product name, location, "R" value, applicable ASTM or FS designation.
 - b. Pint container of adhesives.
 - c. Fasteners.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, handle, and store the equipment in manufacturer's original unbroken packages clearly labeled with:
 - 1. Manufacturer's name.
 - 2. Fire rating.
 - 3. Smoke rating.

4. Insulation rating.

B. Store material in approved dry area off the ground and as recommended by the manufacturer.

1.5 JOB CONDITIONS

A. Environmental Requirements.

1. Prohibited when ambient temperature is lower than 40 degrees F., or when ice, frost or dampness are visible on decks or subgrade.

2. Maintain temperature of 50 degrees F. minimum in structure for 48 hours prior to 48 hours after application of wall insulation.

B. Coordination.

1. Coordinate insulation with items that must be installed before or with insulation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Certain Teed Corp., Insulation Group

B. Johns Manville

C. Owens Corning

D. Or Equal.

2.2 GENERAL

A. Provide insulation in a total thickness that will produce an R value as listed below.

B. Do not exceed specified thickness.

2.3 INSULATION BOARD

A. Insulation Boards for Cavity Spaces:

1. Extruded polystyrene foam insulation complies with ASTM C578, Type.

2. Use R-value of 5.0, minimum.

3. Use R-value of 5.0, minimum.

B. Perimeter Insulation Boards:

1. Extruded polystyrene boards shall.
 - a. Meet the requirements of ASTM C578, Type IV.
 - b. R-value of 5.0, minimum.
 - c. 48 inches wide by 96 inches long and one inch thick, with square edges.

2.4 FLEXIBLE BATTS AND BLANKET ROLLS

- A. Glass fibers and resinous binders formed into flexible blankets shall comply with ASTM C553 or ASTM C665:
- B. Outside Walls: Thermal insulation; Type III, Class A (blankets with reflective vapor-retarder membrane facing and flame spread of 25 or less); 2 ½ inch minimum thickness.
- C. Interior Walls: Acoustical insulation; Type I (unfaced, with fibers manufactured from glass); 2 ½ inch thickness.

2.5 PIPE INSULATION

- A. Insulation - shall be FOAMGLAS cellular glass insulation manufactured in accordance with ASTM C 552, "Standard Specification for Cellular Glass Thermal Insulation," by Pittsburgh Corning Corporation, Johns Manville or equal.
- B. Insulation shall be fabricated in half sections wherever possible. For large diameter piping where half sections are not practical, curved sidewall segments are preferred.
- C. Metal Jacket -0.016" smooth aluminum jacket for insulation O.D.'s of 24" or less. For larger O.D.'s use 0.020" embossed aluminum jacket.

2.6 ADHESIVES

- A. Insulation adhesives as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Examine the substrate. Provide written notification to the Engineer of unsatisfactory conditions.
- B. Do not begin until conditions are corrected.
- C. Prepare surfaces so they are smooth, dry, clean, and free of projections and other substances that might prevent proper application of insulation.

3.2 INSTALLATION

A. General

1. Comply with insulation manufacturer's handling and installation recommendations.
2. Extend insulation full thickness, over entire area to be insulated.
3. Cut and fit around obstructions and fill voids with insulation.

B. Wall and Ceiling Insulation

1. Insulation Board

- a. Apply insulation board where shown on the Drawings.
- b. Support and fasten as indicated or in accordance with insulation manufacturer's recommendations.

C. Perimeter Insulation

1. Install on the inside surface of the foundation wall to a depth of at least two feet below the underside of the slab using a thin layer of adhesive as recommended by the manufacturer.
2. Adhere a layer of 15 pound felt to the insulation the full thickness of the floor slab to prevent bonding of the concrete slab to the insulation.

3.3 PROTECTION

- A. Provide temporary protection for the installed insulation until permanent cover or protection.

END OF SECTION

**SECTION 07 26 00
VAPOR BARRIER**

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 03 10 00 Concrete Forming and Accessories
- B. Section 03 20 00 Concrete Reinforcement
- C. Section 03 30 00 Cast-In-Place Concrete

1.2 SCOPE

- A. The work in this Section of the Specifications consists of furnishing polyethylene sheeting.

1.3 REFERENCES

- A. Standards of the following as referenced:
 - 1. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

- A. Product data: Submit manufacturer's product literature and instructions for vapor barrier material. Refer to 01 33 00.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

- A. Vapor barrier: ten mil thickness polyethylene sheeting (Building) and six mil thickness under Structures; meeting requirements of ASTM E154-68(1979) for serviceability.
- B. Adhesive or tape: acceptable to manufacturer of vapor barrier material.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install vapor barrier over compacted, clean subgrade material, free of debris and protrusions.
- B. Lay vapor barrier over interior building area to receive concrete slab; lap edges 6" and sealing with mastic or tape over entire lap. Lay membrane with seams perpendicular to and lapped in direction of pour. Turn membrane edges up to within 1/2" of slab top at

vertical surfaces intersection.

- C. Lay vapor barrier continuous under joint filler where expansion or control joints are indicated in slab.
- D. Seal openings in vapor barrier around pipes and other protrusions with mastic. Fold at corners to form envelope.
- E. Protect vapor barrier installation from damage until concrete slab is in place.

END OF SECTION

**SECTION 07 92 00
SEALANTS AND CAULKING**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide sealants, caulking and related accessories to weather seal and fill joints except for roadway pavements and glazing, as specified and shown on the Contract Documents.

1.2 QUALITY ASSURANCE

- A. Use a Manufacturing company that has been specializing in the products for a minimum of three years' experience.
- B. Use an Applicator company that has been specializing in applying the work for a minimum of three years documented experience.

1.3 SUBMITTALS

- A. Comply with section 01 33 00.
- B. Product Data:
 - 1. Manufacturer's descriptive product data and certification of compliance with reference specification.
 - 2. Manufacturer's detailed description for handling, recommendation on intended use and installation recommendations.
 - 3. Color Selection:
 - a. Select from full range of colors available on color charts.
 - b. Provide actual samples of sealant colors for final selections, including custom colors if required.
 - c. Selection of colors for the products specified may be dependent on the coordinated selection of other products specified elsewhere.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original unopened containers with labels intact along with referenced specification number, type and class as applicable.
- B. Handle and store products in accordance with manufacturer's recommendations.
- C. Maintain sealants and caulking at a temperature of at least 70 degrees F. for a period of not

less than 24 hours prior to installation.

1.5 JOB CONDITIONS

A. Environmental Requirements

1. Apply sealants and caulking when temperature is above 40 degrees F. and when there is no ice, frost or dampness visible on surfaces to be sealed.

B. Safety Requirements

1. Avoid contact with skin.
2. Wear protective clothing, goggles, gloves and/or barrier creams.
3. Avoid breathing vapors in confined areas.

PART 2 MATERIALS

2.1 SEALANTS, CAULKINGS AND PRIMERS

- A. Use un-staining type of a color specified or selected by the Engineer from the Manufacturer's standard color chart.
- B. Primers, where applicable, comply with sealant manufacturer's recommendations.
- C. Provide backup materials, fillers and joint packing compatible with sealant and primer.
 1. Use back-up material to control calking depth.
 2. Use closed-cell tube or rope shaped stock expanded polyethylene or polyurethane foam.
 3. The width or diameter of backup material to be 1-1/3 to 1-1/2 times the width of the joint.
 4. Use semi-rigid vinyl or polyethylene foam, solid neoprene rod or similar approved backing for joints subject to horizontal traffic or puncture.
 5. Do not use bituminous or oily products as a backup material.
- D. Use Acrylic sealant single component water based latex and single component solvent release type with limited number of fillers and plasticizers. Comply with FSTT-S-00230C.
- E. Use Polysulfide base sealant with two components that comply to TT-S-00227E except as modified herein.

- F. Do not apply Polysulfide sealants with joint fillers and surfaces coated with asphaltic materials, oil base materials, lacquer or paint or any other sealants in which the bonding properties and adverse effects resulting from the combination are not known.
- G. Use Polyurethane based sealants with two components formulated to provide excellent resiliency and resistance to compression and with FS TT-S-00227E except as modified herein.
- H. Use Low-Modulus Silicone sealant rubber based with pigments and fillers formulated to provide excellent weather and ultraviolet rays resistance and comply with ASTM C920, Type 5, NS Class 25.
- I. Mildew-Resistant Silicone Sealant: Use Rubber-based pigments and fillers formulated to resist mildew when exposed to hot, humid environments. Comply with ASTM C920, Type 5, NS Class 25.

PART 3 EXECUTION

3.1 PREPARATION

- A. Inspect joint surfaces before starting work. Verify surfaces are dry and meet sealant manufacturer's requirements.
- B. Clean joint surfaces immediately before installation of gaskets and sealants. Remove dirt, moisture, frost, coatings and other foreign substances that will interfere with performance of compression seal and sealants.
- C. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer.
- D. Prime or seal joints surfaces as recommended by the sealant manufacturer and as shown.
- E. Confine primer or sealer to areas of the compression seal and sealant bond area.
- F. Install bond breaker tape in locations and of type recommended by the sealant manufacturer to prevent bond of sealant to surfaces where such bond could impair the performance of the sealant.
- G. In all joints to receive sealant, install bond breaker specified over backup, unless otherwise recommended by the sealant manufacturer.

3.2 APPLICATION

- A. General
 - 1. Use appropriate and approved equipment to install material in accordance with manufacturer's recommendations for materials intended except where more stringent requirements are shown or specified.

2. Prevent sealants and compounds from spilling onto adjoining surfaces or to migrate into voids of exposed finishes by using masking tape other methods.
3. Clean spills on adjoining surfaces immediately.

B. Sealant and Accessories

1. Install backup material in joints using blunt instruments to avoid puncturing and to control caulking depth.
2. Do not twist rod while installing.
3. Install backing to provide joint depth of:
 - a. Window joints: 1/2-inch wide by 1/2-inch deep.
 - b. Metal louvers and metal door frame joints: 1/4-inch wide by 1/4-inch deep.
 - c. All other joints: 1/2-inch to one-inch wide by 1/2-inch deep.
4. Place sealant in a manner that will fill the joint without air pockets and form a smooth surface.
5. For exposed surfaces of gun and knife grade sealant that cannot be made smooth during initial application, smooth with tool moistened with either water or sealant solvent.
6. Prepare sealant mixtures in quantities that can be applied within the time period recommended by the manufacturer.
7. Discard Materials mixed and not used within this time period.
8. Finish joint to a smooth concave surface slightly lower than adjoining surfaces.
9. Use joints that are finished for horizontal surfaces so moisture and debris will not be entrapped.
10. Provide Finished surface free of wrinkles and sags.
11. Use mildew-resistant silicone sealant in toilet, shower, and locker areas.
12. Use acrylic sealant at interior locations only, in non-moving joints where paintable characteristics are required, such as gypsum board partitions, where caulking is shown, at joints requiring sealant to fill intersections of materials, and only if approved by the Engineer.
13. Use Elastomeric sealants (polyurethane, polysulfide or silicone) at all exterior locations where sealant is required or shown, and at interior locations typically, such

as joints adjacent to door and window frames, at masonry construction and control joints.

3.3 CURING AND PROTECTION

- A. Cure joint sealers and accessories in accordance with manufacturer's instructions.
- B. Protect joint sealers during construction period to prevent damage, soiling or deterioration other than normal wear and weathering up to time of final acceptance.
- C. Replace or restore joint sealers damaged, soiled or deteriorated.

3.4 CLEANUP

- A. Clean adjacent surfaces of sealant and soiling.
- B. Use cleaning materials and methods recommended by manufacturer for the different surfaces.

END OF SECTION

**SECTION 09 91 00
PAINTING**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Work included under this Section shall consist of furnishing all materials and equipment and performance of all labor necessary to paint and waterproof exterior and interior surfaces as outlined in this Section.

1.2 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures
- B. Section 03 30 00 Cast in Place Concrete
- C. Section 04 22 00 Concrete Masonry Unit
- D. Section 06 10 00 Carpentry
- E. Section 26 00 00 General Electrical Provisions
- F. Section 33 35 00 Process Valves and Appurtenances
- G. Division 40, 43, and 46

1.3 PAINTING INCLUDED

- A. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise specified. Surface preparation, priming and coats of paint specified under this Section are in addition to shop-priming and surface treatment specified under other Sections, except as otherwise specified.
- B. The work includes field painting of all bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise specified.
- C. "Paint", as used herein, means all coating systems materials, including primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- D. Paint all exposed surfaces whether or not colors are designated in "schedules", except where the natural finish of the material is obviously intended or specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated,

the Engineer will select these from standard colors available for the materials systems as specified.

1.4 PAINTING NOT INCLUDED

- A. The following categories of work are not included as part of the painter-applied finish work, or are included in other Sections of these Specifications, unless otherwise shown or specified.
1. Shop Priming: Unless otherwise specified, shop priming of ferrous and other metal items is included under the various Sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated components such as wood casework, and shop-fabricated or factory-built mechanical and electrical equipment or accessories.
 2. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) metal toilet enclosures, acoustic materials, pre-finished woodwork, and casework, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, doors, and equipment.
 3. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, and duct shafts. Paint all piping, equipment, and other such items in concealed spaces, unless otherwise indicated.
 4. Finished Metal Surfaces: Metal surfaces of aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require finish painting, except as otherwise indicated.
 5. Operating Parts and Labels: Do not paint any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor, and fan shafts, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
 6. Existing Piping, existing valves, existing equipment, unless otherwise noted:

1.5 SURFACE PREPARATION

- A. Surface preparation shall be in accordance with the specification and manufacturer's recommendations. All surfaces must be clean, dry, and free of oil, grease, and other contaminants prior to coating.
1. Ferrous Metals – Immersion & Severe Exposure: SSPC-SP10 Near-White Blast Cleaning

2. Ferrous Metals – Non-Immersion: SSPC-SP6 Commercial Blast Cleaning
3. Non-Ferrous Metals: SSPC-SP16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
4. Concrete: Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines
5. Concrete Block (CMU) – Non-Submerged: Allow mortar to cure for 14 days. Level protrusions and mortar spatter.
6. Wood: Sand rough areas. Seal knots and pitch pockets. Fill cracks and nail holes after primer has cured.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Material shall be delivered in unbroken original containers bearing the manufacturer's name, trade name, mixing instructions, and application instructions.
- B. The Owner will select the colors from manufacturer's standard color chart.
- C. Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.
- D. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only within recommended limits.
- E. Acceptable manufacturers include Induron, Carboline, Tnemec, PPG, and Sherwin-Williams according to the following schedules.
- F. Concrete coating for cast in place concrete shall be Thoroseal.

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Surface	Induron Coatings, Inc.	Induron Application
1. Structural Steel and Miscellaneous Iron and Steel	PermaClean II Primer	<u>Shop Primer</u> One (1) Coat 3.0 to 5.0 mils dft
A. All interior miscellaneous iron and steel	PermaClean II	<u>Finish Coat</u> Two (2) Coats 3.0 to 5.0 mils dft per coat
B. All exterior miscellaneous iron and steel	PermaClean II	<u>Intermediate Coat</u> 3.0 to 5.0 mils dft per coat
	Indurethane 6600 Plus	<u>Finish Coat</u> 2.0 to 3.0 mils dft per coat
C. All miscellaneous iron and steel in vaults, pits, galleries and in areas exposed to extreme humidity and condensation	PermaClean II	<u>Finish Coat</u> Two (2) Coats 3.0 to 5.0 mils dft per coat
D. All structural Steel	PermaClean II	<u>Finish Coat</u> Two (2) Coats 3.0 to 5.0 mils dft per coat
E. All equipment, iron and steel in areas covered with sewage	PermaClean II Primer	<u>Primer Coat</u> One (1) Coat 0.3 to 5.0 mils dft per coat
	Ruff Stuff 2100 Coal Tar Epoxy	<u>Finish Coat</u> One (1) Coat 16.0 to 18.0 mils dft per coat
2. Exposed Cast Iron Piping System (primed in shop)	PermaClean II Primer	<u>Prime Coat</u> 3.0 to 5.0 mils dft per coat
	PermaClean II	<u>Intermediate Coat</u> 3.0 to 5.0 mils dft per coat
	Indurethane 6600 Plus	<u>Finish Coat</u> 2.0 to 3.0 mils dft per coat
3. Galvanized Iron	Vinyl Wash Primer	<u>Prime Coat</u> 0.5 mils dft
	PermaClean II	<u>Intermediate Coat</u> 3.0 to 5.0 mils dft per coat

	Indurethane 6600 Plus	<u>Finish Coat</u> 2.0 to 3.0 mils dft per coat
4. Exposed Electrical Work	Vinyl Wash Primer	<u>Prime Coat</u> 0.5 mils dft
	PermaClean II	<u>Intermediate Coat</u> 3.0 to 5.0 mils dft per coat
	Indurethane 6600 Plus	<u>Finish Coat</u> 2.0 to 3.0 mils dft per coat
5. Interior & Exterior Concrete Block, non-submerged	Polyfill Epoxy Block filler (Interior)	<u>Prime Coat</u> Fill Porous Surface (Interior)
	AC403 Elastomeric Block Filler (Exterior)	0.5 to 1.0 mils dft (Exterior)
	Induraguard Epoxy (Interior)	<u>Finish Coat</u> Two (2) coats (Interior)
	AC403 Elastomeric (Exterior)	3.0 to 5.0 mils dft each coat Two (2) coats (Exterior) 6.0 to 12.0 mils dft each coat
6. Ferrous metal Doors and Frames	PermaClean II Epoxy Primer	<u>Prime Coat</u> 3.0 to 5.0 mils dft per coat
	PermaClean II	<u>Finish Coat</u> Two (2) coats 3.0 to 5.0 mils dft per coat
7. Equipment	E-Bond 100	<u>Field Prime Coat</u> 1.0 to 2.0 mils dft per coat
	Indurethane 6600 Plus	<u>Finish Coat</u> 2.0 to 3.0 mils dft per coat
8. Interior and Exterior Wood Surface	Aquanaut Primer	<u>Prime Coat</u> 2.0 to 3.0 mils dft per coat
	Aquanaut II	<u>Finish Coat</u> Two (2) Coats 2.0 to 4.0 mils dft per coat
9. Galvanized Steel Trusses and Roof Deck	Vinyl Wash Primer	<u>Prime Coat</u> 0.5 mils dft
	PermaClean II	<u>Finish Coat</u> Two (2) Coats 3.0 to 5.0 mils dft per coat

10. Concrete Wet Well and manholes (as called out)	PermaClean II Primer	<u>Prime Coat</u> One (1) Coat 3.0 to 5.0 mils dft per coat
	Ruff Stuff 2100 Coal Tar Epoxy	<u>Finish Coat</u> One (1) Coat 16.0 to 18.0 mils dft per coat

Surface	Carboline Company	Carboline Application
1. Structural Steel and Miscellaneous Iron and Steel	Carboguard 60	<u>Shop Primer</u> One (1) Coat 4.0 to 6.0 mils dft
A. All interior miscellaneous iron and steel	Carboguard 890	<u>Finish Coat</u> Two (2) Coats 4.0 to 6.0 mils dft per coat
B. All exterior miscellaneous iron and steel	Carboguard 890	<u>Finish Coat</u> One (1) Coat 4.0 to 6.0 mils dft
	Carbothane 134 HG	<u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
C. All miscellaneous iron and steel in vaults, pits, galleries and in areas exposed to extreme humidity and condensation	Carboguard 890	<u>Finish</u> Two (2) Coats 4.0 to 6.0 mils dft per coat
D. All structural Steel	Carbocoat 60	<u>Finish</u> Two (2) Coats 4.0 to 6.0 mils dft per coat
E. All equipment, iron and steel in areas covered with sewage	Carboguard 60	<u>Shop Primer</u> One (1) Coat 4.0 to 6.0 mils dft
	Carboline Bitumastic 300 M Coal tar Epoxy	<u>Finish</u> Two (2) Coats 8.0 mils dft per coat
2. Exposed Cast Iron Piping System (primed in shop)	Carboguard 890	<u>Prime Coat</u> One (1) Coat 4.0 to 6.0 mils dft per coat
	Carbothane 134 HG	<u>Finish Coat</u>

		One (1) Coat 2.0 to 3.0 mils dft
3. Galvanized Iron	Sanitile 120	<u>Prime Coat</u> One (1) Coat 1.0 to 2.0 mils dft
	Carbocrylic 3359	<u>Finish Coat</u> Two (2) Coats 2.0 to 3.0 mils dft per coat
4. Exposed Electrical Work	Sanitile 120	<u>Prime Coat</u> One (1) Coat 0.5 mils dft
	Carbocrylic 3359	<u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft per coat
5. Interior & Exterior Concrete Block, non-submerged	Sanitile 100	<u>Prime Coat</u> One (1) Coat 12.0 to 14.0 mils dft
	Sanitile 155 WB (Exterior)	<u>Finish Coat</u> 2.0 to 3.0 mils dft (Exterior),
	Carboguard 890 (Interior)	4.0 to 6.0 mils dft (Interior)
6. Ferrous Metal Doors and Frames	Sanitile 120	<u>Prime Coat</u> 1.0 to 2.0 mils dft
	Carbocrylic 3359	<u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
7. Equipment	Carbocrylic 3359	<u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
8. Interior and Exterior Wood Surface	Sanitile 120	<u>Prime Coat</u> 1.0 to 2.0 mils dft
	Carbocrylic 3359	<u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
9. Galvanized Steel Trusses and Roof Deck	Carboline Rustbond Penetrating Sealer	<u>Prime Coat</u> One (1) Coat 1.0 to 2.0 mils dft

	Carboguard 890	<u>Finish Coat</u> Two (2) Coats 4.0 to 6.0 mils dft per coat
10. Concrete Wet Well and manholes (as called out)	Carboguard 510 SG	<u>Resurfacer</u> Up to ¼” as needed in single coat
	Plasite 4500S	<u>Finish</u> Two (2) Coats 830.0 to 40.0 mils dft per coat

Surface	Tnemec Company, Inc.	Tnemec Application
1. Structural Steel and Miscellaneous Iron and Steel	Series N69F	<u>Shop Primer</u> One (1) Coat 3.0 to 5.0 mils dft
A. All interior miscellaneous iron and steel	Series N69	<u>Finish Coat</u> Two (2) Coats 3.0 to 5.0 mils dft per coat
B. All exterior miscellaneous iron and steel	Series N69 Series 72	<u>Intermediate Coat</u> <u>One (1) Coat</u> 3.0 to 5.0 mils dft <u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
C. All miscellaneous iron and steel in vaults, pits, galleries and in areas exposed to extreme humidity and condensation	Series N69	<u>Finish</u> Two (2) Coats 4.0 to 6.0 mils dft per coat
D. All structural Steel	Series N69	<u>Finish</u> Two (2) Coats 3.0 to 5.0 mils dft per coat
E. All equipment, iron and steel in areas covered with sewage	Series N69-1211 Series 46H-413	<u>Prime Coat</u> One (1) Coat 3.0 to 5.0 mils dft <u>Finish Coat</u> One (1) Coat 16.0 to 20.0 mils dft

2. Exposed Cast Iron Piping System (primed in shop)	Series N140-1255 (shop primer)	<u>Shop Prime Coat</u> One (1) Coat 3.0 to 5.0 mils dft
	Series N69	<u>Intermediate Coat</u> One (1) Coat 3.0 to 5.0 mils dft
	Series 72	<u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
3. Galvanized Iron	Series 115 Direct to Galvanized	<u>Prime Coat</u> One (1) Coat 2.0 to 3.0 mils dft
	Series 1029	<u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
4. Exposed Electrical Work	Series 1029	<u>Finish Coat</u> Two (2) Coats 2.0 to 3.0 mils dft per coat
Surface	Tnemec Company, Inc.	Tnemec Application
5. Interior & Exterior Concrete Block, non-submerged	Series 130 (Interior and Exterior)	<u>Prime Coat</u> 80-100 sf per gallon (Interior and Exterior)
	Series 113 (interior) Series 156 (exterior)	<u>Finish Coat</u> Two (2) Coats 4.0 to 6.0 mils dft per coat (Interior and Exterior)
6. Ferrous Metal Doors and Frames	Series 151	<u>Prime Coat</u> One (1) Coat 1.0 to 1.5 mils dft
	Series 1029	<u>Finish Coat</u> Two (2) Coats 2.0 to 3.0 mils dft
7. Equipment	Series 1029	<u>Finish Coat</u> Two (2) Coats 2.0 to 3.0 mils dft

8. Interior and Exterior Wood Surface	Series 151	<u>Prime Coat</u> One (1) Coat 1.0 to 1.5 mils dft
	Series 1029	<u>Finish Coat</u> Two (2) Coats 1.5 to 2.5 mils dft
9. Galvanized Steel Trusses and Roof Deck	Series 115 Direct	<u>Finish Coat</u> Two (2) Coats 2.0 to 3.0 mils dft per coat
10. Concrete Wet Well and manholes (as called out)	Series 218	<u>Resurfacer</u> One (1) Coat 1/8” Nominal Thickness
	Series G435	<u>Finish Coat</u> Two (2) Coats 30.0 to 40.0 mils dft

Surface	PPG	PPG Application
1. Structural Steel and Miscellaneous Iron and Steel	Amerlock 2/400/600	<u>Shop Primer</u> One (1) Coat 1.1 to 6.0 mils dft
A. All interior miscellaneous iron and steel	Amerlock 2/400/600	<u>Finish Coat</u> Two (2) Coats 4.0 to 8.0 mils dft per coat
B. All exterior miscellaneous iron and steel	Amerlock 2/400/600	<u>Prime Coat</u> One (1) Coat 5.0 to 10.0 mils dft
	Pitthane Ultra 95-812	<u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
C. All miscellaneous iron and steel in vaults, pits, galleries and in areas exposed to extreme humidity and condensation	Amerlock 2/400/600	<u>Finish</u> Two (2) Coats 4.0 to 8.0 mils dft per coat
D. All structural Steel	Amerlock 2/400/600	<u>Finish</u> Two (2) Coats 4.0 to 8.0 mils dft per coat
E. All equipment, iron and steel in areas covered with sewage	NovaGuard 840	One (1) Coat 16-20 mils dft

2. Exposed Cast Iron Piping System (primed in shop)	Amerlock 2/400/600 Pitthane Ultra 95-812	<u>Shop Primer</u> One (1) Coat 4.0 to 6.0 mils dft <u>Finish</u> Two (2) Coats (Direct to metal if blasted in the field) 8.0 to 20.0 mils dft per coat
3. Galvanized Iron	Pitt-tech plus EP DTM Acrylic Satin	<u>Prime Coat</u> One (1) Coat 1.8 to 3.6 mils dft <u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
4. Exposed Electrical Work	Pitt-tech plus EP DTM Acrylic Satin	<u>Prime Coat</u> One (1) Coat 1.8 to 3.6 mils dft <u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
5. Interior & Exterior Concrete Block, non-submerged	Amerlock 400 BF Interior Pitt-tech Plus EP DTM Satin Acrylic Satin Amerlock 2/400/600	<u>Fill Coat</u> One (1) Coat 12.0 to 14.0 mils dft <u>Finish Coat</u> 6.5 to 8.5 mils dft (Exterior), 2.0 to 5.0 mils dft (Interior)
6. Ferrous Metal Doors and Frames	Amerlock sealer Pitt-Tech Plus EP DTM Acrylic Satin	<u>Prime Coat</u> 1.8 to 3.6 mils dft <u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
7. Equipment	Pitt-tech Plus EP DTM Acrylic Satin	<u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
8. Interior and Exterior Wood Surface	Pitt-tech Plus EP DTM Acrylic Satin	<u>Prime Coat</u> 1.4 min mils dft <u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
9. Galvanized Steel Trusses and Roof Deck	Amerlock 2/400/600	<u>Finish Coat</u> Two (2) Coats 4.0 to 8.0 mils dft per coat
10. Concrete Wet Well and manholes (as called out)	Raven 760 Nova Guard 840/890 or Raven 405	<u>Finish</u> Two (2) Coats at 8-16 mils DFT Or one (1) at 16.0 to 18.0 mils Total dft

Surface	Sherwin-Williams	S-W Application
1. Structural Steel and Miscellaneous Iron and Steel	Macropox 646 FC Epoxy	<u>Shop Primer</u> One (1) Coat 1.2 to 6.0 mils dft
A. All interior miscellaneous iron and steel	Macropoxy 646 FC Epoxy	<u>Finish Coat</u> Two (2) Coats 4.0 to 8.0 mils dft per coat
B. All exterior miscellaneous iron and steel	Macropoxy 646 FC Epoxy Acrolon 218	<u>Prime Coat</u> One (1) Coat 5.0 to 10.0 mils dft <u>Finish Coat</u> One (1) Coat 2.0 to 3.0 mils dft
C. All miscellaneous iron and steel in vaults, pits, galleries and in areas exposed to extreme humidity and condensation	Macropoxy 646	<u>Finish</u> Two (2) Coats 4.0 to 8.0 mils dft per coat
D. All structural Steel	Macropoxy 646 FC Epoxy	<u>Finish</u> Two (2) Coats 4.0 to 8.0 mils dft per coat
E. All equipment, iron and steel in areas covered with sewage	Macropoxy 240 Sher-Glass FF Epoxy	<u>Shop Primer</u> One (1) Coat 4.0 to 6.0 mils dft <u>Finish</u> Two (2) Coats (Direct to metal if blasted in the field) 8.0 to 20.0 mils dft per coat

2. Exposed Cast Iron Piping System (primed in shop)	Macropoxy 240	<u>Shop Primer</u> One (1) Coat 4.0 to 6.0 mils dft
	Sher-Glass FF Epoxy	<u>Finish</u> Two (2) Coats (Direct to metal if blasted in the field) 8.0 to 20.0 mils dft per coat
3. Galvanized Iron	Pro-Cryl Primer	<u>Prime Coat</u> One (1) Coat 1.8 to 3.6 mils dft
	Pro Industrial DTM Acrylic	<u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
4. Exposed Electrical Work	Pro-Cryl Primer	<u>Prime Coat</u> One (1) Coat 1.8 to 3.6 mils dft
	Pro Industrial DTM Acrylic	<u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
5. Interior & Exterior Concrete Block, non-submerged	Pro Industrial Block Filler	<u>Fill Coat</u> One (1) Coat 12.0 to 14.0 mils dft
	Loxon XP (Exterior), Pro Industrial WB Epoxy, B73-300 series (Interior)	<u>Finish Coat</u> 6.5 to 8.5 mils dft (Exterior), 2.0 to 5.0 mils dft (Interior)
6. Ferrous Metal Doors and Frames	Pro-Cryl Primer	<u>Prime Coat</u> 1.8 to 3.6 mils dft
	Pro Industrial DTM Acrylic	<u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
7. Equipment	Pro Industrial DTM Acrylic	<u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
8. Interior and Exterior Wood Surface	Pro Block Latex Primer	<u>Prime Coat</u> 1.4 min mils dft
	Pro Industrial DTM Acrylic	<u>Finish Coat</u> Two (2) Coats 2.4 to 4.0 mils dft per coat
9. Galvanized Steel Trusses and Roof Deck	Macropoxy 646 FC Epoxy	<u>Finish Coat</u> Two (2) Coats 4.0 to 8.0 mils dft per coat
10. Concrete Wet Well and manholes (as called out)	Hi Mil SherTar	<u>Finish</u> Two (2) Coats at 8-16 mils DFT Or one (1) at 16.0 to 18.0 mils Total dft

2.2 CONCRETE COATING

A. Exterior - Above Grade – Cement Based Waterproof System

1. Surface Preparation
 - a. Surfaces must be dry, clean, and free of oil, grease and other contaminants.
 - b. Allow concrete to cure 28 days.
2. 1st Coat
 - a. THOROSEAL, mixed per manufacturer recommendation.
 - b. Maximum Coverage: 2-lb./sq. yd
3. 2nd Coat
 - a. THOROSEAL, mixed per manufacturer recommendation.
 - b. Maximum Coverage: 1-lb./sq. yd

B. Exterior - Below Grade – Coal Tar System

1. Surface Preparation
 - a. Surfaces must be clean and dry.
2. 1st Coat
 - a. TNEMEC Series 46-465 H.B. Tnemecol or equal.
 - b. Maximum Coverage: 94 sf/gal
3. 2nd Coat:
 - a. TNEMEC Series 46-465 H.B. Tnemecol or equal.
 - b. Maximum Coverage: 94 sf/gal

C. Interior Exposure (Non-Submerged) – Epoxy System

1. Surface Preparation
 - a. Brush-Off Blast Cleaning
2. 1st Coat
 - a. TNEMEC Series 66 Hi-Build Epoxoline or equal.

- b. 4 – 5 mils dft.
- 3. 2nd Coat
 - a. TNEMEC Series 66 Hi-Build Epoxoline or equal.
 - b. 4 – 5 mils dft.

PART 3 EXECUTION

3.1 PAINTING

- A. Paint shall not be applied on damp or frosty surfaces, nor during wet, foggy, or weather below 50° F, or above 85% relative humidity. Comply with manufacturer’s product data as to environmental conditions. Surfaces to be painted shall be made free of dust and other foreign matter before paint is applied; surfaces shall be completely dry before paint is applied. Iron and steel which have been shop primed, shall have all abrasions in the priming coat cleaned to bright metal to remove all scale, ridges, rust, and faults in the prime coat. Weld splatter shall be removed and that area re-primed. Voids and open and hollow places shall be repaired with a material compatible with the surface to be repaired.
- B. Paint shall be spread and brushed out so that there shall be no drops, runs, or sags in the coating. Where runs, sags, and drops do occur, they shall be removed, and the surface shall be re-coated. Paint shall be dry before additional coats are applied. Drop cloths shall be used to protect surfaces of the structure and equipment in place, and upon completion of work, paint spots shall be removed from surfaces and defaced surfaces shall be re-finished. Painting found to be defective, and that applied under adverse conditions, shall be removed and new paint shall be applied. Where more than one coat is required, undercoats shall be job-tinted.

3.2 CONCRETE COATING

- A. Mix and apply all products per the manufacturer recommendation. The substrate to be coated must be clean, dry, free of oil and grease. On exposed concrete, rub concrete with a carborundum brick to remove scale and ridges prior to application. Repair/patch honeycombing as needed, then apply coating. After first application allow time for coating to cure and re-apply a second coat.
- B. For Thoroseal application to exposed concrete, coat only the area that will be exposed and down to 12 inches below finish grade. Coat top of exposed wall. Area on the inside of a process basin to be rubbed smooth to a level 12 inches below top of water surface.

END OF SECTION

**SECTION 10 14 00
SIGNAGE**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install signage as specified and scheduled herein.
- B. The types to be furnished are as follows:
 - 1. Restrictive Identification signs.
 - 2. Construction Entrance Banner.

1.2 RELATED WORK

- A. Piping and equipment identification is specified in Section 09 91 00.

1.3 SUBMITTALS

- A. Submit to the Engineer, the manufacturer's complete color range and type styles.
- B. Submit to the Engineer shop drawings showing details of construction and erection. Refer to Section 01 33 00.
- C. Submit
 - 1. Full size sample of each proposed plastic restrictive sign with proposed mounting systems.
 - 2. Other samples as directed.
- D. Submit to the Engineer cleaning and maintenance instructions for all signage components.
- E. Refer to PART 2 for the construction entrance banner submittal requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Restrictive and Hazard Identification signs shall be:
 - 1. 60 mil, polished vinyl, overcoated with Tedlar sheet with four mounting holes and rounded corners for other locations.

2. Print (permanent type as approved) all with required graphics and letters. Print under overcoat where such occurs.
3. Provide stainless steel fasteners and plastic drill-in anchors as required or stainless-steel wire for fastening where each is ordered.
4. Signs shall be by Seton Name Plate Corp. or equal.
5. Restrictive signs shall conform with OSHA regulations for accident prevention. Size of signs: 10-in high by 14-in. Refer to Schedule in Part 3 of this Section.

B. Construction Entrance Banner shall meet the following:

1. Qty: 1
2. Type: Solid vinyl, UV protected material, 100% blockage.
3. Edge: Welded edge with border and black or brass grommets.
4. Size: 4 feet tall and length as required.
5. Color and Letter Size: Submit shop drawing example for Owner Selection.
6. Information on Banner includes:
 - a. City Logo.
 - b. Name of Project and Date.
 - c. City Project Number.
 - d. Specific City Personnel Names (provided by Owner).
 - e. Prime Contractor Name.
 - f. Engineer Name.
 - g. Finance Source, if required. (provided by Owner)

PART 3 EXECUTION

3.1 INSTALLATION

- A. Signage shall be installed in accordance with the manufacturer's recommendations and approved shop drawings.
- B. Damaged units or components shall be removed and replaced at no cost to the Owner.

- C. Signage shall be cleaned to the satisfaction of the Engineer using the approved methods, upon completion of the installation and again, just prior to acceptance of the Project.
- D. Mounting labor and stainless-steel hardware are required under this Section.
- E. Signage shall be located as follows:
 - 1. Restrictive Signage shall be mounted 60-in above the floor or at locations as directed by the Engineer or Owner.
 - 2. Construction Entrance Banner to be installed on existing fence near plant entrance gate.

3.2 SIGNAGE SCHEDULE

A. Restrictive Signage Schedule

QUANTITY	SIGN COPY	LOCATION
2	CAUTION Equipment Starts Automatically	As directed by the Engineer
2	CAUTION Slippery When Wet	As directed by the Engineer
4	CAUTION Use Handrail	As directed by the Engineer
6	Signage to be determined by Engineer and/or Owner	As directed by the Engineer

END OF SECTION

**SECTION 10 14 16
PLAQUES**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Furnish labor, equipment, and materials to install the plaque devices as herein specified and as shown on the drawings.

1.2 QUALITY ASSURANCE

- A. Manufacturer: For purposes of designating type and quality of products herein specified, the drawings and specifications are based on products manufactured or furnished by the firms listed in Part 2 Products. Manufacturers of products similar in design, quality and function may submit for approval prior to bidding.
- B. Acceptable Manufacturers:
 - 1. Spanjer Brothers, Inc.
 - 2. Leeds Sign Co.
 - 3. Woodland Manufacturing.

1.3 SUBMITTALS

- A. Product data: Indicate material types, finishes and sizes, fabrication and installation details and requirements.
- B. Submit shop drawings in accordance with Section 01 33 00 of these specifications.

PART 2 PRODUCTS

2.1 PLAQUE

- A. Provide and install one (1) 16" x 21" aluminum plaque. The plaque shall be located at the entrance to the control building as directed by the Engineer.
 - 1. Plaque shall be 3/8" thick (minimum) with single line border and letters raised 1/8".
 - 2. Letters shall be Classic style on a painted black background.
 - 3. Letter and border shall be satin aluminum.
 - 4. Manufacturer of plaque shall provide all necessary anchors and fastening devices for attaching plaque to masonry wall.

B. Inscription

1. Inscription shall be provided by the Owner. Contractor shall submit layout for approval.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's printed instruction, plumb, level and true to line and location.

END OF SECTION

**SECTION 10 73 16
METAL CANOPIES**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Freestanding, pre-engineered metal canopies including structural steel framing, metal roof panels, accessories and trim. This work is through an Allowance.

1.2 QUALITY ASSURANCE

- A. Erector Qualifications: An erector with a minimum of five years of experienced who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind required. Engineering services are defined as those performed for design and installations of metal canopy systems for this project.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package roof and wall panels for protection during transportation and handling.
- B. Handling: Unload, store, and erect roof and wall panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weather tight and ventilated covering. Store roof and wall panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.4 SUBMITTALS

- A. Product data: Indicate material types, finishes and sizes, fabrication and installation details and requirements.
- B. Submit shop drawings in accordance with Section 01 33 00 of these specifications. These shop drawings will be reviewed for content and compliance with the overall intent of this specification. The vendor is ultimately responsible for the design of the canopy system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturer's: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Arco Building Systems (678) 282-5085, TFC Canopy (800) 832-3212 or equal.

2.2 MATERIALS

- A. Structural-Steel Shapes: ASTM A 992/A 992M 50.0 ksi minimum yield strength.
- B. Steel Plate, Bar, or Strip: ASTM A 529/A 529M; 50.0 ksi minimum yield strength.
- C. Structural square HSS tube steel: A500 grade B; 46.0 ksi minimum yield strength.
- D. Structural round HSS tube steel: A500 grade B; 42.0 ksi minimum yield strength
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Grade 40, with G60 (Z180) coating designation.
- E. Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M and the following requirements:
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Grade 40, with G60 (Z180) coating designation.
- F. Primers: As selected by manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems, capability to provide a sound foundation for field-applied topcoats as follows:
- G. Primer: Manufacturer's standard, lead- and chromate-free, non-photochemically reactive, rust-inhibiting primer.

2.3 DECK MATERIALS

- A. Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot dip process and pre-painted with polyester paint and compatible primer on the face side and wash coat on the back side by the coil-coating process to comply with ASTM A 755/A 755M and the following requirements:
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G60 (Z180) coating designation; Grade 50.
- B. Surface: Smooth, flat, mill finish.

2.4 STRUCTURAL FRAMING

- A. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads, fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
- B. Bracing: Provide lateral bracing as follows:
 - 1. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

2.5 ROOF PANELS

- A. 20 gauge x 16" wide x 3" smooth or embossed steel panels.
- B. Roof Panel Accessories: Provide components required for a complete roof panel assembly including trim, coping, corner units, clips, seam covers, battens, flashings, gutters, sealants, fillers, closure strips, and similar items. Match materials and finishes of roof panels, unless otherwise indicated.
- C. Panels shall have a finish side coated with a full coat of Silicone Modified Polyester (SMP) paint baked on over a polyester primer. Reverse side shall be protected by a whitewash coat baked on over a polyester primer.

PART 3 EXECUTION

3.1 REPARATION

- A. Clean substrates of substances, including oil, grease, rolling compounds, incompatible primers, and loose mill scale that impair bond of erection materials.
- B. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

3.2 ERECTION OF STRUCTURAL STEEL

- A. Erect metal canopy system according to manufacturer's written instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal canopy system manufacturer's professional engineer.
- C. Set structural framing in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

- D. Base plates and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces before setting base plates and bearing plates. Clean bottom surface of base plates and bearing plates.
 - 1. Set base plates and bearing plates for structural members on leveling nuts.
 - 2. Tighten anchor bolts after supported members have been positioned and plumbed.
 - 3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. Shrinkage-Resistant Grout to be provided and installed by the General Contractor.
 - a. Comply with manufacturer's written instructions for proprietary grout materials.
- E. Align and adjust framing members before permanently fastening. Before assembly, clean bearing surfaces and other surfaces will be in permanent contact. Make adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- F. Primary Framing: Erect framing true to line, level, plumb, rigid, and secure. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation.
 - 1. Make field connections using high-strength bolts. Tighten bolts by turn-of-the-nut method.
- G. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips, non-high-strength bolts, and or screws as indicated on manufacturers erection drawings.
- H. Bracing: Install bracing in roof where indicated on manufacturers erection drawings.

3.3 ROOF PANEL INSTALLATION

- A. General: Provide roof panels of full length when possible.
 - 1. Field cutting by torch is not permitted.
 - 2. Rigidly fasten eave end of roof panels and allow ridge end free movement due to

thermal expansion and contraction.

3. Flash and seal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-drilling and tapping screws.
 4. Install screw fasteners with power tools having controlled torque adjusted to tighten without damaging screw threads, or panels.
 5. Use manufacturer supplied fasteners for exterior applications.
 6. Locate and space fastenings in true vertical and horizontal alignment.
- B. Deck Panels: Fasten roof panels to purlins with clip system that requires no “Thru Panel” fasteners.
1. “Deck Clips” must be tested and rated to meet the most critical effects of load factors and load combinations.

3.4 ACCESSORY INSTALLATION

- A. General: Install gutters, downspouts, and other accessories according to manufacturer's written instructions, with positive anchorage and weather tight mounting. Coordinate installation with flashings and other components.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions. Provide for thermal expansion of metal units; conceal fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates resulting in waterproof and weather-resistant performance.
 2. Separations: Separate metal from incompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

3.5 ERECTION AND LOCATION TOLERANCES

- A. Structural-Steel Erection Tolerances: Comply with erection tolerance limits of AISC 303-05, "Code of Standard Practice for Steel Buildings and Bridges."

3.6 CLEANING AND PROTECTION

- A. Touchup Painting: Immediately after erection, clean, prepare, and prime or re-prime welds, bolted connections, and abraded surfaces of prime-painted primary and secondary framing, accessories, and bearing plates.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 2. Apply compatible primer of same type as shop primer used on adjacent surfaces.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded surfaces of shop-painted primary and secondary framing, accessories, and bearing plates are included in Division 9 Section "Painting."
- C. Roof and Wall Panels: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.
1. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

**SECTION 22 05 00
PLUMBING**

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Water piping, fittings, and valves
2. Sanitary waste piping, fittings, and accessories.

1.2 SYSTEM DESCRIPTION

- A. Provide water piping, and fittings, and valves for domestic water use. Provide sanitary waste piping, fittings, and accessories.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data:

1. Include dimensions, finishes, construction information, capacities, operation instructions and accessories.

- C. Maintenance data for all products.

D. Closeout Submittals:

1. Coordinate provisions with Section 01 70 00 – Execution and Closeout Requirements.

- E. Submit operation and maintenance data and warranty information.

1.4 QUALITY ASSURANCE

- A. Coordinate with Section 01 40 00 - Quality Requirements.

B. Manufacturer Qualifications:

1. Minimum 5 years manufacturing similar products.

C. Installer Qualifications:

1. Minimum 2 years installing similar products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
 - 1. Protect internal parts, valve ends, and specialties against corrosion, dirt, and damage.
 - 2. Store valves set in closed position.
 - 3. Storage:
 - a. Indoors: Higher than ambient dew point temperature.
 - b. Outdoors: Watertight enclosures off ground.
- B. Handling: Comply with manufacturer's recommendations.

1.6 WARRANTY

- A. Coordinate Section 01 70 00, Execution and Closeout Requirements.
- B. Provide One year warranty on all labor and materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Acceptable manufacturers are named in the following paragraphs.
- B. Alternates: The number and trade names given for any products are taken from various manufacturer catalogs as stated and shall be construed as being descriptive only of type, style, and quality of material required. Material of other reputable manufacturers of equal quality, type and style may be acceptable only if approved by the Engineer.

2.2 PRODUCTS

- A. Copper domestic water piping, fittings, and trim
 - 1. Provide Type “K” soft temper ASTM B 88 piping for piping underground or underground beneath the floor slab. Piping 1-inch and smaller shall be provide with no joints beneath floor slab. Piping greater than 1-inch underground or underground beneath the floor slab shall be provided with Type “K” hard copper piping and fittings joined with 15 percent silver solder. Piping underground beneath the floor slab shall be bedded in earth and shall not be in contact with concrete slab except at the slab penetration. The slab penetration shall be coated and wrapped. Solder and flux shall be lead free. Provide flux in accordance with ASTM B813 (flux shall be

water flushable. Comply with ASTM B819, B 828, B32 and NSF 61.

2. Provide Type “L” hard copper ASTM B88 piping for above ground piping and for all indirect waste drain piping, including relief valve discharge piping. Provide wrought copper solder type fittings. Provide 95/5 tin/antimony solder. Solder and flux shall be lead free. Provide flux in accordance with ASTM B 813 (flux shall be water flushable). Comply with ASTM B819, B 828, B 32, and NSF 61.
 3. Provide dielectric fittings at all connections to water heaters, pumps, and equipment. Dielectric unions shall limit galvanic current 1% of the adjoining metal to metal contact. Rated for 150 psi. As manufactured by Epco, Victaulic, or Watts.
 4. Isolation valves 3-inch and smaller shall be ball valves; full port, malleable handle, brass stem, forged brass body, and hard chrome plated brass ball. Basis of design is Milwaukee BA 155 600 WOG, 150 SWP. Isolation valves 4-inch and larger shall be butterfly valves or lug type butterfly valves, bronze body, EPDM seat and stem seals, and bronze disk. Basis of design is Milwaukee “M” series. For valves 6-inch and smaller provide lever handle. For valves larger than 6-inch, provide gear operation. Lever handle shall be provided with 10 positions stop plate. Acceptable manufacturers are Apollo, Crane, DeZurik, Dover, Grinnell, Hammond, Jomar, Keystone, Kitz, Victaulic, Milwaukee, Mueller, Nibco, Powell, Resun, Stockham, SVF, Walworth, and Watts.
 5. Check valves shall be Watts Series LF007 Lead Free Double Check Valve Assemblies prevent the backflow of contaminated water into the potable water supply. It shall be constructed of lead-free cast copper silicon alloy (1/2 to 2 in), or fused epoxy coated cast iron (2 1/2 to 3 in) body construction. Maximum Working Pressure is 175psi.
 6. Pressure gauges and lever handle needle valves shall be by Trerice, Ashcroft, Marsh, Moeller, Weiss, Weksler, and American. Gauges shall be bourdon tube type. Bearing shall be bronze. Gauges shall be ANSI Grade A, dial indicating type, with 4-1/2” dial and stainless-steel case and ring.
- B. Cast iron and sanitary waste and vent piping and fittings
1. Provide coated service weight cast iron no-hub soil piping and fittings, CISPI 301, for above ground piping 1 1/2” and larger. Comply with ASTM A-888 and C-564.
 2. Provide neoprene rubber sleeves, CISPI 301.
 3. Provide stainless steel compression, CISPI 301.
 4. Provide coated service weight cast iron hub and spigot piping CISPI HS-74 for underground piping 2” and larger. Comply with ASTM A-74 and C-564.
 5. All soil piping and fitting shall be installed in accordance with the CISPI Cast Iron

Soil Pipe and Fittings Handbook.

C. DWV copper piping and fittings

1. Provide drainage, waste, and vent copper manufactured in accordance with ASTM b-306.
2. Provide wrought drainage fittings in accordance with ANSI B-16.29.
3. Provide solder and a compatible flux for joints.
4. Provide DWV copper for 2” and smaller concealed fixture branch arms. Provide red brass at urinals.

D. Equipment, Drains, and Accessories

1. Water Hammer Arrestors

- a. Stainless steel housing, rubber bellows, size designations per Plumbing and Drainage Institute designate (PDI-WH-201).
- b. Smith No. 5000 series all stainless steel “Hydrotrols” on both cold and hot water line or approved equal.
- c. Install in an upright position at all quick closing valves, solenoids, and plumbing fixtures. Locate and size as indicated on drawings. Where not shown on drawings, locate and size in accordance with Plumbing & Drainage Institute Standard No. WH201.

2. Hose Bibb

- a. Rough brass wall faucet with vacuum break, 3/4-inch hose thread, and wheel handle.
- b. Woodford Model 24 or approved equal.

3. Fire Hose Ball Valve

- a. Wye valve, 2 1/2-inch Inlet, 2x1 1/2 -inch outlets.
- b. Application: Divides Single Flow to Double Flow.
- c. Body Style: Wye
- d. Inlet Type: Female NH
- e. Outlet Type: Male NH x Male NH

- f. Inlet Size: 2-1/2"
 - g. Outlet Size: 1-1/2" x 1-1/2"
 - h. Handle Type: Lever
 - i. Handle Material: 304 Stainless Steel
 - j. Body Material: Brass
 - k. Ball Material: Brass Cast
 - l. Seal Material: Rubber
 - m. Seat Material: PTFE
 - n. Stem Material: Brass Bar
 - o. Max. Pressure: 300 psi
 - p. Manufacturer: Moon American or approved equal.
4. Water Pressure Reducing Valve: 1/2-inch – 2 1/2-inch
- a. Design: Reduce incoming water pressure to a level to protecting plumbing system components and reducing water consumption.
 - b. Water Supply Pressures: up to 300psi.
 - c. Adjustable Reduced Pressure Range: 25 – 75psi.
 - d. Body: 1/2-inch – 2-inch Bronze; 2 1/2-inch Iron
 - e. Seat: Replaceable stainless steel
 - f. Diaphragm: Reinforced Buna-N
 - g. Disc: EPDM
 - h. Model Watts Series 223 or approved equal.
5. Eyewash: See Drawings schedule (NIC)
6. Thermostatic Mixing Valve (NIC)
- a. Cold water bypass flow (65% of rated tempered water flow) means continued protection under adverse conditions.
 - b. Flow range of 1 to 31 GPM provides service for one emergency combination

shower or multiple eyewashes.

c. Haws Model 9201E.

7. Hot Water Recirculating System - Watts Model 500800 or approved equal.(NIC)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

1. Examine areas and conditions under which Work is to be performed and identify conditions that may be detrimental to proper or timely completion.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Demonstrate complete installation and operation before acceptance.

3.3 CLEANING

A. Provide protective covering for installed units.

B. Not to be used for temporary facilities without written approval by Owner.

3.4 DEMONSTRATION

A. Demonstrate the operation and maintenance of equipment.

3.5 PROTECTION

A. Protect work after installation until by acceptance by the Owner.

END OF SECTION

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**SECTION 22 05 29
HANGERS AND SUPPORTS**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide supports, hangers and anchors for piping, equipment, conduit, ductwork, valves, dampers, hardware, shims, and miscellaneous equipment.
- B. The Contractor is responsible for the design of all supports systems. Contractors shall provide all labor, materials, and equipment necessary to furnish, design and install an adequate system of hangers, supports, guidance, anchorage, and appurtenances.
- C. It shall be the Contractor's responsibility to select the appropriate type of support for each instance, in keeping with appropriate type related to the size and service of the pipe being supported. Adequate pipe supports shall be supplied for all systems to provide a rigid overall installation and additional support for pipe ends when equipment is disconnected.

1.2 SUBMITTALS

- A. Comply with Section 01 33 00. Include the following information:
 - 1. Make, model and design performance of each hanger and support and appurtenances.
 - 2. Details of methods for attachment of hangers and supports to building construction for equipment and piping.
 - 3. Manufacturer's catalog information that describes each type of hanger and support provided. Include:
 - a. Specifications.
 - b. A complete bill of materials that identifies all materials of construction.
 - 4. Sizing calculations prepared by a Registered Professional Engineer in the State of Georgia for each type of hanger and support provided.
 - a. Demonstrate acceptable performance for specified operating conditions.
 - b. Size each hanger and supports.
 - c. Include scaled drawings.
 - d. Shop drawing showing the location installation, loads and forces, and deflection of all hangers and supports and their reaction forces to the structure to which they are fastened.

- e. Important details of construction,
 - f. Equipment dimensions,
 - g. Size and location of anchor bolts, and
 - h. Locations of connections to other work.
- 5. Special shipping, storage, protection, and handling instructions.
 - 6. Manufacturer's installation instructions.
- B. Maintenance data for all products.
 - C. Closeout Submittals:
 - 1. Coordinate provisions with Section 01 70 00 – Execution and Closeout Requirements.
 - 2. Submit warranty information.

1.3 QUALITY ASSURANCE

- A. Coordinate with Section 01 40 00 - Quality Requirements.
- B. Manufacturer Qualifications:
 - 1. Minimum 5 years manufacturing similar products.
- C. Installer Qualifications:
 - 1. Minimum 2 years installing similar products.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Comply with Section 01 45 34, Storage Delivery and Handling.

1.5 GENERAL

- A. Provide components that are the standard product of a manufacturer regularly engaged in the production of the required materials and equipment.
 - 1. A single manufacturer shall provide all hangers and supports and appurtenances.
- B. Factor of Safety

1. Hangers and supporting devices shall be designed to provide a minimum working safety factor of 12.
2. The safety factor for pipe hangers and supports shall be based on supporting ten linear feet of pipe filled with water.
3. The safety factor for ductwork supports shall be based on the weight of the ductwork and the duct containing a buildup of material equal to ten percent of the cross-sectional area with a material at 60 pounds per cubic foot.

1.6 1.6 WARRANTY

- A. The manufacturer shall warrant in writing all equipment against defects in materials and workmanship for a period of 12 months from the date of substantial completion. Within this 12-month period, any defective or malfunctioning equipment, component, or accessory shall be repaired or replaced upon notice at no additional cost to the Owner.
- B. Refer to Section 01 70 00 for additional information.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Acceptable manufacturers are named in the following paragraphs.
- B. Alternates: The number and trade names given for any products are taken from various manufacturer catalogs as stated and shall be construed as being descriptive only of type, style, and quality of material required. Material of other reputable manufacturers of equal quality, type and style may be acceptable only if approved by the Engineer.

2.2 PRODUCTS

- A. All supports, and hangers will meet the following material requirements.
 1. All structural steel will conform to ASTM A36.
 2. All structural stainless shall conform to ASTM A167, Type 304.
 3. All pipe support columns shall conform to ASTM 53, Grade and shall be minimum schedule 40.
 4. All embedded anchor bolt materials shall conform to ASTM A193, Grade B; ASTM A276, Type 304; or IFI-104, Grade 304. Nuts shall be heavy hex nuts conforming to ASTM A194, Grade 8 or IFI-104, Grade 304. Minimum anchor bolt size for pipe supports shall be 1/2 – inch diameter.
 5. All rod and bolting materials shall conform to ASTM A193, Type 304. Nuts shall

be heavy hex nuts conforming to ASTM A193, Type 304.

6. All carbon steel or malleable iron straps, hangers, clamps, U-bolts, and other hardware in contact with the pipe shall be shop primed, except where specified or shown on the Contract Drawings to be galvanized.
7. Expansion type anchor bolts shall be of stainless-steel construction and shall comply with federal Specification FF-S-325.
8. All interior and exterior concrete shall be Class A concrete meeting the requirements of these specifications.
9. Fiberglass channels and clamps for Unistrut pipe system are to be vinyl ester and must meet ASTM E84 Class I flame rating and self-extinguishing requirements of ASTM D635.

B. Supports

1. Long runs of pipe subject to expansion shall be hung by means of adjustable swivel pipe roll hangers, Grinnell Figure 174; Fee and Mason Figure 2729; or approved equal.
2. Short runs of uninsulated pipe subject to expansion up to and including 3 1/2 inches as well as pipe of those sizes not subject to expansion shall be hung by means of adjustable swivel, split pipe ring, Grinnell Figure 104; Fee and Mason Figure 199; or approved equal.
3. Insulated piping and tubing, short lengths of 4 inches and larger pipe subject to expansion, and pipes 4 inches and larger not subject to expansion shall be hung by means of adjustable steel clevis hanger, Grinnell Figure 260; Fee and Manson Figure 239; or approved equal.
4. Pipe 2 inches and less in diameter and not subject to expansion may, when paralleling walls, be supported by a single hook clamp hanger, Grinnell Figure 168; Fee and Mason Figure 327B; or approved equal.
5. Flat straphangers will not be permitted. Hangers relying on mastics of adhesives shall not be used.
6. Pipe supported from underneath and subject to expansion shall have adjustable roll stand supports, Grinnell Figure 274; Fee and Mason Figure 161; or approved equal. The pipe roll stand shall be supported by concrete piers, structural steel, or steel brackets as required.
7. Pipe supported underneath and not subject to expansion shall adjustable pipe roll stand supports. Supports shall be properly sized and properly grouted floor flanges. Adjustable pipe supports shall be Standon Model S89 Flange Support or approved

equal.

8. Hangers suspended from structural steel shall be anchored on U.F.S. beam clamp, Grinnell Figure 228L or 2921; Fee and Mason Figure 252L or 253L; or approved equal.
9. Hangers from concrete work shall be secured by universal, galvanized metal inserts, Grinnell Figure 282; Fee and Mason 2570 or approved equal, placed in the concrete at the time of pouring.
10. Uninsulated copper tubing shall be hung by means of copper-plated, split ring hangers with copper-plated sockets, Grinnell Figure CT-109; Fee and Mason Figure 360; or approved equal.
11. Unistrut pipe supports shall be manufactured by B-Line or approved equal.

2.3 DUCTWORK HANGERS

A. Sheet Metal Straps

1. Galvanized straps shall conform to ASTM A 527 for lock-forming quality, and ASTM A 525 for coating designation G-90.
2. Aluminum straps shall conform to ASTM B 209 for alloy MLA with H-14 temper.
3. Stainless steel straps shall conform to ASTM A 167, Type 302, 304, or 316; and ASTM A 480, finish No. 1 or No. 4.

B. Ductwork hangers and supports shall be 1/8-inch thick by one-inch-wide bands or one inch by one- inch channel or angle supports. Perforated bands shall not be acceptable.

C. Hangers and supports shall be trapeze type.

D. Fabricate ductwork hangers in accordance with SMACNA “HVAC Duct Construction Standards”.

E. Sheet metal screws shall be the same material as the duct.

F. Bolts and nuts shall be stainless steel unless otherwise noted.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Examine areas and conditions under which Work is to be performed and identify conditions that may be detrimental to proper or timely completion.

- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Contact ferrous supports and non-ferrous piping materials shall not be permitted. Supports and clamps shall be rubber coated or copper plated as necessary to prevent such contact.
- B. Adequate supports shall be provided so that there is no movement or visible sagging between supports.
- C. Hangers shall permit a minimum of 1 1/2-inch vertical adjustment after installation.
- D. Hanger rods shall be stainless steel conforming to the following sizes:

Rod Diameter, Inches (MINIMUM)	Pipe Sizes, Inches
1/2 and under	1/4 - 2
5/8	2 1/2 - 4
3/4	5 - 8
7/8	10 - 12

- E. Carbon steel, alloy steel, stainless steel, and hard-drawn copper pipe shall be supported on the maximum intervals as follows:

Pipe Size, Inches	Maximum Interval For Steel, Feet Liquid	Maximum Interval For Steel, Feet Gas	Maximum Interval For Copper, Feet
1/2	5	6	4
3/4	6	7	5
1	7	9	6
1 1/2	9	11	8
2	10	13	9
2 1/2	11	14	10
3	12	15	11
4	13	17	
6	17	21	
8	19	24	
10	22	27	
12	23	29	

- F. Annealed copper tubing, polyethylene tubing, and PVC piping shall be supported on the

maximum intervals as follows:

Tube Size, Inches	Maximum Interval Feet
smaller	2
1/2	3
3/4-1	4
1 1/4-2	5
2 1/2 – 3 1/2	6
4	7
6	8

- G. Where indicated or directed by the Engineer, exposed piping and tubing carrying shall be sloped as necessary to permit complete drainage. Pipe deflection between supports shall be considered when determining the slope required to permit complete drainage. All underground piping shall be sloped uniformly for complete drainage.
- H. Cast iron and ductile iron shall be supported as recommended by manufacturer and at all valves and fittings larger than 4 inches. At least one support shall be provided per pipe section or at every other joint, whichever is closer. Supports shall be located next to hubs or bells.
- I. All threaded connections installed loose, such as hanger rods and U-bolts, shall have double nut installation.
- J. Vertical piping shall be supported as shown or required to prevent buckling or swaying utilizing special brackets. Unless otherwise shown, vertical piping shall be supported at the bottom and at each floor. Vertical copper tubing 1 inch and smaller shall be supported at 5-foot intervals.
- K. Provide a support within 18 inches of each elbow and within 24 inches of each equipment.
- L. Pipes passing through non-loading walls and partitions shall not bear on building construction. Pipes shall not be supported from roof decking, bar joists, or ceiling suspensions systems.
- M. No pipe supports shall be anchored to or supported from floor grating.
- N. All dimensions shall be field verified by Contractor. Size supports and hangers using actual field dimensions.
- O. The sizing of channels and clamps for Unistrut pipe support systems are to be based upon manufacturer’s guidelines.
- P. Demonstrate complete installation and operation before acceptance.

3.3 FIELD PAINTING

- A. Field prepare and paint required surfaces as specified in Section 09 91 00.

END OF SECTION

**SECTION 22 05 33
HEAT TRACING FOR PIPING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pipe heat tracing and accessories.
- B. Refer to heat tracing schedule on the Drawings for additional information.

1.2 REFERENCES

- A. IEEE Standards:
 - 1. IEEE 515 - Standard for the Testing, Design, Installation and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications.

1.3 SUBMITTALS

- A. Comply with Section 01 33 00.
- B. Product Data: Submit product description, characteristics, and list of materials for each service and location, including heat tracing and accessories.
- C. Submit layout of each heat trace cable run, power supply end(s), location of thermostat(s), location of LED indicator light(s), location of splices, terminations, etc.
 - 1. Coordinate heat trace cable power requirements with the electrical work.
 - 2. Additional electrical circuits (conduit, fittings, connections, and conductors) may be required due to layout of heat trace cable requirements.
 - a. No additional costs will be paid for by the Owner for these circuits.
- D. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Coordinate with plumbing insulation and jacketing materials.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Applicator: Company shall be certified by the manufacturer of the heat tracing and shall

have five (5) years written documented experience installing heat tracing/insulated/jacketed systems.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 40 00 – Quality Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install heat trace cable and accessories in accordance with manufacturer's written instructions.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers for Heat Trace Cable, Thermostat, Pilot Light, and Accessories:
 - 1. Raychem.
 - 2. Thermon.
 - 3. Or Equal

2.2 HEAT TRACING

- A. JBS-100 with LED Indicator Light.
 - 1. BTV Cable rated at 10 watts per foot for copper piping.
 - 2. BTV Cable rated at 5 watts per foot for PVC piping.

3. AMC - F5 Fixed set point freeze protection thermostat.
4. AT-180 Aluminum tape.
5. When heat tracing PVC pipe, wrap the pipe in aluminum foil prior to installing the heat tracing as required by the heat tracing manufacturer.
6. E-100 -L-A end seal with red signal light.
7. Heating cables shall be self-regulating, capable of maintaining process temperatures up to 150°F and a continuous exposure to pipeline temperature of 185°F while de-energized.
8. Cable must be of parallel construction so that it can be cut to length without
9. changing its power output per unit length.
10. two parallel nickel-plated copper bus conductors with a semiconductive PTC polymer extruded over and between these parallel conductors.
 - a. A polyethylene dielectric insulating jacket is extruded over the heating element core.
11. The semiconductive heating matrix and primary insulating jacket shall be cross-linked by irradiation.
12. The basic cable will be covered by means of a metallic braid of tinned copper.
 - a. The braid will provide a nominal coverage of eighty percent (80%) and will exhibit a resistance not exceeding 0.0045 ohm/ft.
13. The cable shall be covered with a corrosion resistant over jacket of thermoplastic elastomer (for possible exposure to aqueous solutions, mild acids, or bases).
14. Long term stability shall be established by the service life performance test per IEEE 515 Std-current edition.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping has been tested before applying heat tracing materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Systems:

1. Heat trace exposed system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

B. Heat Trace Cable Testing:

1. Factory inspections and tests for self-regulating, power limiting, series constant wattage and constant wattage (MI) heater cables shall include but are not limited to the following:
 - a. Testing shall be done per the latest IEEE Std. 515 test section and applicable manufacturer's standards.
2. In the field, all heater cables shall be meggered. The following separate field megger readings shall be taken on each self-regulating and each M.I. heater cable:
 - a. Heater cable shall be meggered when received at jobsite before installation.
 - b. Heater cable shall be meggered after installation, but before insulation is applied.
 - c. Heater cable shall be meggered after insulation has been installed.
 - d. All three of the above field megger readings shall be greater than 20 megohms. Otherwise, the heater cable is not acceptable and shall be replaced.
3. Field megger tests shall be recorded for each heater cable, and certified reports shall be submitted to the Owner and Engineer.

3.3 SCHEDULES

- A. See Drawings.

3.4 FIELD VERIFICATION

- A. A representative of the manufacturer shall visit the job site to verify the adequacy of each installation.
 1. Provide written verification to the Engineer along with any deficiencies in the work.

END OF SECTION

**SECTION 25 00 10
APPLICATION ENGINEERING SERVICES**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The General Contractor shall provide all labor, materials, wiring, cables, panels, equipment and instruments required for the proposed project. Aqua Aerobics, Inc will be the Process Instrumentation and Control Supplier (PICS). The General Contractor, and/or manufacturers will provide components, and/or services to the PICS.
- B. The PICS shall provide all applications programming and services required to achieve a fully integrated and operational system. The PICS shall coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other sections of these Specifications and with related existing equipment.
- C. Auxiliary and accessory programming structures necessary for system operation or performance shall be included whether or not they are specified or shown on the Contract Drawings.
- D. All equipment shall be controlled in full conformity with the Specifications, Drawings, engineering data, instructions, and recommendations of the equipment manufacturer.
- E. To facilitate the Owner's future operation and maintenance requirements, all programming and operator interface development shall utilize standards as agreed upon by the Owner and Engineer.
- F. The PICS shall coordinate and schedule testing procedures with the General Contractor.
- G. Refer to electrical and instrumentation drawings for I/O requirements.

1.2 RELATED WORK

- A. Refer to Section 25 00 20

1.3 SUBMITTALS

- A. Submittals listed below shall be provided, as a minimum. Each submittal must be complete in order to be reviewed by the Engineer.
 - 1. Preliminary Graphics Submittal
 - 2. Testing, Training and O&M manuals.

1.4 SYSTEM DESCRIPTION

- A. The PICS is responsible for providing all applications programming and configuration

services to accomplish the control and monitoring functions described in the Specifications and Contract Drawings. The PICS shall provide all programming functions. The PICS shall also provide all application programming and configuration services necessary to produce the HMI graphic displays, reports, trends, historical archive, etc. as described in the Specifications and Contract Drawings.

- B. Prior to developing HMI screens, the PICS shall meet with the City and Engineer and show them sample HMI screens to use as a basis for development.
- C. PICS shall update and provide customized graphic displays (not including standard trends, pop-up windows, HMI supplied displays, etc.) to illustrate the entire plant process control system. All updated graphic displays shall be designed by the PICS utilizing the HMI software and shall be approved by the Engineer/Owner. These displays shall be prepared and submitted for review at the second coordination meeting. The displays shall represent all process control systems and all associated equipment, pumps, valves, gates, feed systems, filters and auxiliary systems. The PICS shall establish a consistent process control philosophy, standard graphical layout and standard graphical symbolic representation for all displays. The PICS shall update the displays to include:
 - 1. Trends, Alarms, Historical Data
 - 2. Central City 1 Pump Station
 - 3. LAS Screen and Screw Conveyor
 - 4. Disc Filters
 - 5. Plant Site Pump Station

1.5 PROGRAMMING AND CONFIGURATION GUIDELINES AND DELIVERABLES

- A. Real Variables Processing
 - 1. Real variables shall represent process data for which there are analog signal inputs to the system. The system shall sample each of these input signals at the selected scan frequency and perform the proper conversions and scaling to obtain the instantaneous engineering values. These values shall be used to update real-time data on HMI displays, check for alarm conditions and store for use in historical files.
 - 2. The instantaneous values of all variable data shall be displayed on the appropriate HMI display and shall be added to the historical database whenever the present value exceeds a preprogrammed compression dead band. The compression dead band will be field adjusted by the PICS to provide for maximum storage utilization.

3. Variables such as rate of flow, weight and kilowatt usage shall have their instantaneous values integrated with respect to time and their quantities totaled before archiving.
4. Alarm conditions shall be stored in a separate historical file. In addition, the last 500 alarms shall be displayed on the alarm graphic display. The alarm storage format shall be an alarm description, true time of occurrence, and tag number.

B. Manual Input Data Handling

1. The application software shall provide the capability to manually enter data from any operator's computer keyboard. This data shall consist of additional values for the current data file (e.g., laboratory analyses), inserting alarm limits, set point changes, adjustment to process constants, control system set point changes and system tuning parameter adjustments.
2. All manually entered data shall be entered and stored in the appropriate engineering units. All data entered shall be displayed for confirmation on the data entry device prior to incorporation to the database.

C. HMI Graphic Displays

1. All displays shall contain and continuously update the displayed process variables, date and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers.
2. The HMI displays shall make maximum use of the colors available. All colors shall be approved by the Owner.
3. The HMI displays shall be interlinked for easy and direct operator call up. They shall be available for viewing by either entering the display name (via keyboard) or via a "hot spot" on the current display screen (mouse driven cursor movement and pick button). All displays shall have "hot spots" for, at a minimum, the Alarm Summary display, Plant Overview Menu display and the Summary Menu display.
4. The system shall allow the operator to manually control the status of pumps, valves, etc. via either keyboard entry or the currently displayed graphic display. The status change shall require a secondary acknowledgement (action confirmation) by the operator before the command is processed.
5. Unless specifically noted, all timers, set points, alarm actuation levels, etc. shall be operator adjustable from the HMI.
6. Menu displays shall be provided as a guide to the available display options. The menu displays shall be a complete and logical listing of the names and number of all displays.

7. Graphic displays shall depict basic process schematic diagrams with representative symbols for pumps, tanks, etc. combined with real time process variables or conditions. The equipment represented on the display shall be suitably titled for identity. The displays shall be dynamic (i.e., symbols for a pump shall change color indicating run or stop or alarm, the volume of tanks shall be indicated by varying the height of the interior color of the tank symbol, etc.). Its name and tag number shall identify the data on the display. All of the current data in the database shall be available for graphic displays. It shall be possible to easily modify an existing display or generate a new display. The graphic displays shall consist of a single master plant flow schematic and multiple sub-displays detailing specific plant systems or elements. The process graphic displays shall consist of Master, Area and System displays. The Master and Area displays shall show general graphic representations of the facility covered with general equipment, alarm, analytical summaries and control capabilities. The System display shall detail all relevant aspects of the individual equipment or system (i.e., an individual pump). The intent is to provide the operator with an overview (Master) with the capability of “zooming in” on a process (Area) or a piece of equipment (System) as necessary. The PICS shall use the Instrumentation and Piping Diagrams as part of this Contract to generate the graphic displays. All process variables shall be displayed on their associated display (s) in engineering units. The Engineer/Owner shall approve color standards for the equipment symbols, process piping, etc.
8. Analog trend displays shall display the value of a minimum of eight (8) assigned points versus time. The intent is to depict the type of plot produced on an analog recorder on the HMI display. Each point shall be trended in a different color. Each of the assigned points shall have a point identification number, point name, point description, current value and instrument range display in the color used for its trend. The time period shall be selected and be either current or historical. The time period selected, and time and date of start shall be displayed. The values displayed on a historical trend shall consist of the stored values for each variable trended. Current trends shall be updated at the scan frequency of the variable. A trend display shall not be considered a graphic display.
9. Manual laboratory data summary displays shall consist of all laboratory inputs, displaying the tag numbers, tag name, the current value and the date and time that the value was entered.
10. Alarm summary displays shall consist of all points currently in alarm and shall include the tag number, description, true time of occurrence and present status, (high, low, normal, etc.). The alarm summary shall identify alarm points by severity (event, attention, caution and urgent) by utilizing distinct colors for each severity category. The severity classification shall be easily changeable by the Owner.
11. System status displays shall summarize the error status of all system devices capable of reporting errors to the CPU (i.e., printers, communication devices, etc.). The display shall indicate if an error is detected, or a failure occurs. It shall also allow

assignment of those items capable of acting as back up to other devices. These displays shall be used primarily for maintenance purposes.

12. Single point configuration / status displays shall be of the HMI software manufacturer's standard format.
13. Where data is pulled from vendor furnished control panels (Central City Pump Station 1, LAS Screen and LAS screw Conveyor , Filters and Plant Site Pump Station Control Panel) via Modbus TCP/IP. In general, the PICS shall display all available data from the vendors processor on the Owner's HMI screen regardless of what is shown on the P&ID drawings. PICS shall coordinate map address points with vendors.

D. Alarm / Equipment Status Reporting

1. The alarm log shall display all alarms as they occur. The alarm message shall include the time occurrence, tag name, tag number and whether it is a low, high or failure alarm. When the point in alarm returns to normal, the time, point identification number and "return to normal" shall be displayed. All reports shall include the plant equipment number of the associated device.
2. Equipment status shall be logged whenever a change in status occurs (i.e., start, stop). The status monitoring shall be capable of being disabled and/or suppressed from the operator workstation. The equipment status log shall include the time, equipment name, tag number and the particular change in status.
3. All alarms and events shall be displayed on the display and archived. No alarm or event shall be printed automatically; however, alarms and events shall be available for printing on demand for operator-specified time periods. Alarm information shall consist of point identification number, point name, time of occurrence and type and priority of alarm.
4. All alarms shall be placed in a separate historical file and be easily accessible for use as needed. The PICS shall maintain ninety (90) days of "as logged" raw data and twelve (12) months of partially compressed raw data on the server. The PICS shall recommend the number of additional days or month's data may be retained based on the capacity of the new system.
5. The equipment and point status summary report shall log the status of all points in the system, including contact inputs, real variables with analog inputs and calculated variables. When required this printout will be initiated manually and shall consist of the tag number, tag name and its current status (i.e., Running, Off, High, Low, Active, Disabled, On-scan, Off-scan, etc.).
6. The summary printout shall summarize all alarms for the previous 24-hour period. Normally, this printout shall be initiated manually but provision shall be made so that it may be initiated automatically every day, if desired. The printout shall be

generated on-line from stored data. This printout shall consist of all data in the initial alarm occurrence and return to normal, as specified.

7. The current alarm summary printout shall print all points currently in alarm. This printout shall be initiated manually, as required. The printout shall be generated on-line from stored data. This printout shall consist of all points currently in alarm.
8. The capability shall be provided to sort both daily and current alarm summary reports by operator defined groups. (i.e., print all power failure alarms, etc.).
9. The alarm summary printout shall be initiated manually, as required, be generated from stored data on the server and shall consist of the point identification number and the point name.

E. Historical Data Management.

The following features shall be provided for processing and storage of system historical data:

1. Data Processing and Storage. The real time instantaneous values shall be stored in a historical log file on the server.
2. Data Archiving. Historical data shall be automatically alarmed and stored on the hard drive. The intent is to ensure that a long-term record of historical information is available to support future studies, etc.
3. Each system point (analog or digital, real or pseudo) shall have the capability of being historically logged. A point shall have the capability of being deleted from the historical log at any time. It shall be easy to add or delete system points using minimal keystrokes.
4. Displays used for historical analysis (such as historical trends, alarms/events summary, etc.) shall have similar capabilities to those used for real time data review. The source of data shall be the HMI's database.
5. The ability to produce ASCII and CSV files which can be used in most of the commercial spreadsheet programs (e.g., Lotus and Excel) and database programs (e.g., Paradox, Oracle, Access) shall be provided.

F. Report Definition.

1. Exact report formats and data to be reported shall be determined by the Owner and be developed by the PICS.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 TESTING

- A. Perform the following:
1. Building and loading the database
 2. Conduct online modifications to the database
 3. Demonstrate operability of the interfaces (hardware and software)
 4. Demonstrate all system software functions specified
 5. Demonstrate operability of all process control strategies, graphic screens, and reports
 6. Verify the displays and all interactive capabilities of the operators' workstations
 7. Simulate selected operating conditions to verify the performance of the monitoring and control functions
 8. Demonstrate the performance of the historical database
 9. Demonstrate the performance of the alarm and event logging system
 10. Demonstrate the ability to share data between operator workstations
 11. Demonstrate the ability of each workstation to print reports and graphic displays
 12. Demonstrate the ability for each workstation to read and write to and from designated files from other workstations over the LAN

END OF SECTION

**SECTION 25 00 20
PANELS**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The General Provisions of Section 250000 shall apply to this section.
- B. Furnish all labor, materials, equipment, and incidentals required to fabricate, complete and ready for operation, the panels depicted on the Drawings and in the Panel List below.
- C. All work in this Section shall be the product of the Process Instrumentation and Control Supplier (PICS). Sub-suppliers and/or manufacturers may provide components, enclosures and/or fabrication services to the PICS, but the final product shall conform to this specification and shall be the sole responsibility of the PICS.

1.2 RELATED WORK

- A. Refer to Section 25 00 00.

1.3 SUBMITTALS

- A. Submittals shall be prepared and transmitted to the Engineer for approval in compliance with Section 250000 of these specifications. In addition, shop drawings shall include the following information:
 - 1. Materials for all panels and enclosures.
 - 2. Drawings shall be prepared on 11” by 17” paper, shall be to scale and shall show the location of panel mounted devices as well as doors, louvers and sub-panels.
 - 3. Drawings shall include a panel legend and a bill of materials.
 - 4. The panel legend shall list and identify front of panel devices by their assigned tag numbers, nameplate inscriptions, service legends and annunciator inscriptions.
 - 5. The bill of materials shall list devices mounted within the panel that are not listed in the panel legend and shall include the tag number, description, manufacturer, and model number for each item.
- B. Interconnecting Wiring Diagrams
 - 1. Provide interconnecting wiring diagrams showing electrical connections between panels, consoles, terminal junction boxes and field mounted components.
 - 2. Diagrams shall show component and panel terminal identification numbers and external wire and cable numbers.

3. Circuit names corresponding to the Conduit Schedule shall be shown.
4. These diagrams shall be coordinated with the Electrical Subcontractor and shall bear his mark showing that this has been done.

1.4 SYSTEM DESCRIPTION

- A. Refer to Section 25 00 00.
- B. The following PLC based panels shall be furnished by the PICS as specified under this Section. Refer to the Drawings for size, location and contents of each panel.

LCP No.	Location	Notes
SCADA LCP-A	Electrical Building 1	Nema 12
SCADA LCP-B	Electrical Building 2	Nema 12
SCADA LCP-C	Dewatering Building	Nema 4X Stainless Steel
SCADA LCP-D	Parshall Flume – Effluent	Nema 4X Stainless Steel
SCADA LCP-E	Raw Sewage Pump Station	Nema 4X Stainless Steel

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 25 00 00.
- B. The panels and consoles shall be mounted on wood skids four inches high. Adequate crating shall be provided to protect the panels or consoles from damage during shipping.
- C. Instruments and components shall be blocked and tied down to prevent damage during shipping. Front-panel mounted instruments or components shall be removed or securely protected from damage during shipment. Items removed from the panels shall be repacked in their original containers and shipped with the panel.
- D. Accessories, drawings, instruction bulletins, etc. shall be packed and shipped with the associated panel.

1.6 SPARE PARTS AND TEST EQUIPMENT

- A. Provide spare parts and test equipment as specified in Section 25 00 00 and as indicated below.
 1. Fuses: 20 percent of each size and type used, but no less than ten of each size and type.
 2. Relays: 10 percent of each type used, but no less than five of each type.
 3. Indicating Light Bulbs: 25 of each size and type used.
 4. DC Power Supplies: 20 percent of each size and type used, but no less than two of

each size and type.

5. Five spare pilot indicating lights, rotary hand switches, pushbuttons of each type used.
 6. One spare analog indicator of each type used.
 7. Corrosion Inhibiting Vapor Capsules: Provide 20 of each type and size used.
- B. B. All spare parts shall be packed in a manner suitable for long-term storage and shall be adequately protected against corrosion, humidity, and temperature.

PART 2 PRODUCTS

2.1 CONTROL PANEL GENERAL REQUIREMENTS

- A. Furnish and install the panels per the Specifications and Drawings.
- B. The construction and wiring for the panels shall be in accordance with this Specification and applicable panel drawings. The panel drawings will specify the arrangement of instruments to be mounted on the front, rear and sides of the panels.
- C. All panels shall be fully enclosed for use with high-density instrumentation mounting.
- D. All panel doors shall have a lock installed in the door handle, or a hasp and staple for padlocking. Locks for all panels provided under this Contract shall be keyed alike.
- E. The instruments and equipment designated for rear-of-panel mounting shall be arranged within the panel according to associated panel drawings in a manner to allow for functionality, ease of maintenance and adjustment.
- F. Conductors running from the field to the panels shall be continuous without splices, except at approved junction boxes. All junction boxes and panels shall have 20 percent spare terminals.
- G. Conduits and cables entering panels shall be sealed to prevent the intrusion of gas and moisture.
- H. All components shall be mounted in a manner that shall permit servicing, adjustment, testing and removal without disconnecting, moving, or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates, in such a manner that the component may be removed without removing the plate and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required by the manufacturer to protect equipment from vibration. Mounting orientation shall be in accordance with the requirements of each component.
- I. Components shall be identified with suitable plastic or metal engraved tags attached

adjacent to (not on) each component identifying the component in accordance with the Drawings, Specification and PICS data.

- J. The internal framework of each panel shall permit panel lifting without distortion. Provide removable lifting rings designed to facilitate simple, safe rigging and lifting of the panel during installation. Plugs shall be provided and shall unobtrusively fill the panel lifting ring holes when substituted for the lifting rings after installation is complete.
- K. All panels, consoles and exterior mounted equipment shall be installed with suitable gaskets, faceplates, etc. required to maintain the NEMA rating of the panel.
- L. All panels shall be supplied with suitable nameplates, which identify the panel and individual devices as required. Nameplates shall be provided for all flush mounted equipment in the interior and exterior of each panel. Nameplates shall be constructed of white and black laminated phenolic material having engraved letters extending through the white face into the black layer. Nameplate shall be beveled and attached to panels by adhesive or glue.
- M. Provide a sun / rain shield over enclosure.

2.2 PANEL MATERIALS AND CONSTRUCTION

A. General

- 1. All panels located in indoor areas, unless otherwise specified, shall be NEMA 12 construction.
 - a. Freestanding panels shall be constructed of 12 gauge or thicker steel, suitably braced internally for structural rigidity and strength. All exposed welds, seams or edges shall be ground smooth.
 - b. Wall or Unistrut mounted panels shall be constructed of 14 gauge or thicker steel. All exposed welds, seams or edges shall be ground smooth.
 - c. Front panels or panels containing instruments or components shall be 10 gauge or thicker sheet steel reinforced to prevent warping or distortion.
 - d. Interior panels of 10-gauge steel construction shall be provided where necessary for instrument or component mounting.
 - e. All doors shall be lockable, mounted with strong, continuous, piano type hinges and shall be provided with door handles and three-point latches or screw clamps.
- 2. All panels located in outdoor areas, or in indoor areas where otherwise specified, shall be NEMA 4X Type 316 stainless steel construction.

- a. Freestanding panels shall be constructed of 12 gauge or thicker Type 316 stainless steel, suitably braced internally for structural rigidity and strength. All exposed welds, seams or edges shall be ground smooth.
 - b. Wall or Unistrut mounted panels shall be constructed of 14 gauge or thicker Type 316 stainless steel. All exposed welds, seams or edges shall be ground smooth.
 - c. Front panels or panels containing instruments or components shall be 10 gauge or thicker Type 316 stainless steel reinforced to prevent warping or distortion.
 - d. Interior panels of 10-gauge steel construction shall be provided where necessary for instrument or component mounting.
 - e. All doors shall be lockable, mounted with strong, continuous, piano type hinges and shall be provided with door handles and three-point latches or screw clamps.
3. Panels shall be provided with full length, fully gasketed rear doors or front access doors as shown on the panel drawings. Front access doors with mounted instruments or control devices shall be of sufficient width to permit door opening without interference from flush mounted instruments or control devices.
 4. The panel shall be suitable for top or bottom conduit entry as required by the Electrical Drawings.
 5. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts or other accessories as required to maintain the NEMA rating of the panel and the electrical rating of the conduit system.

B. Finish Requirements

1. All panel sections shall be descaled, degreased, filled, ground and finished. The enclosure, when fabricated of carbon steel, shall be furnished with two rust resistant phosphate prime coats and two coats of enamel, polyurethane or lacquer finish, which shall be applied by either the hot air spray or conventional cold spray methods. Brushed anodized aluminum, stainless steel and fiberglass-reinforced polyester panels will not require a paint finish.
2. The panels shall have edges ground smooth and shall be sandblasted and then cleaned with solvent. Surface voids shall be filled and ground smooth.
3. Immediately after cleaning, one coat of a rust-inhibiting primer shall be applied inside and outside, followed by an exterior intermediate and top coat of a two-component type epoxy enamel. A final sanding shall be applied to the intermediate

exterior coat before the final topcoat is applied.

4. The panel interior shall have a minimum of two coats of flat white lacquer after priming.
5. Unless otherwise noted, the finish exterior colors shall be selected by the Owner from color chips supplied by the PICS.

C. Manufacturers

1. The panels shall be manufactured by Hoffman or Engineer approved equal.

2.3 CONSOLE MATERIALS AND CONSTRUCTION

A. General

1. All consoles located in outdoor areas, unless otherwise specified, shall be NEMA 4X construction.
 - a. Freestanding consoles shall be constructed of a one-piece molded fiberglass-reinforced polyester material, suitably braced internally for structural rigidity and strength with a minimum wall thickness of 0.125 inch thick.
 - b. Surfaces containing instruments or components shall be a minimum of 0.25 inch thick and reinforced to prevent warping or distortion.
 - c. Interior panels of 10-gauge steel construction shall be provided where necessary for instrument or component mounting.
2. Consoles shall be provided with front and rear access lift off doors with Southco Type 44 latches as shown on the panel drawings.
3. The console shall be suitable for bottom conduit entry as required by the Electrical Drawings.
4. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts or other accessories as required to maintain the NEMA rating of the panel and the electrical rating of the conduit system.

B. Finish Requirements

1. Consoles shall be maintenance free using molded-in colors that never require painting, fade or wear off. The finish shall be satin gloss and gel coated.
2. The consoles shall have all edges rounded and ground smooth for safety and appearance.
3. Unless otherwise noted, the finish exterior colors shall be selected by the Owner

from color chips supplied by the PICS.

C. Manufacturers

1. The consoles shall be manufactured by Warminster Fiberglass or Engineer approved equal.

2.4 TEMPERATURE CONTROL

- A. Freestanding panels shall be provided with louvers, forced air ventilation or air conditioning as required to prevent temperature buildup due to ambient temperature conditions and/or electrical devices mounted in or on the panel.
- B. Panels that require louvers shall have them mounted on the rear at the top and bottom of the panel unless the panel is located against a wall, then they shall be mounted on the sides.
- C. Panels that require forced air ventilation fans shall provide a positive internal pressure within the panel and shall be provided with washable or replaceable filters. Fan motors shall operate on 115 VAC, 60 Hz power.
- D. Panels that require air conditioning shall use side-mount air conditioners manufactured by Hoffman Proair or Engineer approved equal. Air conditioners shall operate on 115 VAC, 60 Hz power.
- E. The internal temperature of all panels shall be regulated so as not to exceed 100⁰ F.
- F. The panel cooling equipment shall not compromise the NEMA rating of the panel.

2.5 CORROSION CONTROL

- A. Panels shall be protected from internal corrosion by the use of corrosion-inhibiting vapor capsules as manufactured by Hoffman or Engineer approved equal.

2.6 INTERNAL CONSTRUCTION

A. Internal Electrical Wiring

1. Panel equipment and components shall be mounted and wired on or within the panel or console. Wiring shall comply with the National Electric Code. Wiring within the panel shall be grouped together with wire ducts and secured to the structure. Wiring shall be numbered in compliance with the numbering system used on the wiring / connection diagrams. Wiring and connection diagrams shall comply with ISA S5.4 Instrument Loop Diagrams and shall be as part of the Shop Drawings for review by the Engineer.
2. Power wires shall be 14 AWG Type THWN stranded and shall be insulated for not

less than 600 volts. Conductors shall be of tinned copper construction. All interconnecting wiring, except for electronic circuits, shall be rated for not less than 90° C.

3. Control wires shall be 16 AWG Type THWN stranded and shall be insulated for not less than 600 volts. Conductors shall be of tinned copper construction. All interconnecting wiring, except for electronic circuits, shall be rated for not less than 90° C.
4. Analog signal cables shall be single pair 16 AWG shielded cable with a ground wire. Conductors shall be of tinned copper construction.
5. All wiring leaving or entering the panel shall be terminated on terminal blocks that are rigid, numbered and located for ease of access and troubleshooting.
6. Terminal strips shall be separated into groups for power, control and analog signals.
7. Terminal strips and/or block systems shall be manufactured by Phoenix, Allen Bradley or Weidmuller and shall be rated for a minimum of 600 volts.
8. Wire ducts for supporting internal wiring shall be a plastic type with snap on covers.
9. Each wire shall be provided with a numbered and typed heat shrink tubing identification marker at both ends. Handwritten markers or paper markers will not be permitted. Each individual wire shall be assigned a number that corresponds to the number shown on the Drawings.
10. Each freestanding panel shall have a switched single-tube 20-Watt fluorescent light fixture mounted internally in the ceiling of the panel manufactured by Hoffman.
11. Each panel shall have a duplex convenience receptacle mounted internally within the panel in an appropriate steel box and cover.
12. A single lamp test button shall be provided on a panel, where appropriate, to test all of the indicator lamps in the panel at the same time.
13. Each panel shall be provided with an isolated copper grounding bus for all signal and shield ground connections. Grounding shall be in accordance with the instrumentation manufacturer's recommendations.
14. Each panel shall be provided with a separate copper power grounding bus (safety) in accordance with the National Electric Code.
15. Each panel shall be provided with analog signal isolation (I/I) when analog signals are sent from one panel or console to another.
16. Each panel shall be provided with surge suppression protection (electrical

transients) for connections between AC power systems and electrical or electronic equipment. Surge suppressor grounding shall be in accordance with the manufacturer's recommendations.

17. Each panel shall be provided with a circuit breaker power disconnect switch.
18. Each digital output shall be wired to an interposing relay and one normally open contact from each relay shall be wired to the terminal strip. The contact shall be rated for 115 VAC, 10 Amp or 24 VDC, 10 Amp.

B. Print Storage Pockets

1. Print storage pockets shall be provided on the inside of each panel or console. Its size shall be sufficient to hold all of the prints and documentation necessary to service the equipment attached to it or within it.

C. Equipment Shelves

1. Equipment shelves shall be provided as necessary to support miscellaneous equipment that is normally not mounted or fastened directly to a panel.
 - a. SCADA System Data Highway Fiber-Optic Ethernet Switches
2. Shelves shall be fabricated out of aluminum sheet metal and shall be fastened securely to the equipment panel within the enclosure.

2.7 MISCELLANEOUS PANEL COMPONENTS

A. Panel Meter - Digital Readout

1. Type
 - a. Numerical digital process meter.
2. Functional Performance
 - a. The meter shall be a 3-½ digit minimum resolution LED indicator and shall display the value of the analog input signal in engineering units with a scaled range, as noted. The decimal point shall be field selectable and the meter shall provide an over range indication.
 - b. Accuracy shall be 99.9 percent.
 - c. Power requirements shall be 120 VAC or 24 VDC, as required.
 - d. The operating temperature limits shall be 0 to 60° C.

3. Physical
 - a. The meter shall be housed in a NEMA 4X high impact plastic enclosure with a splash proof lens.
 - b. The meter shall provide a permanent service legend to display the engineering units of the process variable.
 - c. The meter dimensions shall not exceed 4” wide x 2” high x 5” deep.
4. Manufacturers
 - a. The digital readout panel meter shall be Model PD690 as manufactured by Precision Digital or Engineer approved equal.

B. Pilot Indicating Lights

1. Type
 - a. Heavy-duty oil tight type utilizing low voltage lamps with integral lamp test.
2. Functional Performance
 - a. Units shall be provided with low voltage lamps suitable for 24 VDC power.
 - b. Units shall provide for a remote lamp test function.
 - c. Lamps shall be replaceable from the front of the unit.
3. Physical
 - a. Lens colors shall be as indicated on the Drawings and shall be approximately 1 ¼ inch in diameter.
 - b. Provide legend nameplates engraved to indicate the required function of each device.
 - c. Units shall be rated NEMA 4X for outdoor weatherproof conditions.
4. Manufacturers
 - a. The pilot indicating lights shall be Model 800T as manufactured by Allen Bradley or Engineer approved equal.

C. Rotary Hand Switches and Pushbuttons

1. Type

- a. Control devices shall be heavy-duty oil tight type with stackable contact blocks.
 2. Functional Performance
 - a. Provide control devices, switch configurations as required for the control system specified and as shown on the Drawings.
 3. Physical
 - a. For 115 VAC service, provide contacts rated 10 Amps at 115 VAC, for 24 VDC service provide contacts rated 5 Amps at 125 VDC, for electronic (millivolt / milliamp) switching provide gold plated contacts rated at 28 VDC.
 - b. Pushbuttons shall have flush type operators and selector switches shall have knob or wing lever operators.
 - c. Provide legend nameplates engraved to indicate the required function of each device.
 - d. Units shall be rated NEMA 4X for outdoor weatherproof conditions.
 4. Options / Accessories Required
 - a. Provide lockout pushbuttons, key-operators, etc. as indicated on the Drawings.
 - b. Provide make-before-break bridging contacts as required for the control system specified.
 5. Manufacturers
 - a. The rotary hand switches and pushbuttons shall be Model 800T as manufactured by Allen Bradley or Engineer approved equal.
- D. General Purpose Relays and Time Delay Relays
1. Type
 - a. Units shall be general-purpose plug-in type.
 2. Functional Performance
 - a. Provide general-purpose control relay and time delay relay configurations as required for the control system specified and as shown on the Drawings.
 - b. Mechanical life expectancy shall be in excess of 10 million operations and

the duty cycle shall be rated for continuous operation.

- c. Relays shall be provided with an integral indicating light to display when a relay is energized.
- d. Solid-state time delay relay periods shall be 0.1 second to 4.5 hours and shall be adjustable, provided with polarity protection and transient protection.

3. Physical

- a. For 115 VAC service, provide contacts rated 10 Amps at 115 VAC, for 24 VDC service provide contacts rated 5 Amps at 125 VDC, for electronic (millivolt / milliamp) switching provide gold plated contacts rated at 28 VDC.
- b. Relays shall be provided with dust and moisture resistant covers.

4. Options / Accessories Required

- a. Provide all mounting rails, mounting sockets, etc. that are required.

5. Manufacturers

- a. The general-purpose relays and time delay relays shall be Model 700HF as manufactured by Allen Bradley or Engineer approved equal.

E. Signal Isolators / Boosters / Converters

1. Type

- a. Solid-state electronic type.

2. Functional Performance

- a. Provide signal isolators, boosters or converters as required for the control system specified and as shown on the Drawings.
- b. Accuracy shall be 0.15 percent or better.
- c. Inputs shall be current, voltage, frequency, temperature or resistance as required.
- d. Outputs shall be current, or voltage as required.
- e. Isolation shall be complete between input circuitry, output circuitry and the power supply.
- f. Zero and span adjustments shall be provided.

- H. The UPS shall be Best Power, Ferrups Model FE or Engineer approved equal.

PART 3 EXECUTION

3.1 Installation

- A. Refer to Section 250000.
- B. The panels and consoles shall be factory tested and approved by the Engineer prior to shipment.
- C. The panels and consoles shall be installed at locations as shown on the Drawings.

3.2 FACTORY ACCEPTANCE TEST (FAT)

- A. Refer to Section 250000.
- B. All panels and consoles shall be tested for proper operation and approved by the Engineer at the PICS factory, or other selected site, prior to shipment to the Jobsite.
- C. Tests shall demonstrate all specified control functions by simulating inputs and outputs to the panels, communication to and from the SCADA and HMI systems, etc.
- D. Acceptance of factory tests by Owner or Engineer shall not constitute a waiver of requirements to meet field tests under specified operating conditions, nor does inspection relieve the PICS of his responsibility in any way.

END OF SECTION

SECTION 26 00 00
GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Furnish and install all materials, equipment, labor, supervision, and services necessary to complete all electrical work specified herein and shown on the Drawings.
- B. Contractor shall coordinate service to each site (Raw Sewage Pump Station & Wastewater Treatment Plant) with the local utility company.
- C. Principal Features
 - 1. Complete system of conduits, cables and conductors to supply electrical energy throughout the facility.
 - 2. Installation of Control Panels and instruments
 - 3. All field terminations, including instruments, vendor panels, etc.

1.2 APPLICABLE STANDARDS AND CODES

- A. Local, State, and National Electrical Codes.
- B. National Electrical Code, 2023.
- C. Rules of the Electrical Utility and the National Electrical Safety Code.
- D. Life Safety Code 101.
- E. NECA Standard of Installation.
- F. NFPA (National Fire Protection Association).

1.3 FEES AND TESTS

- A. Contractor shall be responsible for all fees for permits, inspections, and tests necessary to complete this work. Contractor shall demonstrate to the Owner and the Engineer that all items of equipment installed are completely operational and free of defects in all modes.

1.4 COORDINATION WITH OTHER TRADES

- A. Furnish and locate all anchor bolts, inserts and supports for installation by the other trades as required. Coordinate the location of all fixtures, outlets, equipment, and devices with other trades to avoid conflicts.

1.5 LIST OF PROPOSED MANUFACTURERS

- A. List of Proposed Materials: The Contractor shall submit a complete list of the proposed manufacturers for each proposed item as required to complete the work. Additional submittal data, sufficient to determine equality, shall be required if the Contractor proposes to substitute another manufacturer's equipment.
 - 1. Intent of Drawings
 - a. Electrical plan drawings show only general locations of equipment, devices and raceways, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of raceway, subject to the review of the Engineer.
 - 2. Departures from Contract Documents
 - a. Submit to the Engineer in writing details of any necessary, proposed departures from these Contract Documents, and the reasons, therefore. Submit such requests as soon as practicable and within 30 days after award of the Contract. Make no such departures without written approval of the Engineer.

PART 2 PRODUCTS

2.1 REFERENCE TO DRAWINGS

- A. Reference shall be made to Drawing Schedules, Details, Notes, and Specifications for: Manufacturer, model, catalog number, size, capacity, performance, ratings and installation of equipment and material.

2.2 CHOICE OF MATERIALS AND EQUIPMENT

- A. In submitting substitutions, bidders should note the following minimum considerations: (1) capacities shown are absolute minimal and must be equaled, (2) physical size limitations for space allotted, (3) structural properties, (4) noise level, (5) interchangeability, (6) compatibility with other materials and assemblies, (7) similar items shall be same manufacture and style wherever possible.
- B. All material and equipment, for which a UL, ANSI, or a NEMA Standard is established, shall be so approved and labeled or stamped.
- C. Adhesives are not acceptable as a mounting, supporting, or assembling technique, unless noted otherwise.

2.3 ELECTRICAL EQUIPMENT

- A. NEMA Standards shall be taken as minimum requirements for electrical equipment.

- B. Equipment shall operate properly under a plus or minus 10 percent of the system voltage.

2.4 SUBMITTALS DURING CONSTRUCTION

- A. Provide complete manufacturers' descriptive information and shop drawings for all permanently installed equipment, material and devices furnished under Division 26, Electrical, including certified outline drawings, arrangement drawings, elementary (schematic) diagrams, interconnection and connection diagrams, in accordance with provisions elsewhere in these Contract Documents. Provide the number of copies specified in Section 01 33 00. Operation and Maintenance Manuals shall be submitted in accordance with Section 01 78 23.
- B. Provide certified shop drawings, literature and requested samples showing items proposed for use, size, dimensions, capacity, special features required, schematic (elementary) control diagrams, equipment schedules, rough-in, etc., as required by the Engineer for complete review and for use during installation. Use NEMA device designations and symbols for all electric circuit diagrams submitted. Make content of the schematic (elementary) connection or interconnection diagrams in accordance with the latest edition of NEMA ICS 1.
- C. Manufacturer's standardized elementary diagrams will not be acceptable unless applicable portions of the diagram have been clearly identified and non-applicable portions deleted or crossed out.
- D. Certified arrangement drawings, outline dimensions, and weights for all major (engineered) equipment including, but not limited to:
 - 1. Low voltage switchgear.
 - 2. Transformers.
 - 3. Variable frequency drives.
- E. Functional description or logic diagrams for all control systems furnished under Division 26, Electrical.
- F. Characteristic curves for all protective devices.
- G. Certified drawings and descriptive literature for all equipment and devices furnished under Division 26, Electrical, and not listed above.
- H. Schematic (elementary drawings for any electrical control and bills of material for equipment including, but not limited to:
 - 1. Motor control
 - 2. Control systems furnished under Division 26, Electrical.

3. Switchgear, Breakers, and Automatic Controllers
4. Variable Frequency Drives
- I. Connection diagrams showing all internal wiring and all required field connections for the following:
 1. Low voltage switchboard
 2. Breakers
 3. Variable Frequency Drives
- J. The interconnection diagrams shall show terminal points, intermediate connections, device designation, terminal numbers, polarity of dc circuits, conductor identification, and any other information necessary to show which conductor connects to which point; the Contractor shall review and sign off on the control interconnection diagrams.
- K. In addition to submittals for specific items mentioned above, furnish shop drawing information on the following items:
 1. Conduit, tubing, and fittings.
 2. Wireway.
 3. Outlet and device boxes.
 4. Pull boxes and junction boxes.
 5. Terminal junction boxes.
 6. 600-volt conductors.
 7. Control cable.
 8. Receptacles.
 9. Surge suppressors

PART 3 EXECUTION

3.1 WIRING ELECTRICALLY OPERATED EQUIPMENT

- A. The Contractor shall be responsible for electrical connections to all equipment requiring electrical power. This responsibility applies to equipment furnished under this and other Divisions and by the Owner.

3.2 RECORD AND AS-BUILT DOCUMENTS

- A. Maintain at the job site a set of Contract Documents kept current by indicating thereon all changes, revisions and substitutions, between work as specified and as installed.
- B. Furnish Owner with complete set of Operation and Maintenance Manuals.

3.3 EQUIPMENT OPERATION

- A. This Division is responsible for: (1) proper rotation, (2) observing that lubrication has been properly performed, (3) that motors operate within nameplate limits, and (4) adjustment of circuit breaker and MCP trip settings.

3.4 CLEANING AND PAINTING

- A. Fixtures, panels, and equipment shall be thoroughly cleaned. All equipment shall be touched up or repainted as required to present a clean professional appearance. Paint all ferrous metal that is not otherwise protected against corrosion. Paint exposed pipe threads with Bitumastic No. 50.

3.5 IDENTIFICATION

- A. Identify all major items of equipment including controls, panels, switches, contactors, motor starters, junction boxes and metering by permanent nameplates, with wording approved by Engineer. Secure metal nameplate frame with screws or brads. Adhesives are acceptable on components within NEMA 1 enclosures.
- B. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on record drawings.
- C. Each instrument shall be identified with a stamped stainless-steel tag system (Brady or approved equal). Instrument tags shall be permanently attached to each individual instrument and stamped with the appropriate number per instrument specification section.
- D. Each cable shall be identified with a permanent labeling system (Brady Catalog Number B-292 with printed legends or approved equal). Instrumentation cables shall be labeled with the appropriate instrument number of the originating signal (Ex. FT-2020-1). Multiplex cables, power and control cables shall be labeled with the appropriate cable number per the conduit and cable schedules. Refer to PICS shop drawings for instrument cable identification.
- E. All switchgears, MCC's, MCC compartments, power panels, lighting panels, control panels, control cabinets, etc. shall be identified with permanently mounted phenolic labels.
- F. All power and lighting panels shall have typed schedules mounted on panel doors.
- G. All terminals and associated wires shall be numbered and labeled respectively and wiring

diagrams shall be installed in the MCC or electrical panel doors.

3.6 TEST PERIOD

- A. Each piece of equipment shall continue to meet performance specifications throughout the first year of operation. Contractor shall replace or repair any defect due to faulty workmanship or material which shall develop within 1 year from date of acceptance.
- B. For first year after final acceptance, Contractor shall provide, at no cost to Owner, any required maintenance and service necessary to assure the proper operation of the system. Date of acceptance shall be certified by Engineer as that date on which the Contract Work has been satisfactorily completed, as a whole, in accordance with the Contract Documents.

3.7 GROUNDING

- A. See Specification 26 05 26.

3.8 ELECTRICAL TESTING AND START-UP

A. General

- 1. Prior to energizing any equipment, the electrical contractor shall thoroughly vacuum clean the equipment with an industrial type vacuum cleaner. The outside of all electrical equipment shall be cleaned, and paint touched up as required to leave equipment in an “as purchased” condition.
- 2. During start-up of new equipment, the electrical contractor shall provide sufficient personnel to aid with start-up of the electrical equipment to remove any faults, and to make the necessary adjustment for proper operation of electrical equipment and installation. This includes sufficient personnel to aid equipment service personnel in their check-out of the electrical equipment and service.
- 3. All testing equipment shall be furnished by the Contractor.
- 4. All failures under tests due to defective material or poor workmanship shall be corrected by the Contractor at no expense to the Owner.
- 5. The electrical contractor shall not, under any circumstances, energize any electrical equipment covered by these Specifications without first obtaining permission from the Engineer.

B. Grounding

- 1. After all connections have been made to the ground, ground tests shall be made to verify its adequacy. See specification 26 05 26.

C. Typewritten directories shall be inserted in all panels showing the designation of each

circuit. All power and replacement fuses necessary for testing shall be furnished and paid for under this item.

D. Circuit Continuity

1. Complete installation shall be free of short circuits, open circuits, and other defects. Insulation Resistance and Continuity Tests shall be performed in accordance with Section 26 05 26-3.2 to prove that all parts of the installation are intact.

3.9 INSTALLATION OF EQUIPMENT

- A. The electrical contractor shall coordinate with the Local Utility Company, Contractor and Owner in order to have electric power available when required.

3.10 TEMPORARY ELECTRIC POWER

- A. The contractor shall coordinate, furnish, pay for, and provide any necessary provisions for electric power used during construction.

END OF SECTION

**SECTION 26 05 19
WIRE AND CABLE**

PART 1 GENERAL

1.1 SCOPE

- A. Work covered by this section includes furnishing all labor, equipment, and materials required to install, connect, and test all wire and cable, including splices, terminations, connectors, and accessories for a complete installation as shown on the Drawings and/or specified herein.
- B. The Contractor's attention is directed to the fact that all wires and cables are not necessarily shown on the Drawings, which are more or less schematic. However, the Contractor shall be responsible for furnishing and installing all wire and cable indicated or required to properly connect and place into operation all equipment and services requiring such wiring and/or cable.

1.2 QUALITY ASSURANCE

- A. Samples of all wire and cable, clearly marked and long enough to show complete identification, shall be submitted to the office of the Engineer for approval prior to wiring installation.
- B. No defective or damaged wire and cable shall be incorporated into the work.

1.3 SIZING OF CONDUCTORS

- A. Unless otherwise required or directed by the Engineer, conductors shall be furnished in the sizes shown on the Drawings. No wire for lighting, power, or motor control circuits shall be smaller than No. 12 AWG. Motor control circuits carrying less than 8 amps may be No. 14 AWG. No wire for instrumentation and low-level signal transmission pairs shall be smaller than No. 16 AWG for single pairs or No. 20 AWG for bundled cable.
- B. All wires and cables shall be of such size as to conform to the regulations of the current edition of the National Electrical Code for current carrying capacity.
- C. Where the size of lighting wiring is not given on the Drawings, it shall be of such size that the voltage drop from the main panel to the lighting panel is not more than 1 percent, and the drop in the branch circuit is not more than 2 percent. The voltage drops in motor feeder, when the wire size is not specified, shall not be more than 3 percent at full load from the Motor Control Center to the motor terminal.

1.4 SHOP DRAWINGS AND ENGINEERING DATA

- A. Complete shop drawings and engineering data shall be submitted in accordance with requirements of the Section 01 33 00 of these Specifications.

1.5 STORAGE AND PROTECTION

- A. Store and protect all wire and cable in accordance with the manufacturer's recommendations and requirements of the Section 01 60 00 of these Specifications.
- B. Wire and cable shall be stored indoors in a dry and warm location and in its original packaging.

1.6 GUARANTEE

- A. Provide a guarantee against defective materials and workmanship in accordance with requirements of the Section 00 72 14 Article 23 of these Specifications.

PART 2 PRODUCTS

2.1 CONDUCTORS - GENERAL

- A. Conductors shall be solid or Class B concentric stranded, soft, or annealed, uncoated copper free from kinks and defects in accordance with ASTM B 3 or B 8.
- B. Copper conductors should have a conductivity not less than 97 percent.
- C. The wire and cable shall have size, grade of insulation, voltage, and manufacturer's "E-Number" permanently marked on the outer covering at not more than 2-foot intervals.
- D. All wires shall conform to the latest Standards of the ASTM and ICEA and shall be tested for their full length by these Standards.
- E. All control circuit wiring and all wiring No. 8 AWG and larger shall be stranded. Lighting branch circuits No. 12 and No. 10 AWG may be solid. Wiring shall be stranded as follows:
 - 1. No. 14 thru No. 2 AWG shall have a minimum of 7 strands.
 - 2. No. 1 thru No. 4/0 AWG shall have a minimum of 19 strands.
 - 3. No. 250 MCM thru No. 500 MCM shall have a minimum of 37 strands.
 - 4. All circuits except control and instrumentation circuits shall have a separate grounding conductor carried in the conduit.

2.2 CONDUCTORS FOR WIRE AND CABLE

- A. XHHW - For service entrance, motor branch, and feeder circuits operating at 208, 240, and 480 volts, the conductors shall be single-conductor, cable rated, 600 volts. The single-conductor cable shall consist of uncoated annealed copper, Class B stranded per ASTM B 8 and insulated with corona, ozone, heat and moisture resisting cross-linked polyethylene insulation rated to withstand a copper temperature of 90 degrees C,

Underwriter's approved Type XHHW and shall be as manufactured by Southwire, General Cable Corporation, Okonite Company or equal.

- B. THWN-2 - For general lighting and receptacle branch circuits operating at 120 volts, the conductor shall be single-conductor cable rated 600 volts. The single-conductor cable shall be uncoated annealed copper. No. 12 and No. 10 AWG may be solid or stranded; larger cables shall be stranded per ASTM B 8 or B 3 and insulated with polyvinyl chloride insulation rated to withstand a copper temperature of 75 degrees C, Underwriter's approved Type THWN-2, and shall be as manufactured by Southwire, General Cable Corporation, Okonite Company, or equal.
- C. VFD Cables – For VFD cables, use 3/C with ground, bare copper XLPE insulation overall dual copper tapes helically applied shield, block PVC outer jacket, 600/1000V TC-ER 90C dry/wet 1000V CSA AWM, Sunlight resistant, dry wet. Cable shall be equal to Belden 29526C (#4), Belden 29525C (#6), Belden 29524C (#8), Belden 29523C (#10), Belden 29522C (#12) or approved equals that have equivalent or less overall diameters.
- D. For lighting fixture drop wire or for running in fluorescent units, the conductors shall be single-conductor cable rated 600 volts. The single-conductor cable shall be stranded tinned copper with a 31-mil-thick wall silicone insulation and a glass braid jacket overall rated to withstand a copper temperature of 150 degrees C, Underwriter's approved silicone insulated fixture wire type SFF-2, and shall be as manufactured by General Cable Corporation, General Electric Company, or equal.
- E. For control circuits the conductors may be single or multi-conductor cable rated 600 volts. The conductors shall consist of uncoated annealed copper Class B stranded per ASTM B 3 or B 8 and shall be No. 14 or No. 12 AWG, 7-strand, identified at each end using Brady wire markers B-500 vinyl cloth, Thomas and Betts "E-Z Code" wire markers, or equal.
 - 1. Single-conductor cable shall have 45-mil-thick wall of cross-linked polyethylene or polyvinyl chloride insulation, color red, to withstand a copper temperature of 90 degrees C, Underwriter's Laboratories approved Type RHH-RHW, and shall be as manufactured by General Electric Company, Phelps Dodge, General Cable, Okonite, or equal.
 - 2. Multi-conductor cable shall consist of single-conductor cables rated 600 volts and insulated to withstand a copper temperature of 90 °C cabled together to form a cable assembly which is Underwriter's Laboratories approved for installation in conduit. The core shall be color coded in accordance with ICEA, Method 1, with a plastic tape cover and a PVC or neoprene jacket overall.
- F. Bare grounding conductor shall be Class A or B medium hard drawn, high conductivity bare copper, sized as shown on the Drawings. Conductors No. 6 AWG and smaller may be solid. Conductors No. 4 AWG and larger shall be stranded.
- G. Flexible power cords shall be moisture-resistant, oil-resistant, neoprene-sheathed service cable designed for extra hard usage, Type SO, rated 600 volts at 90 degrees C continuous

conductor temperature. Flexible heater cords shall be moisture-resistant, oil-resistant, neoprene and cotton sheathed service cable designed for extra hard usage, Type HSO, rated 600 volts at 90 degrees C continuous. Insulation shall be thermoplastic ethylene-propylene conforming to ICEA S-68-516. Neoprene shall conform to ASTM D 752. All flexible cords shall be UL listed.

2.3 INSTRUMENTATION AND THERMOCOUPLE EXTENSION WIRING

- A. Instrumentation and low-level DC signal wiring shall be shielded, twisted pair conductors. Single twisted pairs shall consist of 2, Class B stranded, No. 16 AWG annealed copper conductors, 1 white and 1 black, with 15 mils of PVC insulation rated for 600 volts and 90 degrees C minimum continuous conductor temperature. Pairs shall be twisted to a lay of 1.5 to 2.5 inches. A 0.35 mil by 0.50 mil aluminum-mylar tape shield with stranded, bare No. 18 AWG, tinned copper drain wire in contact with the aluminum side of the shield shall be applied helically around the twisted pair. An overall jacket of 90 degrees C black PVC at least 30 mils in thickness shall be applied to the outside. Shield coverage shall be full 100 percent. All instrumentation wiring shall be UL listed.
- B. Twisted, Shielded Triad Instrumentation Cable for RTD circuits: Stranded copper conductors, size #16 AWG. Insulate conductors individually with color-coded PVC. Provide shield for each triad and tinned-copper drain wire. Provide flame-retardant PVC outer jacket. Cable shall be rated 600 volts and 90 degrees C. Cable shall be designed for noise rejection for use in process control signals.

2.4 AUDIO SIGNAL WIRING

- A. Audio signal wiring for public address and sound systems shall be shielded, twisted pair instrumentation cable with 2 No. 16 AWG conductors constructed in accordance with the requirements of Part 2.3 of this section.

2.5 ETHERNET CABLES

- A. Ethernet cables routed in conduit shall be Cat 7a enhanced cable suitable for outdoor use and in conduits. Outer shield shall be braided. Conductor shall be 22 AWG.

2.6 FIBER CABLE

- A. See P&ID drawing for fiber type. Coordinate fiber type with PICS / System Integrator prior to purchase.

2.7 TELEPHONE AND COMMUNICATION WIRING

- A. Indoor telephone and communication cable shall consist of solid, minimum No. 22 AWG, annealed copper conductors insulated, and standard telephone color coded with polyethylene and twisted together in pairs. Pairs shall be cabled together and protected with a metal tape shield and a polyethylene or PVC jacket overall. Cable shall be suitable

for installation in ducts.

- B. Buried telephone cable shall be REA approved for aerial installation on messenger wire, installation in underground ducts, and direct burial. Cable shall consist of solid, minimum No. 22 AWG annealed copper conductors insulated and standard telephone color coded with polypropylene or polyethylene and twisted together in pairs. Each pair shall be twisted to a different lay length. Cable with more than 25 pairs shall be assembled from oscillated, bundled, 25-pair subunits. Bundled pairs shall be covered by a nonhygroscopic tape, an inner jacket of polyethylene, a shield of aluminum or tinned copper, and an outer jacket of black, high-molecular weight polyethylene copolymer. Cable core shall be completely filled with a nontoxic, petrolatum-polyethylene weatherproofing compound. Jacket shall be sequentially marked to indicate footage.

2.8 SPLICES AND TERMINATIONS

- A. Splices, taps and attachment of fittings and lugs shall be electrically and mechanically secure, and approved solderless lugs and connectors shall be used. Lugs and connectors shall be top quality product of Burndy, O-Z, Thomas and Betts, or equal manufacturer. Conductors shall not bind at bushings. Lugs shall be of the correct sizes for the conductors joined and strands shall not be cut from a conductor.
- B. Splices, taps, and terminations of cable rated 600 volts and less requiring tape shall be half lap and at least 3 layers. Taping shall be neatly done and form a permanent insulation equal in mechanical and electrical strength to the insulation of the conductor. Taping shall be as follows:
 - 1. Rubber Insulation
 - a. Inner Layer: Okonite Rubber Tape, 3M “Scotchfil” Electrical Insulation Putty, Plymouth “Plysafe” Tape, or equal.
 - b. Outer Layer: 3M “Scotch No. 88” Tape, Permacel No. 295 Tape, Slipknot Grey Tape, or equal.
 - c. Thermoplastic Insulation: 3M “Scotch No. 88” Tape, Permacel No. 295 Tape, Slipknot Grey Tape, or equal.
 - 2. Terminations at motor junction boxes shall be sealed with 3M “Scotchkote” Electrical Coating over the outer layer of tape. All splices 600 volts and less in No. 8 AWG and larger sizes shall be made using approved bolted connectors properly taped as specified herein.
- C. For No. 10 AWG and smaller branch circuit and fixture conductors operating at 277 volts or less, live spring pressure connectors rated for 600 volts may be used for splices and junctions. When installed in a fixture, connectors shall be rated for 1,000 volts.

2.9 GROUND RODS

- A. Ground rods shall be Copperweld, sectional type. Ground rods shall be UL listed and REA approved and shall conform to ANSI C33.8.
- B. Connections between grounding conductors and grounding rods shall be mechanical if above ground, thermal if underground.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All interconnecting wiring shall be installed in approved conduit or cable trays and connected as shown on the Drawings and/or specified herein. Unless otherwise shown or specified, all wiring shall be run in conduit.
- B. Unless otherwise shown on the Drawings, wiring shall be run by the most direct route keeping overall circuit length to a minimum.
- C. Instrumentation and low-level signal wiring shall not be located in the same conduit as motor wiring, feeder wiring, branch circuit wiring, or control wiring. Control wiring shall not be located in the same conduit as feeder wiring, or instrumentation wiring.
- D. All control and circuit wiring in cabinets, boxes, gutters, etc. shall be neatly tied and held using nylon cable ties and mounting brackets.
- E. After installation, conductors shall not have dents, scars, cuts, pressure indentations, abraded areas, etc.
- F. Conductors 600 volts and below shall not be bent to a radius less than 12 times the cable diameter. Conductors above 600 volts shall not be bent to a radius of not less than 24 times the cable diameter.
- G. Wiring run in metallic conduits shall be arranged such that there are an equal number of conductors of each phase in each conduit. Under no circumstances shall metallic conduits contain one single conductor or several conductors of only one phase. This requirement shall not apply to single, bare grounding conductors run in conduit to grounding rods or grids.
- H. Conductors may be coated with talc, soapstone, Ideal “Yellow 77” or “Wire Lube”, Electro-Compound “Y-ER EAS,” or equal, to facilitate pulling into raceways, but in no case may they be greased or coated with any substance injurious to conductor insulation and jacket. Pulling tension shall be exerted primarily on the strongest component of conductors, normally the metallic conductors themselves and not on the insulation jacket. When installing cable in conduit with pulling eye attached to copper conductor, the tension shall not exceed 0.008 pound per circular mil area of the conductor nor 5,000 pounds, whichever is smaller. When a basket grip is used over the outer jacket of the

cable, the maximum pulling tension shall not exceed 0.008 pound per circular mil area of the conductor nor 1,000 pounds, whichever is smaller. In no case shall pulling tensions recommended by the wire manufacturer be exceeded. The maximum sidewall pressure exerted on the insulation and sheath at a cable bend shall not exceed 300 pounds per foot of conduit bending radius. Conductors shall not be pulled “through” any outlet, conduit or box. Separate “pulls” shall be made on each side of such point.

- I. Unless otherwise specified, splices shall be made at outlet or conduit boxes, pull or junction boxes, manholes, or vaults. No splice shall be drawn into a conduit. Splices in wiring rated 600 volts and below shall be made with enough spare wire for 2 splices to be remade with the wire at the same location.
- J. All instrumentation and thermocouple extension wire shields shall be grounded. Shields on individual circuits shall be electrically continuous and shall be grounded at only 1 point in the circuit. Shields on thermocouple extension wire shall be grounded at the thermocouple only.
- K. Surge suppressors shall be installed with the shortest line lead possible, but in no case longer than 18 inches unless otherwise shown on the drawings.
- L. Inside manholes, all cables are to have racks with insulator supports. Supports are to be within 6 inches of each side of a splice and spaced not farther than 3 feet apart.
- M. All conductors are to be identified. Branch circuits, motor feeders, and lightning wiring shall be identified by color coding consistent with the existing facility. If the facility is new, the color code shall be as follows:

	277/480V	120/208/240V
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Neutral	Grey	White
Ground	Green w/ Stripe	Green

- N. The color coding on No. 8 AWG and smaller conductors shall be continuous in length. No taping, painting or other means of coding will be acceptable. Conductors No. 6 AWG and larger and conductors operating above 600 volts shall be black with color coded tape visible at each point of access or view.
- O. All circuits shall be identified at each termination and at all accessible locations such as manholes, hand holes, and pull-boxes. A circuit name shall be assigned based on the equipment at the load end of the circuit. Add a suffix letter if necessary to make the circuit number unique. Utilize sleeves for conductor sizes #2 AWG and smaller, and marker plates attached with nylon tie cords for larger conductor sizes. Taped-on markers

or markers relying on adhesives shall not be allowed.

- P. Conductors used for temporary construction power shall not be used for the permanent installation, and the permanent conductor system shall not be used for construction power unless authorized in writing by the Engineer. Circuit protective devices shall never be temporarily bypassed.
- Q. Cables shall be pulled and installed without splices. Splices shall only be made with the Engineer's approval.
- R. Apply fireproofing tape to cables in hand holes and manholes, and in other locations such as vaults, throughout their exposed length. Follow the tape manufacturer's installation instructions closely.

3.2 TESTING

- A. Perform visual and mechanical inspection of each individual exposed power cable #6 AWG and larger for physical damage, correct terminations in accordance with the Drawings, cable bends in accordance with bending radius requirements, proper circuit identification, proper lug type, tightness of bolted connections with proper torque level per NETA ATS, Table 10.12 or manufacturer's specifications, and proper grounding.
- B. Perform Insulation Resistance Testing of all conductors #6 AWG and larger with respect to ground and each adjacent conductor. Apply 1,000 volts dc for one minute on 600 volts insulated conductors in accordance with NETA. Minimum insulation resistance values shall not be less than 50 meg-ohms. Investigate all deviations between adjacent phases.
- C. Perform Continuity test by ohmmeter method to ensure proper cable connections of all conductors #6 AWG and larger.

END OF SECTION

**SECTION 26 05 26
GROUNDING**

PART 1 GENERAL

1.1 STANDARDS

- A. All electrical systems shall be grounded in accordance with the National Electrical Code, Local Codes, these Specifications and the contract drawings.

PART 2 PRODUCTS

2.1 CABLE AND EQUIPMENT

- A. Use green colored and bare stranded copper conductors.
- B. Use approved ground clamp manufactured for such purpose.
- C. Use approved grounding electrodes and ground rod.
- D. Make permanent ground connection with exothermic weld method.

PART 3 EXECUTION

3.1 GENERAL

- A. In general, alternating current circuits of 600 volts and below, surge suppressors, conductor raceway systems, and platform steel framework shall be effectively and permanently connected to a grounding system by means of copper conductors having cross section as required by the National Electrical Code and of capacity sufficient to ensure continuity and continued effectiveness of the ground connections under conditions of excess current. If some of the equipment to be grounded is not covered herein by detailed instructions or is not shown completely and clearly on the Drawings, such provisions of the National Electrical Code as may apply are to be considered minimum requirements for the work.
- B. All metallic conduit systems, whether used for power or lighting wiring, shall be installed in such a manner as to produce electrical continuity and shall be bound together at one or more points and connected to the building system ground, except that isolated sections of conduit not exceeding 4 feet in length are not to be grounded or bonded unless specifically called for.
- C. Rigid metal conduit systems made up with fittings, boxes, and apparatus housings having fully threaded hubs need no additional provisions for continuity of ground. If the conduit system contains cutouts, pull boxes, junction boxes, switchboxes, etc., to which the conduit is fastened by means of locknuts and bushings, such interruptions in the grounding continuity shall be eliminated by bonding the conduit to the housings or by separately grounding each box and conduit sections, etc., that are so isolated. Grounding

wedge lugs shall be used between all bushing and metal boxes. Paint and other nonconducting material shall be removed from the surface of conduit, fittings, and metal housings prior to connecting grounding clamps, straps, or other devices.

- D. Equipment Grounding: Panel, starters, lighting fixtures, motor control center, etc., for power and lighting constitute the fundamental center of the associated distribution systems. As such, the metallic enclosures, frames, and other noncurrent carrying metal parts of this equipment shall be connected by one or more grounding conductors to the grounding system. Install a ground connection from the ground bus of switchgears, MCCs, and other electrical panels with ground bus to the ground grid.
- E. All motor frames shall be grounded. The ground conductor shall be run inside the conduit containing the power conductors. In the case of most 3-phase circuits, this means a fourth conductor in each branch circuit. The grounding conductor may be as large as the power conductor or as small as allowed by Section 250 of the NEC but shall not be smaller than No. 12 AWG. The grounding conductor shall be stranded, with green insulation through No. 4 AWG; larger sizes may be bare stranded. Ground connection at the motor shall be terminal lug or servit post inside motor conduit box and the other end connected to the ground bus in the motor control center.
- F. Transformer Grounding: Bond the neutrals of outdoor substation transformers and distribution transformers within buildings to system ground network, and any additional grounding electrodes shown near the transformers. Connect the case of the transformer to the grounding system as well.
- G. In making ground connections, the surfaces to all parts that will touch shall be thoroughly cleaned to ensure making good electrical contacts.
- H. All clamped joints shall be made up firmly. Thermal joints shall be equal to CadWeld Type TA. Where exposed to mechanical injury, the grounding conductor shall be suitably protected by pipe or other substantial guard. If guards are iron pipe or other magnetic material, the grounding conductor shall be electrically connected to both ends of the guard to reduce impedance of the circuit.
- I. Grounding conductors shall be without splice or joint if applicable and shall be straight and short except that when laid underground they shall be laid slack to prevent their being readily broken unless otherwise mechanically protected.
- J. No fuse, switch, circuit breaker, or similar disconnecting devices shall be inserted in the grounding conductor or connection throughout the entire installation.
- K. Grounding conductors shall be medium hard drawn, stranded bare copper wire sized as required by the National Electrical Code Article 250. Conductors Size No. 6 and smaller may be solid; Size No. 4 and larger shall be stranded. Ground wire shall be carried in conduit to the grounding point.
- L. Ground rods where required, shall be of copper-clad steel not less than ¾-inch in

diameter, 10 feet long or as shown on the Contract Drawings, and driven full length into the earth. The maximum resistance of a single driven ground shall not exceed 5 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, a minimum of 2 additional rods shall be installed not less than 10 feet on center. Connections between grounding conductors and ground rods shall be mechanical if exposed, thermal if buried.

- M. Except where specifically indicated otherwise, all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and neutral conductor of the wiring system shall be grounded. The ground connection shall be made at the main service equipment and shall be extended to driven rods on the exterior of the building.
- N. All neutral conductors shall be continuous throughout the system and shall be grounded only at the point of origin of the service neutral.
- O. All receptacles shall have provision for grounding conductor connection and shall be grounded to the grounding conductor and outlet box.
- P. All exposed steel columns, tanks, ladders, towers, and elevated platform shall be effectively grounded using No. 4/0 or larger bare copper grounding conductors and driven ground rods. Where multiple columns or tanks must be grounded, ground points shall be interconnected by minimum No. 4/0 bare copper grounding conductors buried approximately 18 inches below finished grade.
- Q. Anchor bolts securing exposed electrical equipment, structures, metal enclosures, and tanks located outdoors shall be electrically connected to the steel reinforcement in the concrete foundation or footing. Connection shall consist of minimum No. 2/0 bare copper conductors and mechanical grounding clamps.
- R. Surge arrestor ground terminals shall be connected to the equipment ground bus. Ground paths for lightning and surge arresters and capacitors shall be kept as short and direct as practical. If possible, arresters shall be connected in direct shunt relationship to the equipment terminals. Supporting brackets shall be connected directly to the equipment frame.
- S. Grounding resistors, where specified, shall have a resistance within the boundary limits specified in IEEE Standard 142 in order to minimize transient overvoltages during ground faults. Ground fault current shall not be less than that required to operate protective devices or 25 amps, whichever is greater.
- T. Lightning and surge arresters used with grounded-wye systems which do not have effectively grounded neutrals as defined by IEEE Standard 100 shall have a voltage rating not less than the maximum phase-to-phase voltage of the system.
- U. The grounding system equivalent resistance shall not exceed 5 ohms for the entire system under normally dry conditions unless otherwise specified. After the grounding system has been installed and all connections made, tests shall be made by the Electrical

Contractor to determine the resistance to earth. If the resistance of the entire system exceeds the specified maximum, additional ground rods shall be driven to reduce the resistance to this value.

- V. Gas piping or piping conveying flammable liquids shall not be used as grounding electrodes.
- W. The use of salts or electrolytes to reduce earth resistance shall not be permitted.
- X. Permanently connect the green ground conductor to each receptacle junction box (self-tapping screw).
- Y. Install a ground rod inside each manhole. Connect any metallic raceway and all noncurrent-carrying metal parts to the ground rod with a No. 6 AWG (min.) copper conductor. Similarly, provide a ground rod for every pole-mounted site lighting and make grounding connections.
- Z. Bond the standby generator neutral to the grounding system with a properly sized grounding conductor. Ground the generator frame to the ground grid.
- AA. Ground metallic fences when used to enclose electrical equipment.
- BB. Bond all metallic pipe systems, ducts, etc as per the NEC.

3.2 TESTING

- A. Ground resistance testing shall be done in accordance with IEEE standard 81-1993 to confirm that the resistance of the grounding system is 5 ohms or less (test shall not be run within 72 hours of last rain fall). Ground resistance testing shall be done with the power off and the grounding electrode conductor isolated from the utility, and the service to prevent coupling. The testing equipment shall use the fall of potential method of earth resistance measurement. The test equipment must be designed to reject the effects of stray ac and dc currents on readings.
- B. A test report shall be submitted to the engineer and included in the O & M manual for the project. The report shall include but not be limited to:
 - 1. Date of test
 - 2. Time of day
 - 3. Weather condition (ex. 82°F, 82% RH, cloudy)
 - 4. Date of last rain fall $\geq \frac{1}{2}$ " in a 24-hour period
 - 5. Soil type
 - 6. Minimum of five (5) readings

7. A plot of all readings indicating a level spot in the curve at the system resistance.
- C. All ground resistance testing shall be done in the presence of the Engineer. If test measurements indicate a grounding system resistance of greater than 5 ohms, additional grounding cable shall be buried in locations and at the direction of the Engineer. Ground resistance testing as described herein shall be repeated after the additional ground cable has been installed. The installation of grounding cable and repeat testing shall be done until the 5-ohm grounding system resistance has been achieved.
- D. Test equipment for ground resistance measurement shall be Vibroground by Associated Research, Megger null balance by Biddle, or alternate approved by the Engineer.

END OF SECTION

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**SECTION 26 05 33
BOXES**

PART 1 GENERAL

1.1 SCOPE

- A. All boxes required throughout the electrical raceway system shall be furnished and installed in accordance with the requirements which follow.

1.2 SECTION INCLUDES

- A. Outlet boxes.
- B. Pull and junction boxes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Boxes shall be equal to Appleton, Crouse Hinds, Raco, or Steel City.

2.2 MATERIAL

- A. Outlet Boxes
 - 1. Sheet Metal Outlet Boxes: NEMA OS-1, UL 514; galvanized steel, with ½ inch male fixture studs where required.
 - 2. Cast Boxes: Cast ferrous alloy with galvanized or cadmium finish, deep type, gasketed cover, threaded hubs for use with steel conduit, UL 514.
 - 3. Floor Boxes: Full adjustable, steel, water and concrete tight equal to T&B model number 68 D.
 - 4. Except as indicated otherwise on the drawings or in these specifications, all junction boxes or pull boxes 4-inch trade size or smaller in any dimension shall be galvanized malleable iron or acceptable equal cast ferrous metal for use with steel conduit.
- B. Pull and Junction Boxes
 - 1. Junction boxes and pull boxes shall be as indicated on the drawings and as specified in these specifications. Where no type or size is indicated elsewhere for junction boxes or pull boxes, they shall be in accordance with the requirements of the NEC, Article 314, Paragraphs 28, 29, 40 and 41 for use on systems with a nominal rating of 600 volts and less, and Section IV for use on systems with a nominal rating of over 600 volts.

- a. Sheet Metal Boxes: NEMA OS-1; galvanized steel. Boxes larger than 12-inches in any dimension are hinged enclosure. Equal to Hoffman Bulletin A-51.
 - b. Cast Metal Boxes: NEMA 250; Type 4, galvanized cast iron box and cover, neoprene gasket, stainless steel cover screws, UL listed as raintight. Provide flat-flanged type for surface mounting and outside flange recessed cover type for underground use. Boxes for sidewalk or other traffic areas to have appropriate duty cover with non-skid finish.
 - c. Corrosion Resistant Boxes: UL 508 Type 4X, gasketed screw cover. For boxes larger than 12-inches in any dimension provide hinge on one side and stainless-steel toggle latches (equal to Hoffman A-FC412SS) on the other three sides. Equal to Type 304 stainless steel equal to Hoffman Bulletin A-51.
 - d. Floor Boxes: Floor boxes shall be cast iron with bolted covers. The boxes shall be approximately 12 inches square and 10 inches deep and shall be located as shown on the drawings with the lid flush with the finished floor. Floor boxes shall be Neenah No. R-7517-DB or alternate acceptable to the Engineer.
2. Electrical enclosures, except junction boxes and pull boxes 4-inch trade size and smaller and other enclosures of cast metal, shall be constructed from steel plate reinforced as required to provide true surfaces and adequate support for devices mounted thereon.
 3. Except as indicated otherwise in these specifications or on the drawings, all junction boxes and pull boxes larger than 4-inch trade size for use in indoor locations shall be sheet steel hot-dip galvanized after fabrication and those for use in outdoor or wet corrosive indoor locations shall be 316 stainless steel.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordination of Box Locations

1. Provide boxes as shown on Drawings, and as required for splices, taps, wire pulling and equipment connections.
2. Box locations shown on the Drawings are approximate unless dimensioned. Verify box locations prior to rough-in. Coordinate mounting heights and locations of outlet mounted above counters, benches, backsplashes, and other furnishings. Any outlet may be relocated by up to 10 feet before it is permanently installed without incurring additional cost.

3.2 INSTALLATION

A. Box Installation

1. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.
2. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
3. Support boxes independently of conduit openings.
4. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
5. In inaccessible ceiling areas, position outlets and junction boxes within 6-inches of recessed luminaires to be accessible through luminaire ceiling opening.
6. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
7. Align wall-mounted outlet boxes for switches, thermostats, and similar devices. Align adjacent devices at different elevations in one vertical line. Set floor boxes level and flush with finish flooring material.
8. Unless otherwise noted, use only cast outlet boxes. Galvanized steel boxes shall be used only in finished areas where they are completely concealed within walls or ceiling.
9. Conduit openings in boxes shall be made with a hole saw or shall be punched. Field locate holes in junction and pull boxes so as to afford the maximum bending radius for the conductors.
10. Boxes mounted on concrete shall be secured by self-drilling anchors. Mounting on steel shall be by drilled and tapped screw holes, or by special support channels welded to the steel, or by both. Boxes larger than 4-inch trade size shall be leveled and fastened to the mounting surface with not less than 1/4-inch air space between the enclosure and mounting surface. All mounting holes in the enclosure shall be used.
11. Except as prevented by the location of other work, all junction boxes and outlet boxes shall be centered on structures.
12. Label cover of junction boxes with circuit numbers of conductors in the box.
13. Medium voltage boxes and low voltage boxes shall be kept separate. Provide

physical partitions where required.

14. Unless indicated otherwise on the drawings or in these specifications, electrical enclosures except junction boxes and pull boxes 4-inch trade size and smaller, shall be as follows:

<u>Location</u>	<u>Enclosure Type</u>
Indoor (Nonhazardous) Dry Areas	NEMA 1
Areas where moisture conditions are more severe than those for which NEMA 1 enclosures are intended	NEMA 4
Wet, corrosive indoor areas	NEMA 4X SS
Outdoor (Nonhazardous)	NEMA 4X SS
Class 1, Division 2	NEMA 7

END OF SECTION

**SECTION 26 05 34
CONDUIT**

PART 1 GENERAL

1.1 SCOPE

- A. Work covered by this section includes furnishing all labor, equipment, and materials required to install electrical conduit and fittings as specified herein and/or shown on the Drawings.
- B. The Contractor's attention is called to the fact that all conduits and conduit fittings are not necessarily shown completely on the Drawings, as the Drawings are schematic. However, the Contractor shall furnish and install all conduits and conduit fittings indicated or required for the proper connection and operation of the equipment.

1.2 SHOP DRAWINGS AND ENGINEERING DATA

- A. Shop drawings and engineering data shall be submitted in accordance with requirements of Section 01 33 00 of these Specifications.

1.3 STORAGE AND PROTECTION

- A. Store and protect conduit and fittings in accordance with the manufacturer's recommendations and requirements of the Section 01 45 34 of these Specifications. Conduit shall be stored aboveground and adequately supported.

1.4 GUARANTEE

- A. Provide a guarantee against defective equipment and workmanship in accordance with requirements of Section 00 72 00 Article 7 of these Specifications.

PART 2 PRODUCTS

2.1 GENERAL

- A. Unless otherwise shown or specified, all conduits shall be rigid metal. See the paragraph on Conduit Application for additional information.
- B. Conduit terminations at electrical equipment such as electric motors, dry type transformers and heaters shall be made using liquid-tight, flexible metal conduit.
- C. Damaged, dented, flattened, or kinked conduit shall not be used.

2.2 RIGID METAL CONDUIT

- A. Rigid metal conduit shall be heavy wall, mild steel conduit conforming to ANSI C80.1 and Federal Specification WW-C-581, hot dip galvanized both inside and out. All

conduits shall bear the approved stamp of the Underwriters Laboratories.

- B. Rigid metal conduit shall be by Allied Tube & Conduit, Republic, or equal.

2.3 RIGID NONMETALLIC CONDUIT

- A. Rigid nonmetallic conduit for voltages 600V and less shall be Schedule 40 heavy wall polyvinyl chloride (PVC) electrical conduit rated for 90 degrees C conductors and conforming to NEMA TC-2, Type EPC-40-PVC. It shall be listed by Underwriters Laboratories in conformance with the National Electrical Code. Conduit fittings, elbows, and joint cement shall be produced by the same manufacturer as the conduit. Conduits shall be as manufactured by Carlon, Allied Tube and Conduit, Borg-Warner, or equal.
- B. Rigid nonmetallic conduit for voltages higher than 600V shall be polyvinyl chloride (PVC) power duct rated for 90 degrees C conductors and conforming to NEMA TC-6, Type EB. Conduit fittings, elbows, and joint cement shall be produced by the same manufacturer as the conduit. Conduit shall be as manufactured by Carlon, Olin, or equal.

2.4 PLASTIC-COATED RIGID METAL CONDUIT

- A. Rigid metal conduit prior to application of plastic coating shall conform to Part 2.02, Rigid Metal Conduit, of this section.
- B. Plastic coating shall be polyvinyl chloride (PVC) bonded to the metal a uniform thickness of 40 mils the full length of the conduit except the threads. The bond between the metal and PVC coating shall be equal or greater than the tensile strength of the PVC coating.
- C. A coupling shall be furnished loose with each length of conduit and shall have a PVC sleeve extending 1 pipe diameter, or 2-inches, whichever is least, beyond the end of the coupling. Elbows shall have the same thickness of PVC coating as on the conduit. All threaded conduit and elbow ends shall have plastic thread protectors.
- D. The rigid steel galvanized PVC coated conduit and fittings shall be KorKap as manufactured by Plastic Applicators, Houston, Texas; Plasti-Bond as manufactured by Pittsburgh Std. Div. of Robroy Industries, Verone, Pa.; or equal.
- E. PVC-coated rigid conduit shall meet the ASTM D870 Boil Test.

2.5 RIGID ALUMINUM CONDUIT

- A. Rigid aluminum conduit shall be manufactured of 6063 alloy in temper designation T-1. The fittings shall be of the same alloy.
- B. All conduits shall bear the approved stamp of the Underwriters Laboratories and be manufactured to ANSI C80.5 and Federal Specification WW-C-540c.
- C. Rigid Aluminum conduit shall be by Republic, Allied Tube and Conduit, or equal.

2.6 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

- A. Flexible conduit shall have an oil-resistant, liquid-tight jacket in combination with flexible metal reinforcing tubing and shall be designed for use with waterproof fittings. An integral ground wire shall be pulled. Flexible conduit shall be American Brass Sealite Type UA as manufactured by Electric-Flex Company; Flexible Metallic Conduit as manufactured by Ideal Industries, Inc; or equal. Only Underwriter's Laboratories approved fittings shall be used.

2.7 CONDUIT FITTINGS AND BUSHINGS

- A. Wherever conduits terminate in sheet steel boxes, double bonding type locknuts and bushings shall be used except when terminating in cast hubs. All bushings shall be insulated metallic type, equal to O. Z. Electrical Manufacturing Company, Type B; T & B Company, 1200 Series; Appleton Electric Company, Type BU-I; or equal.
- B. Where conduits terminate in steel or cast NEMA 4 enclosures with no factory-installed threaded hubs, a threaded hub shall be installed equal to Myers Electric Products, Inc., Type ST or STG; Appleton Electric Company, Type HUB; Crouse-Hinds, Type HUB; or equal.
- C. All conduits terminating at motor control centers shall be suitably grounded to the motor control center ground bus using grounded type insulated bushings equal to O. Z. Electrical Manufacturing Company, BLB or IGB; Appleton, Type BIB; Thomas and Betts, 3800 Series; or equal.
- D. Conduit expansion fittings shall be O. Z. Electrical Manufacturing Company, Type EX with Bonding Jumper, Type XJ; Appleton, Type SJ with Type XJB4 Bonding Jumpers; Crouse-Hinds, Type XJ with GC100 Bonding Jumper; or equal.
- E. All outdoor conduit penetrations shall enter the enclosures, panels, junction boxes from the bottom side. Top and side penetrations are not permitted without the Engineer's approval.
- F. All outdoor conduit hubs shall be watertight Myer's hubs.

2.8 CONDUIT BOXES

- A. Exposed conduit boxes and pulling elbows shall be of diecast, copper-free aluminum with threaded body and removable neoprene- gasketed cover. Conduit boxes shall conform to Federal Specification W-C-586a and shall be Crouse-Hinds "Condulet," Appleton "Unilet Form 85," or equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Minimum size conduit shall be 3/4 inch aboveground and 1 inch below ground except

where noted otherwise, and no conduit shall have more than 40 percent of its internal area occupied by conductors.

- B. During construction all installed conduits shall be temporarily plugged, capped, or otherwise protected from the entrance of dust, trash, moisture, etc., and any conduits that may become clogged shall be replaced. No conductor shall be pulled in until all work that might cause damage to the conduit or conductors has been completed.
- C. Conduit connections to sheet metal enclosures shall be securely fastened by double lock nuts inside and outside and shall have grounding bushings.
- D. Conduit straps or brackets secured to concrete, brick, or masonry shall be by means of expansion bolts, toggle bolts, or approved drill anchors. No wood plugs will be permitted.
- E. Conduits supported from building walls shall be installed with at least 1/4-inch clearance from the wall using pipe spacers equal to Appleton Electric Company, T & B Company, Steel City, or equal. Clamp back to prevent the accumulation of dirt and moisture behind the conduit.
- F. Unless otherwise shown or specified, exposed rigid conduit shall be installed parallel or at right angles to structural members, surfaces, and building walls.
- G. Two or more conduits in the same general routing shall be parallel with symmetrical bends.
- H. Conduits shall be at least 12 inches from high temperature piping, ducts, and flues.
- I. Conduit installed horizontally shall allow headroom of at least 7 feet, except where it may be installed along structures, piping, equipment, or in other areas where headroom cannot be maintained because of other considerations.
- J. Wherever necessary conduit boxes and pulling elbows shall be inserted in the lines. Gaskets shall be used to ensure a dust and watertight installation on all conduit boxes and fittings.
- K. All bends and turns in conduits shall have a bend radius of not less than 6 times the internal diameter of the conduit. Bends shall be made using an approved bender to provide smooth bends with no kinks, dents, or flattening.
- L. All concealed conduits shall be placed in walls, floors, ceilings, or slabs at the proper time in accordance with the progress of the work. The Contractor shall cooperate in every respect in meeting schedules and shall not delay the structural work unnecessarily. Conduits embedded in concrete shall be blocked and braced in place by use of adequate conduit separators to prevent displacement during pouring of the concrete. Where conduit interferes with structural steel, steel reinforcement, or in the opinion of the Engineer occupies too much space in the slab, the conduits shall be rearranged or installed exposed as directed by the Engineer. No additional payment will be made for such

rearrangement of conduit whether or not additional conduit or fittings might be required.

- M. Conduit wall seals with water stops shall be installed in outside walls below grade for all incoming or outgoing underground conduit emerging directly into the building area. The conduit wall seals shall have a pressure ring and sealing grommet to ensure a watertight installation.
- N. Conduit expansion fittings and ground bonding jumpers shall be installed on all conduits passing through building expansion joints to provide movement in the conduit system.
- O. Where groups of conduits terminate together or pass-through floors, provide template to hold conduits in proper relation to each other and to building.
- P. Conduits shall be plugged or capped with plastic caps during construction to protect threads and prevent entrance of dirt and water.
- Q. Conduits shall be adequately supported at intervals as required by the National Electrical Code. One to two exposed conduits running parallel to each other may be supported by strap anchors, or 1-hole clamps (walls only). Exposed conduits larger than 2 inches or groups of more than 2 conduits run parallel shall be supported by means of minimum 12-gauge, slotted steel channels fitted with 2-piece, bolted pipe clamps. All conduit supports, clamps, straps and brackets shall be stainless steel for corrosion resistance.
- R. Runs of conduit shall not contain more than four 90-degree bends (360-degrees total) between conduit boxes panelboards, or terminations. In general, and to the extent practical length of conduit runs between conduit boxes or similar means of access shall not exceed 100 feet.
- S. Exposed service entrance conduits and main feeder conduits shall be identified using stenciled letters at intervals not to exceed 20 feet. Size of letters shall be equal to one-half the diameter of the conduit or 2 inches, whichever is less.
- T. In Class 1, Division 2 areas, the contractor is responsible for installing seal-off fittings as required by Articles 500, 501, and 502 of the National Electric Code. The drawings do not show seal off fittings and it is the contractor's responsibility to locate and install the seal-offs based on field routing of the conduit.

3.2 INSTALLATION OF RIGID METAL CONDUIT

- A. Terminations and connections of rigid metal conduit shall be threaded. Conduits shall be reamed free of burrs and terminated with insulated metallic conduit bushings.
- B. Conduit threads shall be coated with a petroleum base corrosion-inhibitor with low electrical contact resistance before assembly equal to Burndy Engineering Company, Inc., Penetrax "A" or equal screw thread lubricant (zinc-petroleum or zinc-chromate compounds are permissible).

- C. All conduits shall be suitably grounded to the plant ground grid using grounded type insulated bushings, O. Z. Electrical Manufacturing Company, Type BLG or IGB, T & B Company, Appleton Electric Company, or equal.
- D. Conduit across structural joints where structural movement is allowed shall have bonded, weathertight expansion and deflection fitting the same size as the conduit.
- E. Support spacing for conduits 1 inch and smaller shall not exceed 6 feet, and conduits 1¼ inches and larger shall not exceed 10 feet. Supports shall be as specified under basic electrical materials and methods. Conduits 1½-inch and smaller may be supported by 1-hole conduit straps and 2 inches and larger shall be supported by 2-hole conduit straps. Conduit racks shall be as manufactured by Unistrut, Kindorf, or equal. Conduit racks shall be 316 stainless steel.
- F. Conduit joints shall be made up tight using a pipe wrench. Channel lock pliers will not be permitted, and unions shall be used as necessary to aid in the installation. Conduits shall be cut square and the ends reamed smooth after threading to prevent injury to conductors. Conduit joints in concrete or exposed to weather or damp locations shall be drawn up tight and coated with insulating paint before casting in concrete or painting exposed conduit system.
- G. Plastic-coated rigid metal conduit and fittings shall be installed in accordance with the manufacturer's specifications and recommendations. Any damage to the plastic coating shall be repaired in accordance with the manufacturer's requirements. The manufacturer shall certify the installers before installation can be started.

3.3 INSTALLATION OF RIGID NONMETALLIC CONDUIT

- A. Field bending of polyvinyl chloride conduit shall be made with appropriate equipment. No torches or flame-type devices shall be used.
- B. When joints are to be made with polyvinyl chloride conduit, the conduit shall be cut with a fine-tooth saw and deburred. Conduit ends shall be wiped clean of dust, dirt, and shavings and shall be dry. Solvent cement shall be applied to bond the joint. The joint should be watertight.
- C. Polyvinyl chloride conduit shall be installed in accordance with the manufacturers' specifications and recommendations.

3.4 INSTALLATION OF LIQUID-TIGHT FLEXIBLE METAL CONDUIT

- A. Terminations at motors shall be made with flexible liquid-tight metal conduit from conduit stub to terminal box; flexible connection shall be made as short as possible. Flexible conduit shall be Type UA, black. Underwriter's Laboratories approved flexible liquid-tight conduit connectors shall be as manufactured by Thomas and Betts Company,

Appleton Electric Company, or equal.

- B. Uncoated flexible metal conduit may be used for short connections between junction boxes and lighting fixtures or speakers installed in suspending ceiling systems. Flexible metal conduit shall be connected using Underwriters Laboratories approved grounding connectors.

3.5 INSTALLATION OF UNDERGROUND CONDUIT

- A. All underground conduits shall be concrete-encased unless otherwise noted on the Drawings or directed by the Engineer. No conduit shall be concealed or encased until the Engineer has inspected the conduit for proper installation and accurate placement.
- B. The Contractor shall be responsible for all excavating, draining trenches, forming of duct assembly and protective concrete envelope, backfilling, and removal of excess earth.
- C. Underground conduit shall be installed with a minimum 3-inch per 100-foot downward slope for drainage. Drains shall be provided at all low points.
- D. Bends and turns shall be made using long sweeps. Ninety-degree bends will be used only where required and shall be kept at a minimum. Field coordinate conduit bends with minimum bending radius of conductor prior to installation of conduits.
- E. Where rigid nonmetallic conduits emerge from underground, an adapter from rigid nonmetallic conduit to rigid metal conduit shall be installed and all exposed conduits shall be rigid metal conduit. The last bend shall be rigid galvanized steel.
- F. All rigid metal conduit risers shall be protected with 2 coats of a Bitumastic compound before concrete is poured from a point 12 inches below grade to a point not less than 6 inches above grade or surface of concrete. All stub-ups shall extend upward with one length of rigid metal conduit until after concrete is poured to assure vertical alignment.
- G. Conduits shall be encased in concrete with 3-inch minimum concrete cover all around.
- H. Concrete for concrete encasement shall be Class B concrete conforming to requirements of the section entitled “Cast-In-Place Concrete,” of these Specifications. Longitudinal and lateral steel reinforcement shall be provided as shown on the Drawings.
- I. All underground conduit runs for voltages less than 600 volts shall be at least 24 inches below grade and shall have a minimum conduit separation of 4 inches. Provide a magnetic warning tape 12” below finished grade.
- J. All underground conduit runs for voltages over 600 volts shall be at least 36 inches below grade and shall have a minimum conduit separation of 4 inches. Conduit shall have a minimum 4-inch concrete cover on all sides. Provide a magnetic warning tape 12” below finished grade.
- K. All underground conduit runs shall be rodded, and a mandrel drawn through followed by

a swab to clean out any obstructions that may cause cable abrasions. The mandrel shall be 12 inches in length and the diameter ½ inch less than the inside diameter of the conduit.

- L. All underground conduit runs shall be marked by a strip of permanently colored red polyethylene tape, 0.004-inch-thick and 6 inches wide, buried above the conduit and 6 inches below finished grade. Provide a magnetic warning tape 12” below finished grade.
- M. All spare conduits shall be provided with permanent waterproof caps at stub-ups and shall be furnished with a 500# fiber tape pulling wire. Waterproof raceway tags shall be attached to the pulling cords, at each end and at each intermediate pulling point. The raceway tags shall identify the origin and destination of the conduit.

3.6 CONDUIT APPLICATION

- A. Install the following conduit types, unless otherwise shown on the drawings.
 - 1. Outdoors, exposed (Not Buried): Aluminum Rigid Conduit
 - 2. Indoors
 - a. Dry Areas Aluminum Rigid
 - b. Wet Areas Aluminum Rigid
 - 3. Underground (Under Slabs-on-Grade, Encased or Embedded in Concrete)
 - a. PVC Schedule 40
 - 4. Conduits in Wetwell
 - a. Aluminum Rigid
 - 5. Chemical Feed Areas
 - a. PVC Schedule 80
 - 6. Transition Areas and Final Connections to Equipment
 - a. Motor Connections – Flexible metal, liquid-tight conduit.
 - b. Light Fixture Connections – Flexible metal non-metallic liquid-tight conduit in dry areas and liquid-tight in wet areas.

END OF SECTION

**SECTION 26 28 16
MOTOR DISCONNECT SWITCHES**

PART 1 GENERAL

1.1 SELECTION INCLUDES

- A. Three phase motor disconnect switches.
- B. Single phase motor disconnects switches under 1 horsepower.
- C. Single phase motor disconnects switches over 1 horsepower.

1.2 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 00.

PART 2 PRODUCTS

2.1 THREE PHASE MOTORS

- A. Disconnect switches for three phase motors shall be a heavy-duty type rated 600 volts and shall be UL listed. Outdoor switches shall be in NEMA 3R enclosures; indoor switches in non-corrosive atmospheres shall be in NEMA 1 enclosures; indoor switches in wet, corrosive atmospheres shall be in NEMA 4X enclosures.
- B. Switches shall be single throw non-fusible with provisions for padlocking the handle in the open position.

2.2 SINGLE PHASE MOTORS UNDER 1 HORSEPOWER

- A. Disconnect devices for single phase motors up to 1 horsepower, not controlled with magnetic starters, shall be toggle operated manual motor starters rated 240 volts ac. Outdoor switches shall be in NEMA 3R enclosures; indoor switches in non-corrosive atmospheres shall be in NEMA 1 enclosures; indoor switches in wet, corrosive atmospheres shall be in NEMA 4 enclosures.
- B. Switches shall be non-fusible type with a thermal overload trip assembly. The handle shall include a handle guard with provisions for padlocking the handle in the open position. Continuous ratings shall be as shown on the Contract Drawings.

2.3 SINGLE PHASE MOTORS OVER 1 HORSEPOWER

- A. Disconnect switches for single phase motors over 1 horsepower in non-corrosive atmospheres and having separate overload protection and control shall be general duty rated for 240 volts ac. Outdoor switches shall be in NEMA 3R enclosures and indoor switches shall be in NEMA 1 enclosures.

- B. Disconnect switches for single phase motors over 1 horsepower in corrosive atmospheres and having separate overload protection and control shall be heavy duty rated for 600 volts ac in NEMA 4X enclosures.
- C. Switches shall be 2 pole non-fusible, single throw types with provisions for padlocking in the open position. Continuous ratings shall be as shown on the Contract Drawings.

2.4 VFD

- A. Disconnect switches for motors that are fed from variable frequency drives (VFDs) shall have an auxiliary set of NO/NC contacts to that should break when switch is open.

2.5 NAMEPLATES

- A. Nameplates shall be provided for each motor disconnect switch to identify the load served. Nameplates shall be engraved with 3/16-inch minimum height black letters on a white background and shall be mounted on the front of the enclosure with stainless steel screws.

2.6 ACCEPTABLE MANUFACTURERS

- A. Disconnect switches shall be manufactured by General Electric/ABB, Cutler Hammer, Square D, or Engineer approved alternate.

PART 3 INSTALLATION

3.1 INSTALLATION

- A. Install in accordance with the manufacturer's instructions.

END OF SECTION

**SECTION 26 50 00
LIGHTING**

PART 1 GENERAL

1.1 DESCRIPTION

A. This section specifies luminaires (lighting fixtures) features and installation.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
NFPA 70	National Electrical Code (NEC)

1.3 WARRANTY

A. Emergency Lighting Unit Batteries Warranty:

1. Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period: Two years from date of Substantial Completion. Provide full warranty for first year and prorated warranty for the remaining warranty period.

B. LED Luminaires Warranty:

1. A written 5-year on-site replacement material, fixture finish and workmanship. On-site replacement includes transportation, removal, and installation of new products. Finish warranty must include warranty against failure or substantial deterioration

such as blistering, cracking, peeling, chalking or fading.

2. A written 5-year replacement material warranty for defective or non-starting LED source assemblies.
3. A written 5-year replacement material warranty on all power supply units (PSU).
4. The warranty period shall begin on the date of Substantial Completion. The Supplier/ Subcontractor shall provide the Owner with appropriate signed warranty certificates.
5. The warranty period for batteries for emergency power on fixtures used for both normal and emergency lighting shall be within the specified warranty period: Two years from date of Substantial Completion.

1.4 SUBMITTALS

- A. Luminaire model numbers are provided on the drawings in the lighting schedule. The manufacturer's catalog numbers listed are examples of the basic model or series. Referenced catalog numbers may not include voltage, mounting style, modifications, and other special features that are specified. The Supplier/Subcontractor, and manufacturer shall provide the specified requirements.
- B. The Supplier/Subcontractor may propose an alternate luminaire for approval; however, sufficient information shall be provided as a part of the submittal for the Design-Builder's Representative to review and compare the listed luminaire and the proposed alternate. Supplier/Subcontractor and luminaire supplier shall provide a photometric, energy usage (efficiency), approvals/listings and materials comparison between the two fixtures. If an alternate luminaire layout is required the Supplier/Subcontractor and luminaire supplier shall provide all illuminance calculations as part of the submittal to verify minimum illuminance levels are met by the proposed revisions. Proposed alternates shall be shown to be equivalent or superior to the luminaire listed. It shall be the Supplier/Subcontractor's responsibility to provide sufficient information to the Design-Builder's Representative to verify and approve alternates.

PART 2 PRODUCTS

2.1 LIGHTING MATERIALS

- A. Unless otherwise specified, lighting materials, including fixtures, accessories, and hardware, shall conform to the detailed requirements specified on the applicable Light Fixture Schedule. Lighting fixtures shall be provided where specified on the drawings. The drawing's light fixture placement is diagrammatical in nature. The actual installation and fixture layout shall be coordinated with the various trades and equipment.

2.2 LED LUMINAIRES (LED)

- A. LED luminaires shall be a complete functioning unit with all components including light source, lamps, power supply, control interface and any additional components needed for operation and shall be assembled by the luminaire manufacturer.
- B. Luminaires shall comply with ANSI chromaticity standard for classifications of color temperature. See the Light Fixture Schedule for specified LED lamp color and color temperature. Luminaire shall be UL or ETL listed and labeled.
- C. Luminaire testing shall be per IESNA LM-79 AND LM-80 procedures.
- D. Provide shop drawings showing illumination levels with LED systems based on lumen output at 70 percent lumen depreciation for white LEDs and 50 percent for colored LEDs. Initial lumen output for all LEDs shall be listed individually.
- E. LED drivers shall have reversed polarity protection, open circuit protection and require no minimum load. Drivers shall operate at a minimum 80 percent efficiency and have a class A noise rating.
- F. Where LED systems are required to be dimmable, the LED system shall be capable of full and continuous dimming.

PART 3 EXECUTION

3.1 GENERAL

- A. The location and type of luminaries, associated poles, fixtures, and receptacles are as shown on the drawings.
- B. Fixture locations indicated on the drawings are approximate and shall be coordinated with other work in the same area to prevent interference between lighting fixtures and other equipment. Any fixture shall be relocated if, after installation, it is found to interfere with other equipment or is so located to prevent its practical intended use.
- C. The Supplier/Subcontractor shall mark the locations of exterior pole mounted fixtures and verify the location is acceptable to the Owner and Design-Builder's Representative prior to installation.
- D. Labels and marks, except the UL label, shall be removed from exposed parts of the fixtures. Fixtures shall be cleaned when the project is ready for acceptance. Photoelectric cells shall be oriented toward the south and shall be installed in an unobstructed location.
- E. Raceways, wire, or cable shall be provided in accordance with Division 26. Raceways and wire shall be provided from the fixtures, switches and receptacles to the lighting panel in accordance with the NEC. Underground and outdoor wire splices shall be in accordance with Section 26 05 19.

- F. Fixtures labeled to require conductors with a temperature rating exceeding 75 degrees C shall be spliced to circuit conductors in a separately mounted junction box. Fixture wire shall meet UL and NEC requirements. Fixture shall be connected to junction box using flexible conduit with a temperature rating equal to that of the fixture.
- G. Recessed fixtures shall be provided with mounting hardware for the ceiling system specified. A concealed latch and hinge mechanism shall be provided to permit access to the lamps and ballasts and for removal and replacement of the diffuser without removing the fixture from ceiling panels. Fixtures recessed in concrete shall have protective coating of bituminous paint.
- H. Fixtures shall be aligned and directed to illuminate an area as specified. Fixtures shall be directly and rigidly mounted on their supporting structures. The conduit system shall not be used to support fixtures.
- I. Fixtures installed in rows shall be carefully aligned vertically and horizontally. Lighting fixtures mounted on building steel, shall be centered on the beam flanges or webs, except where deviations are required to avoid interference.
- J. Mount continuous rows of luminaries in straight line. Utilize alignment clips between reflectors, where applicable.
- K. Fixture supports that are welded to steel members shall be treated with rust-resistant primer and finish paint where brackets or supports for lighting fixtures.
- L. Provide manufacturer recommended mounting hardware and brackets.

3.2 WIRE CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values or use torque values specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage then replace damaged fixtures and components. Verify normal operation of each fixture after installation.
 - 1. Test for Emergency Lighting:
 - 2. Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. Retest to demonstrate compliance with specification requirements where adjustments are made. Replace fixtures with damage or corrosion during warranty period.
- C. Lamps shall be furnished for all fixtures.

- D. Fixture maintenance shall be continuous until the date the Supplier/Subcontractor leaves the jobsite. All fixtures shall be cleaned immediately prior to the Supplier/Subcontractor leaving the jobsite unless otherwise directed by the Engineer.
- E. Immediate lamp replacement, whenever burnouts occur, shall be continuous until the date the Supplier/Subcontractor leaves the jobsite.
- F. Touch up luminaire and pole finish at completion of work.
- G. Clean lenses and diffusers at completion of work. Clean paint splatters, dirt and debris from installed luminaires.

END OF SECTION

**SECTION 31 10 00
SITE CLEARING**

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of Site Clearing is shown on the Contract Drawings.
- B. Site Clearing operations include, but are not limited to the following:
 - 1. Protection of existing trees and other vegetation.
 - 2. Removal of trees and other vegetation.
 - 3. Topsoil stripping.
 - 4. Clearing and grubbing.
 - 5. Abandoning buildings and structures.
 - 6. Removing above-grade improvements.
 - 7. Removing underground improvements.
 - 8. Salvaging, storing, and protecting designated items.

1.2 RELATED SECTIONS

- A. Section 01 50 00 Temporary Facilities and Controls
- B. Section 31 20 00 Concrete Reinforcing
- C. Section 31 2333 Excavation and Fill for Pipeline

1.3 PROTECTION OF EXISTING IMPROVEMENTS

- A. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements indicated to remain in place.
- B. Protect improvements on adjoining properties as well as those on the project site.
- C. Restore any improvement damaged by this work to their original condition, as acceptable to the Owners or other parties or authorities having jurisdiction.

1.4 PROTECTION OF EXISTING TREES AND VEGETATION

- A. Protect existing trees and other vegetation indicated to remain in place against

unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.

- B. Water trees and other vegetation which are to remain within the limits of the Contract Work as required to maintain their health during the course of construction operations.
- C. Provide protection for roots over 1-1/2 inches diameter that are cut during construction operations. Coat the cut faces with an emulsified asphalt, or other acceptable coating, especially formulated for horticultural use on cut or damaged plant tissues. Temporarily cover all exposed roots with wet burlap to prevent roots from drying out; provide earth cover as soon as possible.
- D. Repair or replace trees and vegetation damaged by construction operations, in a manner acceptable to the Engineer. Perform tree damage repair by a qualified tree surgeon. Replace trees which cannot be repaired and restored to full-growth status, as determined by the tree surgeon.

1.5 PROTECTION OF ADJACENT PROPERTY

- A. Protect improvements, trees, and vegetation on adjoining property as well as those on property designated for site clearing work.
- B. Execute work so as not to create a nuisance to persons utilizing adjacent property.
- C. Use work methods and provide temporary facilities as necessary to prevent washing, erosion, siltation or dust damage, or hazard to persons and property, within and off the project site.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 STRUCTURE ABANDONMENT

- A. Prior to removal of indicated buildings and structures, disconnect, and seal or have utility owner disconnect and seal all active utility services. Perform disconnection and sealing work in accordance with utility owner's standard service removal policy. Assume all costs associated with disconnecting and sealing utility services.
- B. Remove all equipment, furnishings and exposed four inch and larger piping within a building or structure to be demolished before undertaking its removal. Protect, properly store and prevent damage to any item removed which is shown on the Drawings to be reused in the project.

3.2 CLEARING

- A. Remove vegetation, trees, brush, stumps, logs, grass, weeds, roots, poles, stubs, rubbish, refuse dumps, sawdust piles, loose boulders of one cubic yard or less, debris, and other objectionable matter resting on or protruding through the ground surface, or appearing within the work limits before final project acceptance.
- B. Remove above-grade improvements, surfacing and pavements (including bases for pavements), concrete slabs, curbs, gutters, walks, concrete or wood headers, abandoned utilities and utility structures, abandoned buildings and structures, and other work as specifically indicated which is resting on or protruding through the ground surface, or appearing within the work limits before final project acceptance.

3.3 GRUBBING

- A. Completely remove stumps and other organic matter protruding through the ground surface. Use only hand methods for grubbing inside the drip line of trees indicated to be left standing (if any).
- B. Remove abandoned underground facilities, such as utilities and structures, walls, footings, basements, wells, septic tanks, cisterns, underground pipe and other indicated work, to a depth of three feet below finished grade or to such greater depth as may be necessary for construction. Break up or penetrate on-grade floor slabs at abandoned underground structures to permit movement of ground water. At a minimum provide openings of at least four-square inches per ten square feet of floor slabs. The abandonment or removal of certain underground pipe or conduits may be shown on mechanical and electrical drawings and is included under work of these headings. Removal of abandoned underground piping or conduit which interferes with construction is included under this Section.
- C. Stumps within the clearing limits prescribed on the Contract Drawings that are more than 5 feet from the pipeline trench excavation may be left in place IF GROUND DOWN TO 4 INCHES BELOW the natural or final grade whichever is lower.

3.4 HOLES AND DEPRESSIONS

- A. Fill holes, depressions and voids created or exposed by clearing or grubbing operations, including abandoned underground structures, with satisfactory soil material, unless further excavation or earthwork is indicated.
- B. Place fill material in horizontal layers not exceeding six inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

3.5 TOPSOIL REMOVAL

- A. Topsoil is defined as friable clay loam surface soil found in a depth of not less than four inches or more than eight inches. Satisfactory topsoil is reasonably free of subsoil, clay

lumps, stones, and other objects over two inches in diameter, and without weeds, roots, and other objectionable material.

- B. Strip topsoil in such manner so as to prevent intermingling with the underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
- C. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance from such trees to prevent damage to the main root system.
- D. Stockpile topsoil in storage piles in areas shown, or where otherwise authorized. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust.

3.6 DISPOSAL GENERAL REQUIREMENTS

- A. Waste matter generated from clearing and grubbing operations becomes the property of the Contractor unless otherwise provided by the Contract Documents. Dispose of all such matter legally and without nuisance to others.
- B. Accomplish disposal of cleared and grubbed matter daily so as to maintain site in a safe and neat condition at all times.
- C. Owners of the property may remove merchantable timber, equipment, furnishings, buildings, or other items of value from the project site before the Contractor begins his operations, and no assurance exists that any such material, except for items specifically designated for reuse in the project, will be on the construction site when the Contractor begins his work.

3.7 BURNING

- A. Construction waste may NOT BE BURNED.

3.8 CHIPPING

- A. Where practical, chip brush and roots to maximum dimension of one inch and use for soil erosion control and/or a substitute for mulch in finished grassing or landscaping.
- B. Where chips are used for mulch, it may be substituted pound for pound for any mulch required for the project.

3.9 REMOVAL OF WASTE MATTER

- A. When matter generated from clearing and grubbing operations can be disposed of on-site other than chipping, disposal areas and methods permitted will be indicated on the Drawings. In the absence of such indication, remove from the project site and legally dispose of all waste and objectionable matter.

END OF SECTION

**SECTION 31 23 33
EXCAVATION & FILL FOR PIPELINE**

PART 1 GENERAL

1.1 SCOPE

- A. Work under this Section shall include all clearing and grubbing, trench excavation, preparation of trench for pipe laying, pipe bedding, tamping of fill around piping, complete trench backfill, dressing of completed backfill.
- B. The Contractor shall determine, as far as possible in advance, the location of all existing water, sewer, and gas pipes, storm drains, and all existing buried cables. Coordination-allow those utilities sufficient time to locate and protect their properties in accordance with local and/or state laws. In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done.

1.2 RELATED SECTIONS

- A. Section 01 50 00 Temporary Facilities and Controls
- B. Section 31 10 00 Site Clearing
- C. Section 32 92 00 Turf and Grasses
- D. Section 33 31 00 Sanitary Utility Sewerage Piping

1.3 LABORATORY TESTS

- A. All laboratory tests to determine compliance of embedment and backfill materials with specified requirements and to determine compliance with specified compaction requirements will be paid for by the Owner, except for retesting of failed samples, which will be at the Contractor's expense.

1.4 CLOSING OF STREETS AND DRIVES

- A. The Contractor shall not close more than one city block at a time to traffic and shall maintain at least one lane open for local traffic except for locations where this is not possible in the opinion of the Engineer.
- B. Driveways which are cut for installation of piping must be backfilled and cleared for traffic within four hours of being cut. Property owners must be given 24 hours advance notice that work will be done.
- C. The Engineer shall be notified of any scheduled street closing, and his approval must be obtained for such closing. Notification must include a scheduled time for closing the street and a scheduled time for completion of work.

PART 2 PRODUCTS

2.1 BACKFILL AND FILL MATERIALS

- A. Provide acceptable soil materials for backfill and fill, free of stumps, trees, roots, sod, muck, trash and other deleterious matter.
- B. Handle, conserve, store and place excavated material to provide least desirable acceptable material at the bottom of fills and backfills and grade up to the best material at the top. Do not permit rock having any dimension in excess of two inches to be used in the top two feet of fill and backfill.

2.2 BEDDING MATERIAL

- A. Provide #57 stone conforming to GDOT Specification 800, latest revision.

PART 3 EXECUTION

3.1 PREPARATION OF SITE

- A. Prior to starting construction operations, the Contractor shall remove all vegetation, debris and other objectionable matter standing or lying on the surface within the limits of the areas to be excavated or filled. Removal and disposal of such materials shall be done in a manner acceptable to the Engineer.
- B. Areas occupied by trees, brush or other vegetation shall be cleared of such growth and suitably grubbed. All large roots or stumps shall be removed to a depth at least 2' below original ground surface. Any pits or cavities thereby created which extend beyond the excavation limits shall be filled with the materials and in the manner specified herein.
- C. Ornamental trees, cultivated shrubs, and similar growth which occupies streets, alleys, or other public rights-of-way or easements, but which lies outside the exact limits of excavation shall remain undisturbed and shall be carefully preserved and protected by the Contractor throughout all stages of the construction work.
- D. The Owner will secure rights-of-way or easements through private lands where required; but the Contractor shall give due notice to tenants therein and shall be responsible for damage to property therein. Each building, wall, fence, pole, tree, lawn, or other property or improvement encountered, whether public or private, shall be carefully protected from all injury, and, in case of damage or removal, shall be completely repaired or restored to its original condition. All costs related to damage to such improvements shall be borne by the Contractor. Special care shall be taken in trenching under or near buildings to avoid or minimize all damage or injury thereto.
- E. Exploratory excavation shall be made when necessary to locate underground obstructions. Every pipe, conduit, foundation or other "underground structure" encountered in trenching shall be carefully protected from injury or displacement. All

costs related to damage to such structures and pipelines or damage to property or persons resulting from damage to such structures and pipelines shall be borne by the Contractor. Damage shall be completely repaired within a reasonable time. No claim shall be made for damage or delay of the work on account of the proximity of or the leakage from such structures and pipelines.

- F. Preparation of the site as specified above shall be considered as an integral part of the excavation, and no separate payment therefore will be allowed.
- G. Where high-pressure gas lines are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started. No blasting operations will be allowed within 5' of gas pipes. Removal of rock in this area shall be done by jackhammer and/or hand excavation. The Contractor shall be responsible for the requirements of Georgia law with regard to blasting or excavating near gas pipes.

3.2 TRENCH EXCAVATION

- A. Trench excavation or excavation for pipelines shall consist of excavation necessary for the construction of sewer lines and all appurtenant facilities therefore, including sand or crushed stone cushion, and pipe protection as called for on the plans or as specified herein. It shall include site preparation, backfilling and tamping of pipe trenches and the disposal of waste materials, all of which shall conform to the applicable provisions of these Specifications.
- B. Trench excavation shall be made in open cut and true to the lines and grades shown on the plans or established by the Engineer, unless tunneling or boring is shown or specified. When practical, the banks of the trenches shall be cut in vertical, parallel planes equidistant from the pipe centerline. The horizontal distance between such planes - that is, the overall width of trench - shall vary with the size of pipe to be installed. The overall width of trench shall be 24" for pipe 6" in diameter and smaller and the pipe outside diameter plus 16" for pipe 8" in diameter and larger. When sheeting is used, the distance between vertical planes shall be measured from the inside faces of the sheeting. When vertical banks for trench excavation are not practical to construct or create conditions dangerous to workers, the banks may be sloped provided that such excavation does not damage adjacent structures. When trench banks are sloped, such banks shall be cut to vertical planes as specified above for that part of the ditch below the level of 12" above the top of the pipeline. The bottom of the trench shall be level in cross section and shall be cut true to the required grade of the pipe except where concrete cradles or cushion materials are shown on the plans, specified or authorized by the Engineer, in which case the excavation shall extend to the bottom of the cradle or cushion.
- C. Bell holes for bell-and-spigot pipe shall be excavated at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of joints in the pipe. Bell holes shall not be excavated more than 10 joints ahead of pipe laying.

- D. Excavation for other pipeline structures shall be as specified for structural excavation.
- E. When muck, quicksand, soft clay, or other materials unsuitable for foundations or subgrade are encountered extending beyond the limits of the excavation, such material shall be removed and replaced with sand cushion as specified in these Specifications.
- F. Pipe trenches shall not be excavated more than 500 feet in advance of pipe laying, and all work shall be performed so as to cause the least possible inconvenience to the public. Temporary bridges or crosswalks shall be constructed where necessary to maintain vehicular or pedestrian traffic. Crosswalks and bridges shall have handrails or other features necessary for safe use by the public.
- G. Pipe trenches shall not be excavated in advance of the pipe laying a distance greater than that which can be completed within a day's operation. Trenches will not be allowed to remain open overnight. In areas where the excavation must remain open, adequate barricades and safety equipment shall be placed around the excavation to provide warning and protection to vehicular and pedestrian traffic.
- H. In all cases where materials are deposited along open trenches, they shall be placed so that, in the event of rain, no damage will result to the work or adjacent property.
- I. Excavation shall be considered as an integral part of laying pipe and no specific payment will be allowed, therefore.

3.3 SHEETING, SHORING AND BRACING

- A. The sides of all excavations shall be sufficiently sheeted, shored and braced whenever necessary to prevent slides, cave-ins, settlements or movement of the banks and to maintain the excavation clear of obstructions that will, in any way, hinder or delay the progress of the work or endanger workers. Wood or steel sheet piling of ample design and type shall be used when necessary. All sheeting, shoring and bracing shall have sufficient strength and rigidity to withstand the pressures exerted and to maintain the walls of the excavation properly in place and protect all persons and property from injury or damage.
- B. Where excavations are made adjacent to existing buildings or other structures or in paved streets or alleys, the Contractor shall take particular care to sheet, shore and brace the sides of the excavation adequately so as to prevent any undermining of or settlement beneath such structures or pavement. The Contractor will be liable for any damage to any structure or injury to any person that results from his operations.
- C. Sheeting and shoring materials shall be withdrawn as trenches are being backfilled, after backfill has been placed over pipe at least 18". If their removal before backfill is complete endangers any adjacent structure, they shall be left in place until backfill is complete and pulled then, if possible. Voids caused by sheeting withdrawal shall be backfilled and tamped with thin rammers designed for the purpose. If not withdrawn, sheeting shall be cut off at least 18" below surface.

- D. Sheeting, shoring and bracing shall be considered as an integral part of the excavation work and no specific payment will be allowed, therefore.

3.4 UNDERWATER EXCAVATION

- A. Where the excavation area shown on the plans falls under the groundwater surface or near the banks of a flowing stream or other body of water, the Contractor may adopt and carry out any method he may deem feasible for the performance of the excavation work and for the protection of the work, thereafter, provided the method and equipment to be used result in completed work which complies with the Specifications and is acceptable to the Engineer. In such cases, the excavation area shall be effectively protected from damage during the excavation period and until all contemplated construction work therein has been completed.
- B. The cost of all temporary construction work necessary or incidental to work under water or in wet conditions, including the cost of installing and removing sandbags, coffer dams, sheet piling, excavation and backfill, pumping and dewatering, shall be considered as an integral part of the cost of excavation and no separate payment therefore shall be allowed or made.

3.5 BORROW EXCAVATION

- A. Wherever the backfill requires a volume of material that is in excess of the volume of suitable materials available from excavation or trenching, Contractor shall be responsible for obtaining additional backfill material from borrow pits which are acceptable to the Engineer.
- B. Borrow pits shall be properly cleared and grubbed and all objectionable matter shall be removed from the borrow pit material prior to its placement in the backfills.
- C. Borrow excavation shall be considered an integral part of the excavation work and no separate payment therefore will be allowed.

3.6 ROCK IN PIPE TRENCHES

- A. Rock encountered in trench excavation shall be removed for the overall width of trench which shall be a minimum of 12" plus the diameter of the pipe. It shall be removed to a depth of 6" below the bottom of the pipe if rock extends to such depth.
- B. The space below the ultimate pipe grade shall be filled with fine earth, sand, crushed stone, or other approved materials as required, compacted to proper grade and made ready for pipe laying. Unless otherwise specified or authorized by the Engineer, fine earth removed from the pipe trench shall be used as cushion material. Fine earth so used shall be thoroughly compacted with approved power tools. No allowance shall be made under this item for bell hole excavation. Bedding shall be included in the unit price proposed per foot of pipe.

3.7 DRILLING AND BLASTING

- A. Drilling and blasting methods used in rock excavation shall be optional with the Contractor but shall be conducted with due regard for the safety of persons or property in the vicinity of the work and in strict conformity with all laws, ordinances and of the work and in strict conformity with all laws, ordinances and regulations governing blasting and the use of explosives. Rock excavation near existing structures of all types shall be conducted with the utmost care and every precaution shall be taken to prevent damage to such structures. Any damage or injury of whatever nature to persons or property caused directly or indirectly by blasting operations shall be promptly repaired, replaced, or compensated for by the Contractor at his own expense and to the entire satisfaction of the persons injured or the owners of the property damaged.

3.8 BACKFILLING TRENCHES

- A. Place #57 stone for pipe bedding and hunch to 1 foot above the pipe.
- B. The backfilling of pipeline trenches shall be started immediately after the pipe work has been inspected and approved by the Engineer. Backfill material shall consist of fine loose earth free of large clods, stones, vegetable matter, debris, and/or other objectionable material. Backfill shall be deposited and compacted in accordance with the manufacturer's recommendations. If the trench extends along or across streets, roadways, proposed roadways, useable alleys or sidewalks, the remainder of the trench shall be backfilled and tamped to it full depth in the manner specified above with a minimum density of 95% Standard Proctor for the full depth. Otherwise, it may be filled with loose material without compaction. Where tamping of material is not required for the full depth of the trench, this material (from a height of one foot above the pipe upward) shall be as herein before specified, except that a broken stone content of not more than 50% by volume will be allowed of stones not exceeding 6" maximum dimensions, provided that these stones are thoroughly mixed with earth.
- C. Before being placed under pavement, earth material for backfill which is, in the opinion of the Engineer, too dry to allow thorough compaction, shall receive an admix of sufficient water prior to compaction to insure such compaction. Earth material considered by the Engineer to have excessive water content shall not be placed.
- D. Backfill material having less than a 10% clay content may be compacted by puddling with water in lieu of tamping when authorized by the Engineer. Such puddling shall consist of applying water under pressure to the entire content of the trench beginning near the trench bottom and working through pipes or well points.
- E. Backfill materials used shall contain a sufficient amount of moisture for proper compaction. In areas to be paved and areas not to be paved but inside road rights-of-way, the backfill shall be brought up in accordance with this Paragraph and compacted to not less than 95% of Standard Proctor.
- F. Compaction tests may be required at varying depths and intervals determined by the

Engineer. Tests shall be made by a qualified independent testing laboratory selected by the Engineer. The Owner shall pay for all compaction testing. However, in the event that such tests fail to meet the requirements of the Specifications, the expense of such tests shall be borne by the Contractor.

- G. Where the test results indicate that compaction is less than the allowable minimum specified in this Paragraph, the material will be removed to the depths and limits determined by the Engineer and new material placed and compacted to minimum standards at no additional cost to the Owner.
- H. Where excavation has been made within the limits of finished areas across private property such as golf course, the top one foot of backfill material shall consist of fine loose earth free of large clods, vegetable matter, debris, stone and/or other objectionable materials.
- I. Where tamping of backfill, material is not required for the full depth, the backfill material shall be neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation. Any deficiency in the quantity of materials for backfilling the trenches or for filling the depressions caused by settlement shall be supplied by the Contractor.
- J. Where pipe trenches are cut across pavement, the Contractor shall construct a temporary surface over the cut by filling and tamping the upper 6" of the cuts with selected gravel or crushed stone which will not disintegrate under the traffic, and which shall be maintained in good condition under traffic until the permanent pavement has been constructed. No specific payment will be allowed for temporary surfacing.
- K. All backfilling shall be done in a manner which will not disturb or injure the pipe or structure over or against which it is being placed. Any pipe or structure injured, damaged or moved from its proper alignment during backfilling operations shall be opened up and then re-backfilled as herein specified.
- L. The Contractor shall replace all surface materials and shall restore drives, curbing, sidewalks, gutters, shrubbery, fences, sod and other disturbed surfaces to a condition equal to that before the work began, furnishing all labor and materials incidental thereto. No payment for such items shall be made unless specifically stated in these Specifications and/or in the Bid Schedule.

3.9 SAND CUSHION

- A. Sand cushion shall consist of either coarse sand, gravel, or crushed stone. All cushion material shall pass a 1-1/2" screen and 90% shall be retained on 20 mesh screens. The material shall be handled on the job so that it will be kept clean and free of dirt, clay and other foreign matter and will retain its ability to pass water freely.
- B. Sand cushion shall be used, 1) at locations shown on the plans or when specified to provide bedding for pipe where rock has been removed from the trench; 2) in local areas

where rock has been removed from the pipe trench and the excavated materials are not suitable for bedding the pipe; and 3) in local areas where unsuitable materials such as muck, quicksand, soft clay, swampy material or excessive groundwater make it necessary to provide a satisfactory pipe foundation.

- C. Sand cushion used to provide bedding for pipe where rock has been removed from the trench shall be placed to the overall width of trench, which shall be as specified in this Section. It shall be placed to the depth of 6" below the bottom of the pipe. Sand cushion used to provide additional bedding for pipe installed in deep cuts shall be placed to the width and depth shown on the plans or as directed by the Engineer.
- D. Sand cushion under structures shall be placed in the areas and to the depth shown on the plans or as authorized by the Engineer.
- E. Cushion material shall be compacted by tamping with suitable tools and shaped to receive the pipe and to support the full length of the barrel of the pipe at exact line and grade.
- F. All costs pertaining to sand cushion requirements contained herein shall be included in the unit price proposed per foot of pipe submitted in the Bid Schedule.

3.10 MAINTENANCE

- A. All excavated areas, backfills, embankments, trenches and access roads, grading and ditches shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. Where trench backfill has settled, trenches shall be re-backfilled.
- B. At the end of each work week, Contractor shall inspect road surfaces where excavations have been made and make all necessary repairs to the surfaces disturbed by the construction work.

3.11 PAVEMENT REPLACEMENT

- A. Where pipe trenches are cut across paved driveways a temporary surface, as specified in this Section, shall be provided before permanent pavement patch is made.
- B. Where pipe is installed running longitudinally with paving, installation of backfill shall be as specified in this Section.
- C. Payment for pavement replacement shall be per linear foot of pipeline covered and shall include excavation Class A concrete trench cap and surfacing material. Trench widths are considered to be widths as specified in this Section and extra paving width due to sloping trench sides shall be done at no additional cost to Owner.
- D. Contractor shall be responsible for any pavement replacement that is made necessary by construction equipment while working on off-road excavation.

- E. Where pipe trenches cut across or along dirt or gravel-based roads or driveways, installation of backfill shall be according to this Section.

3.12 BLASTING

- A. The Contractor shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use of explosives and the protection of life and property. The Contractor shall be responsible for all damage caused by his blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.
- B. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

3.13 UNAUTHORIZED EXCAVATION

- A. Except where otherwise authorized, shown, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, at no additional expense to the Owner, with concrete placed at the same time and monolithic with the concrete above.

3.14 DEWATERING

- A. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter, until the structure to be built or the pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
- B. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12" or more below the bottom of the excavation.
- C. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.
- D. The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes and all such pipes or conduits shall be left clean and free of sediment.

3.15 DISPOSAL OF EXCESS EXCAVATION

- A. Transport excess excavated material, including unsatisfactory soil material, to any designated spoil areas, and spread as specified; otherwise remove from the Owner's property and construction site, and legally dispose of such material.

3.16 DISPOSAL OF WASTE MATERIAL

- A. Remove waste materials from Owner's property and legally dispose of such material.

3.17 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one year after final completion of the Contract under which the work was performed.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer or Owner.

3.18 PROTECTION OF GRADED AREAS

- A. Protect newly graded areas from traffic and erosion and keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified compaction and tolerances.

3.19 RECONDITIONING COMPACTED AREAS

- A. Where completed compacted areas are disturbed by subsequent construction, adverse weather, or other cause, scarify surface, re-shape, and compact to required density prior to further construction.

END OF SECTION

**SECTION 31 23 34
EXCAVATION & FILL FOR STRUCTURES**

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of excavation, filling and grading is shown on the Contract Drawings.
- B. Excavating, filling and grading operations include, but are not limited to the following:
 - 1. Earthwork inside and outside structure limits.
 - 2. Preparation of subgrade for slabs and pavements.
 - 3. Providing borrow material.
 - 4. Spreading of topsoil.
 - 5. Finishing and dressing of graded surfaces.
 - 6. Maintaining graded areas including erosion and sediment control.

1.2 RELATED SECTIONS

- A. Section 01 50 00 Temporary Facilities and Controls
- B. Section 31 10 00 Site Clearing
- C. Section 32 92 00 Turf and Grasses
- D. Section 33 39 00 Sanitary Utility Sewerage Structures

1.3 SITE INFORMATION

- A. Verify existing site grades to be substantially consistent with grades shown on the Drawings before commencing work. Report any significant conflict in grades to the Engineer before proceeding.
- B. Subsurface conditions presented, if any, are not intended as representations or warrants of continuity of such conditions between soil borings or pits. It is expressly understood that the Contractor is solely responsible for interpretations or conclusions drawn there from. Data are made available for the convenience of the Contractor who may perform additional test borings and other exploratory operations at his expense, provided such operations are acceptable to the Engineer.

1.4 LABORATORY TESTS

- A. All laboratory tests to determine compliance of embedment and backfill materials with specified requirements and to determine compliance with specified compaction requirements will be paid for by the Owner, except for retesting of failed samples, which will be at the Contractor's expense.

1.5 PROTECTION OF PERSONS AND PROPERTY

- A. Barricade open excavations and post warning lights for safety of persons. Operate warning lights during hours from dusk to dawn each day.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities adjacent to excavations, from damage caused by settlement, lateral movement, undermining, washout and other hazards.
- C. Take precautions and provide necessary bracing and shoring to prevent movement or settlement of existing improvements or new construction.
- D. Use work methods and provide temporary facilities as necessary to prevent washing or siltation damage or hazard to persons and property, within and off the project site.

1.6 USE OF EXPLOSIVES

- A. Do not bring explosives onto site or use in work without prior written permission from authorities having jurisdiction. Use explosives in accordance with OCGA, Chapter 9, Title 25.
- B. Use explosives only as legally permitted and when other work methods are impractical.
- C. Do not permit explosives on the project site other than during the least practicable use period.
- D. Assume sole responsibility for handling, storage and use of any explosive materials.

PART 2 PRODUCTS

2.1 BACKFILL AND FILL MATERIALS

- A. Provide acceptable soil materials for backfill and fill, free of stumps, trees, roots, sod, muck, trash, and other deleterious matter.
- B. Handle, conserve, store and place excavated material to provide least desirable acceptable material at the bottom of fills and backfills and grade up to the best material at the top. Do not permit rock having any dimension in excess of two inches to be used in the top two feet of fill and backfill.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavation consists of removal and disposal of material encountered to obtain required subgrade elevations.
- B. Borrow excavation consists of the removal and utilization of approved materials from authorized areas.
- C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations, finished grade or dimensions without specific authorization of the Engineer.
- D. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring excavation elevations to proper positions, only when acceptable to Engineer.
- E. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise requested by Engineer.

3.2 STABILITY OF EXCAVATION

- A. Slope sides of excavations to comply with local codes and authorities having jurisdiction. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated.
- B. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

3.3 SHORING AND BRACING

- A. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
- B. Maintain shoring and bracing in excavation regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- C. Provide minimum requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

3.4 DEWATERING

- A. Perform earthwork in a manner to prevent surface water and minimize subsurface or ground water from flowing into excavations, and to prevent water from flooding project site and surrounding area.
- B. Do not allow water to accumulate in excavations. Remove water using dewatering

methods which will prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

- C. Convey water removed from excavations and rainwater to collecting or run-off areas. Provide and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.
- D. Dewatering for wetwell excavation shall remain in place until top slab has been poured.

3.5 BORROW AND BORROW AREAS

- A. Obtain and use borrow only when there is an insufficient quantity of suitable material derived from project earthwork operations to complete earthwork and site grading and when authorized by the Engineer. (Borrow is not a pay item unless included on the Bid Schedule.)
- B. Borrow areas will be furnished by the Contractor.
- C. Reclaim borrow areas in accordance with local codes and authorities having jurisdiction. But in no case shall borrow area reclamation consist of less than the following:
 - 1. Drainage so as to prevent standing water.
 - 2. Grading, finishing and dressing as necessary so that excavated surfaces are left in a smooth, neat and even condition and are sloped not steeper than three horizontal to one vertical.
 - 3. Removing all trash, debris, rock, boulders, and other deleterious material from the borrow area.
 - 4. Vegetative planting in accordance with the requirements of Georgia Manual for Erosion and Sediment Control, latest version.

3.6 MATERIAL STORAGE

- A. Stockpile satisfactory excavated materials where authorized until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
- B. Locate and retain materials away from edge of excavations.
- C. Dispose of excess soil material and waste materials, such as unsatisfactory excavated soil material, trash and debris, as specified hereinafter.
- D. When select excavated materials are indicated on the Drawings for use in constructing fills or backfills, perform operations, including stockpiling and rehandling, as necessary

to assure use of the most desirable materials at intended locations.

3.7 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.1 feet. Extend excavation a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required, and for inspection.
- B. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete is placed. Trim bottoms to required lines and grades so as to obtain a solid base on which to place concrete.
- C. When dewatering is required, the mass excavation must extend only to within 2 or 3 feet of the design bottom elevation. The remaining excavation should be performed in small sections after confirmation of adequate dewatering. As small sections of the subgrade are exposed, they should be inspected by the geotechnical engineer and then protected with a layer of crushed stone. Equipment traffic on the prepared subgrade should be avoided. Even with successful dewatering, it will probably be necessary to undercut localized areas of very weak subgrade soils and replace them with crushed stone based on geotechnical inspection at the time of construction.

3.8 GENERAL EXCAVATION

- A. Conform to elevations and dimensions shown. Remove exposed rock to a depth approximately one foot below finished grade. (Rock excavation is not a pay item unless included on the Bid Schedule).
- B. For areas designated for spreading of topsoil, carry excavation a uniform depth below finished grade by an allowance appropriate to attainment of required finished grade after placement of topsoil.

3.9 EXCAVATION FOR PAVEMENTS

- A. Undercut finished pavement lines to comply with cross-sections, elevations and grades, as shown.

3.10 EXCAVATION FOR CHANNELS

- A. Cut channels, ditches, and swales to shape and grades as shown. Deposit excavated materials a sufficient distance from the edge of channels and ditches to prevent cave-ins or material falling or sliding into excavation. Keep all waterways free of obstructions, debris and siltation until final acceptance.

3.11 REMOVAL OF UNSATISFACTORY SOIL MATERIALS

- A. To the extent authorized, over-excavate those soil materials which are unsatisfactory in

the opinion of the Engineer. Such additional excavation, provided it is not due to fault or neglect of Contractor, will be measured and paid for as Additional Work at the Adjustment Price listed in the GENERAL REQUIREMENTS of these Specifications, unless otherwise provided in the Contract Documents.

- B. Where removal of unsatisfactory soil material is due to fault or negligence of Contractor in his performance of shoring and bracing, dewatering, material storage, or other specified requirements, excavate resulting unsatisfactory soil material and replace with satisfactory soil material at no additional cost.

3.12 COLD WEATHER PROTECTION

- A. Protect footing and foundation subgrades against freezing when atmospheric temperature is less than 35°F by covering with dry insulating materials of sufficient depth to prevent frost penetration.

3.13 PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

- A. Achieve not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for each layer of soil material-in-place as determined by ASTM D698 (Standard Proctor) test procedures:
 1. Structures: Under structures and within 10 feet outside of exterior walls, compact top 12 inches of subgrade and each layer of backfill or fill material to 98 percent of maximum density.
 2. Building Slabs and Steps: Under and within five feet outside perimeter of slabs and steps, compact top 12 inches of subgrade and each layer of backfill or fill material to 98 percent of maximum density.
 3. Berms and Liquid Holding Fills: Compact each layer of backfill or fill material to 98 percent of maximum dry density.
 4. Lawn or Unpaved Areas: Compact each layer of backfill or fill material to 88 percent of maximum dry density.
 5. Walkways: Under and within two feet horizontal distance of paved walks, compact top six inches of subgrade and each layer of backfill or fill material to 98 percent of maximum dry density.
 6. Pavements: Under and within entire roadbed, compact top 12 inches of subgrade and each layer of backfill or fill material to 98 percent of maximum dry density.
 7. Spoil Areas: Compact each layer of backfill or fill material to 88 percent of maximum dry density.

3.14 MOISTURE CONTROL

- A. Where subgrade or layer of soil material is too dry to achieve required compaction, uniformly apply water to surface of subgrade or layer in such manner as to prevent excessive free water from appearing on surface during or subsequent to compaction operations.
- B. Remove, dry and replace, or scarify and air dry in place, soil material that is too wet to achieve required compaction.

3.15 BACKFILL AND FILL - GENERAL

- A. Place acceptable soil material in layers, to required subgrade or finish grade elevations. Backfill excavations as promptly as work permits.

3.16 PRIOR TO BACKFILL PLACEMENT

- A. Backfill excavations as promptly as work permits, but not until completion of the following where applicable:
 - 1. Inspection of Engineer of construction below finish grade, such as damp-proofing, waterproofing, perimeter insulation and similar work.
 - 2. Inspection by Engineer and recording locations of underground utilities.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities or leave in place as authorized.
 - 5. Removal of trash and debris.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.17 PREPARATION OF GROUND SURFACE TO RECEIVE FILL

- A. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with existing surface.
- B. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage

of maximum density.

3.18 PLACEMENT AND COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- B. Place backfill and fill materials in uniform layers to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.
- C. Do not mix excavated rock, masonry or concrete with backfill material placed within two feet of installed pipe.
- D. Spread stockpiled topsoil uniformly over areas designated for grassing or landscaping.

3.19 GRADING - GENERAL

- A. Uniformly grade areas within limits of earthwork, including adjacent transition areas. Smooth and compact finished surface within specified tolerances, with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grade area adjacent to structures to drain away from structures (except drainage inlets), and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
 - 1. Grassed or Landscaped Areas: Finish areas to within not more than 0.10 feet above or below the required elevations.
 - 2. Walks and Pavements: Shape surface of areas under walks and pavements to line, grade and cross-section, with finish surface not more than 2 inch above or below the required subgrade elevation.

3.20 COMPACTION

- A. After grading, compact subgrade surfaces to the depth, percentage of maximum density, and elevation tolerance for each area classification. Retest for compaction as per Section 1.03 for each area disturbed.

3.21 PROTECTION OF GRADED AREAS

- A. Protect newly graded areas from traffic and erosion and keep free of trash and debris.

- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified compaction and tolerances.

3.22 RECONDITIONING COMPACTED AREAS

- A. Where completed compacted areas are disturbed by subsequent construction, adverse weather or other cause, scarify surface, re-shape, and compact to required density prior to further construction.

3.23 DISPOSAL OF EXCESS EXCAVATION

- A. Transport excess excavated material, including unsatisfactory soil material, to any designated spoil areas, and spread as specified; otherwise remove from the Owner's property and construction site, and legally dispose of such material.

3.24 DISPOSAL OF WASTE MATERIAL

- A. Remove trash, debris, garbage, and waste materials to designated spoil areas. Spread material in layers approximately one foot thick and compact. Do not place waste material within two feet of finished grade.
- B. If no spoil areas are designated, remove waste materials from Owner's property and legally dispose of such material.

END OF SECTION

**SECTION 32 12 16
ASPHALT PAVING**

PART 1 GENERAL

1.1 PROJECT SCOPE

- A. The work covered by this Section of the Specifications consists of furnishing all materials, equipment, and labor necessary for clearing and grubbing, excavating, backfilling, grading, preparation of base and subbase, curb and gutter, paving, drainage structures and all other work as indicated on the Contract Drawings and/or as specified herein.

1.2 RELATED SECTIONS

- A. Section 31 10 00 Site Clearing
- B. Section 31 23 33 Excavation & Fill for Pipeline.
- C. Section 31 23 34 Excavation & Fill for Structures.

1.3 GENERAL

- A. The work include both new pavement and the full restoration of pavement due to construction related activities and as shown on Construction Drawings. Sections of existing pavement need to be replaced in their entirety as shown on the Construction Documents and required by these Specifications. The Contractor is responsible for the scheduling of all related work.

1.4 STANDARD SPECIFICATIONS

- A. The Standard Specification Construction of Roads and Bridges latest revision of the Department of Transportation, State of Georgia (DOT) shall govern in all matters. Such Specifications are hereby incorporated by reference into these Contract Specifications.

PART 2 PRODUCTS

2.1 CONTROL OF MATERIALS

- A. In accordance with Section 106, GDOT Standard Specifications, latest revision.

2.2 HOT MIX APSHALTIC CONCRETE CONSTRUCTION

- A. In accordance with Section 400, GDOT Standard Specifications.

2.3 COLD MIX FOR PATCHING

- A. In accordance with Section 401, GDOT Standard Specifications latest revision.

2.4 BITUMINOUS PRIME

- A. In accordance with Section 412, GDOT Standard Specifications, latest revision; Viscosity grade MC-70.

2.5 BITUMINOUS TACK COAT

- A. In accordance with Section 413, GDOT Standard Specifications latest revision; Grade SS-1 or SS-1h.

2.6 GRADED AGGREGATE

- A. In accordance with Section 815, GDOT Standard Specifications, latest revision.

2.7 AGGREGATES FOR ASPHALTIC CONCRETE

- A. In accordance with Section 802, GDOT Standard Specifications latest revision.

2.8 HOT MIX ASPHALTIC CONCRETE MIXTURES

- A. In accordance with Section 828, GDOT Standard Specifications latest revision.
- B. Base course 19mm Superpave
- C. Surface Course 9.5mm Superpave

2.9 LIME

- A. In accordance with Section 882, GDOT Standard Specifications latest revision.

2.10 PAINT TRAFFIC STRIPING

- A. In accordance with Section 652, GDOT Standard Specifications latest revision.

2.11 PLASTIC PAVEMENT MARKINGS

- A. In accordance with Section 657, GDOT Standard Specifications latest revision.

PART 3 EXECUTION

3.1 HOT MIX ASPHALTIC CONCRETE CONSTRUCTION

- A. Work includes installation asphaltic concrete pavement construction and associated work as shown on the Contract Drawings and detailed in these Specifications.
- B. All work shall be performed in accordance with the appropriate sections of the GDOT standard specifications, latest revision.

3.2 TRAFFIC MARKINGS

- A. Work includes the installation of temporary traffic markings during the construction to safely direct the public during construction.
- B. Work includes the installation of permanent traffic markings to match existing traffic markings, restoration the traffic markings to original conditions prior to construction.

3.3 ACCEPTANCE

- A. Final payment is subject to Owner acceptance for smoothness and trafficability.

END OF SECTION

**SECTION 32 92 00
TURF AND GRASSES**

PART 1 GENERAL

1.1 SCOPE

- A. Work under this Section shall include seeding or sodding all disturbed areas. Such areas shall be restored as nearly as possible to original condition.
- B. Sod replacement due to erosion on steep slopes will be done at no additional cost to the Owner.

1.2 RELATED SECTIONS

- A. Section 31 10 00 Site Clearing.
- B. Section 31 23 33 Excavation & Fill for Pipeline.
- C. Section 31 23 34 Excavation & Fill for Structures.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer and indication of conformance with state and federal laws, as applicable.

1.4 PROJECT CONDITIONS

- A. Weather Limitations: proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 PRODUCTS

2.1 FERTILIZER:

- A. Before planting, a fertilizer of 10:10:10, or other approved composition, shall be hand-raked into the topsoil at a rate of 10 pounds per 1,000 square feet and then watered. Apply lime as per soil test made by Contractor.

2.2 SEED

- A. The area shall be seeded with either common hulled Bermuda, at a rate of 15 lbs. per acre, or Kentucky 31 tall fescue, at a rate of 50 lbs. per acre.

2.3 MULCHES

- A. The area shall be mulched with hay at a rate of 2-1/2 tons per acre.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, or chemicals has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable, and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements and other facilities, trees, shrubs and plantings from damage caused by planting operations.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus ½ inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.3 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions in right angles to each other.
- B. Do not use wet seed or seed that is moldy or otherwise damaged.
- C. Sow seed at a total rate of 3 to 4 lb./1,000 sq. ft.

- D. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly and water with fine spray.

3.4 3.4 CLEAN UP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks or other paved areas.
- B. All seeding shall be watered thoroughly as soon as completed and shall be watered at least twice daily, or more often if necessary, to provide continuous growth without setback until all growth from seed is thoroughly established.
- C. An acceptable stand of grass shall be obtained by the Contractor, as determined by the Engineer, and defined as covering 98% of the area to be grassed with no bare area greater than one square foot and the entire area fully stabilized against erosion.
- D. If the schedule of construction is such that grassing cannot be accomplished before final inspection of all other items of the Work, the Contractor shall obtain a signed proposal to the Owner for an approved local landscaper for the work specified. The Owner shall deduct the amount of the proposal from the final payment. The work of spreading and compacting topsoil shall be performed, as specified above, by the local landscaper at time of grassing and this work shall be included in his proposal.

END OF SECTION

**SECTION 33 11 00
DUCTILE IRON PIPING FOR WATER, PROCESS AND FORCE MAINS**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The work includes furnishing all material, labor, tools, equipment, skills, and incidentals necessary to construct required ductile iron water mains, force mains and process piping.

1.2 ORDER OF WORK

- A. The Engineer will designate the starting point, or points, for construction and the order in which the work shall be constructed, completed, and placed into operation for water mains and force mains. All other process piping is to be installed in the order required by the Contractor.

1.3 SINGLE SOURCE OF PIPE AND FITTINGS

- A. A single pipe manufacturer will be responsible for providing all pipe on this project. This pipe manufacturer will be responsible for the quality of all materials and shall provide a one-year warranty for all materials supplied for this project.

1.4 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 Submittal Procedures.
- B. The Contractor shall submit for review fabrication and layout drawings. The submittal shall include all pipe, fittings, and valves to be installed for this project. For exterior piping in the yard, minimum scale is 1-inch equals 10 feet. For interior piping use minimum scale of 1/8 inch per foot.
- C. Layout drawings for each piping system showing the following as a minimum:
 - 1. Pipe material, class, grade, joint type, coating system and lining system.
 - 2. Joint and gasket dimensions.
 - 3. Use AWS welding symbols to show welded connections. Indicate the net weld length.
 - 4. Fittings, couplings, joints, and joint harnesses.
 - 5. Centerline elevations.
 - 6. Location, size, and type of anchor bolts.
 - 7. Wall and floor penetrations. Include sleeves, castings, sealant, escutcheons, and

- other accessories.
 - 8. Complete bill of materials.
 - 9. Orientation of valves and valve operators.
 - 10. Critical clearances.
 - 11. Thrust restraint. Address materials, sizes, assembly ratings and pipe attachment methods for each type of pipe.
 - 12. Expansion compensation.
 - 13. Insulation.
 - 14. Pipe coatings.
 - 15. Pipe identification.
 - 16. Miscellaneous details required for a complete and functional installation.
- D. Laying schedules for underground piping systems. As a minimum, identify the following:
- 1. Pipe invert station and elevation at each grade and alignment change.
 - 2. Pipe length as measured along the centerline.
 - 3. Limit of each reach of pipe thickness class and joint restraint system. Include joint restraint design calculations.
 - 4. Limit of concrete encasement.
 - 5. Location of valves and other mechanical equipment.
 - 6. Details of special piping and fittings.
 - 7. Thrust block details. Include concrete quantity, bearing area on pipe and fitting locations.
 - 8. Joint information for dissimilar pipes.
 - 9. Joint deflection (both horizontal and vertical).
 - 10. Test pit information as indicated on the drawings and as required by the Engineer.
- E. Restrained joint details. Include:

1. Calculations.
2. Drawings showing where each type of restrained joint is used. Mechanical joints may not be used as a restrained joint.

PART 2 PRODUCTS

2.1 GENERAL

- A. The Contractor shall furnish all materials and incidental items (whether or not they are specifically described herein) necessary to complete all work called for under the contract, except for any items that are specifically listed in these contract documents as being furnished by the Owner.

2.2 DUCTILE IRON PIPE

- A. Pipe: Pipe shall be ductile iron (D.I.P.) pressure class 350, designed and manufactured in accordance with the latest revision of ANSI/AWWA C151/A21.51.
 1. The Pressure Class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacture's mark, country where cast, year in which the pipe was produced and the letters "DI" or "Ductile" shall be cast or stamped on each length of pipe.
 2. Pipe manufactured by American Cast Iron Pipe Company, US Pipe, and McWane Ductile meet the requirements of this specification. Therefore, pipe shall be as manufactured by the above-named manufacturers. No substitution is permitted.
- B. Pipe Joints: Pipe joints shall be as the type specified on the project plans. Restrained Joint Pipe shall be:
 1. For 30" through 42" DIP, restrained by Flex-Ring restrained joints TR Flex or HP Lok restrained joints.
 2. For 4" through 24" DIP, restrained by Fast-Grip or Field Lok gaskets inserted in Push-On Joints.
 3. For all mechanical joints, restrained by Megalug Glands by EBAA Iron, Inc. or approved equal.
 4. Standard "Push-On" type joints shall be in accordance with the latest revision of ANSI/AWWA C111/A21.11 and furnished complete with gaskets.
- C. Inspection and written certification that the pipe meets all applicable specifications will be required in accordance with section 51-4 of ANSI A21.51-81. A written transcript of foundry acceptance tests must be furnished in accordance with section 51-14 of ANSI A21.51-81. These documents must be forwarded to the Engineer prior to shipping of

pipe.

- D. Fittings shall be ductile iron. Fittings shall conform to the latest revision of either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Fittings shall also have a cement-mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4, of latest revision.
- E. Fittings and accessories less than 30-inches shall be furnished with Mechanical Type Joints in accordance with ANSI/AWWA C111/A21.11, or latest revision.
- F. MJ fittings manufactured by Sigma Corporation, Star Pipe Products or named pipe manufacturers meet the requirements of this specification. Therefore, fittings shall be as manufactured by the above-named manufacturers. No substitution is permitted.
- G. Fittings and accessories greater than 30-inches shall be HP Lok as manufactured by US Pipe or Flex-Ring by American Cast Iron Pipe Company. Therefore, pipe shall be as manufactured by the above-named manufacturers. No substitution is permitted.
- H. Coating and Lining:
 - 1. For buried pipe: The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be 200g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. All pipes shall be manufactured and coated in the United States at the pipe manufacturer's facility. Fittings shall be coated with Tnemec-Zinc 90-98-Zinc rich paint with 2.5-3.0 mils DFT, or approved equal, with 2.0 mil minimum and asphalt topcoat. Pipe and fittings shall be Protecto 401 ceramic epoxy lined. Air piping will be provided with no interior coating.
 - 2. For exposed piping: the exterior shall be the manufacturers standard prime coating suitable for painting after installation. The interior of the pipe shall be cement lined in accordance with ANSI/AWWA C104/A21.4, latest revision.
 - 3. For plant air piping exposed: the exterior shall be the manufacturers standard prime coating suitable for painting after installation. No interior cement lining.
 - 4. Potable water pipe and fittings shall be lined with a bituminous asphalt coating in accordance with ANSI A21.4 and AWWA C104, NSF 61 for water applications.
- I. Restrained Joints: Restrained gaskets shall be color other than the color of the pipe and shall be consistent throughout the entire cross section of the gasket. The color shall not be attained by surface coating; it shall be inherent within the rubber. Gaskets shall meet applicable requirements of AWWA/ANSI C111/A21.11 and shall be ANSI/NSF

Standard 61 certified.

- J. Assembly of restrained pipe joints shall allow for a radius of not greater than 600-feet with no additional fittings.
- K. Gaskets:
 - 1. Flanged: Gaskets for use with flanged surfaces shall be full face bulb gasket, American Toruseal Flange Gasket for approved equal.
 - 2. Push on:
 - a. Sewer: Styrene Butadiene Rubber (SBR) conforming to ANSI AWWA C104 (A21.11)
 - b. Water: Styrene Butadiene Rubber (SBR) or EPDM in accordance with AWWA C104 (A21.11)
 - c. Air: Viton (FKM) in accordance with ASTM D200

2.3 CASING PIPE

- A. Jacked casing pipe shall be a smooth steel pipe with a minimum yield point of 35,000 psi, meeting ASTM A53 or ASTM A139. The minimum wall thickness shall be as indicated below:

Nominal Diameter (Inches)	Nominal Thickness (Inches)
Under 14	0.188
14	0.219
16	0.219
18	0.250
20	0.281
22	0.312
24	0.344
26	0.275
28	0.375
30	0.406
32	0.438
34	0.469
36	0.469
42	0.500
48	0.625
54	0.750

2.4 GATE VALVES

- A. These valves shall be non-rising stem design, ductile iron body, bronze mounted with

compression resilient seat manufactured in accordance with AWWA Standard C-515. Valves shall be designed for a minimum working pressure of 250 psi (except where plans call for a higher-pressure rating) and shall have 2" square operating nuts, except in meter vaults where handwheels shall be installed. The wedge shall be constructed of ductile iron fully encapsulated with EPDM rubber. Valves shall have non rising stems, shall open when turned to the left and shall meet AWWA Specifications. The valves shall have a flange connection conforming to ANSI B 16.1 when flanges are shown on the plans.

- B. Restrained valve ends shall employ a boltless positive joint restraint equal to the Flex-Ring joint. Friction style restrainers, which point load the adjoining pipe, will not be allowed.
- C. Gate valves shall be Series 2500 Flex-Ring RW Ductile Iron Resilient Wedge Gate Valve as manufactured by American Flow Control or approved equal.

2.5 VALVE BOXES

- A. Valve boxes shall be provided for all buried valves. Valve boxes for valves shall be approved standard cast iron, adjustable-shaft boxes having a minimum shaft diameter of 5-1/4 inches. The casting shall be coated with two coats of coal tar pitch varnish. The lids of all water main boxes shall bear the word "Water" or the letter "W". Boxes shall be equal to Vulcan Pattern VVB-4. Valve boxes shall be flush with the final grade after grading and / or paving.
- B. Valve extension stems shall be constructed with standard valve operating nut, 4-1/2" diameter x 1/4" steel guide plate, 1-1/4" square solid steel stem, and standard operating wrench coupling with four 3/8" set screws. The material shall be galvanized. The extension stem must be capable of surviving a torque test to 1000 ft-lb without failure. Extension stem shall be terminated two feet from finished grade.
- C. The valve box top and lid shall be constructed of ductile iron.

2.6 VALVE MARKER (NOT IN CONTRACT)

- A. One concrete valve marker shall be furnished and set at each valve located in the yard. The marker shall be made of 3000 psi concrete and shall be four (4) feet long and 4" on each side, with #4 reinforcing bars as shown on the detail.
- B. The markers shall be set an even number of feet between the center line of the valve and the center line of the aluminum disc in the top of the marker, and the distance in feet between the valve and marker shall be stamped in the marker at the time of setting.

2.7 COMBINATION AIR AND VACUUM RELEASE VALVES

- A. Air release and vacuum break valve shall be of the compact single chamber design with solid cylindrical HDPE control floats housed in a tubular stainless-steel body with epoxy powder coated cast iron or steel ends secured by stainless steel tie rods. The valve shall

have an integral orifice mechanism, which shall operate automatically to limit transient pressure rise induced by closure to twice valve rated working pressure. The intake orifice shall be equal to the nominal size of the valve. The flat face or the control float seating against a nitrated rubber O-ring housed in a dovetail groove circumferentially surrounding the orifice shall affect large orifice sealing. The seating and unseating of a small orifice nozzle on a natural rubber seal affixed into a control float shall control discharge of the pressurized air. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seat is prevented. All components shall be easily replaced. Connection to valve inlet shall be flanged.

- B. The valve shall be Vent-O-Mat series RBX. No substitution permitted.

2.8 MEGALUGS

- A. Restraint devices for nominal pipe sizes 3 inch through 48 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. The devices shall have a working pressure rating of 350 psi for 3-16 inch and 250 psi for 18-48 inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN. Three (3) test bars shall be incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8. Chemical and nodularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis.
- B. Restraint devices shall be Listed by Underwriters Laboratories (3" through 24" inch size) and Approved by Factory Mutual (3" through 12" inch size).
- C. Restraint devices manufactured by EBBA Iron Sales, Inc., Sigma Corporation, and Star Pipe Products meet the requirements of this specification. Therefore, restraint devices shall be as manufactured by the above-named manufacturers. No substitution is permitted.

2.9 SUBGRADE STABILIZER

- A. Subgrade stabilizer shall consist of crushed stone meeting size and gradation requirements for GDOT #57 or #56 designation.
- B. The use of recycled concrete is NOT permitted.

2.10 SAND FOR BACKFILL

- A. Sand for backfilling over water mains, when required, shall be coarse, well graded sand relatively free from dirt and other foreign matter. Sand shall be approved by the Engineers.

2.11 BORROW MATERIAL

- A. Borrow material may be either:
 - 1. Material hauled from borrow areas outside the project area.
 - 2. Suitable material that is excavated from the pipe trench and is unsuitable for immediate use as backfill due moisture.

- B. The Contractor shall identify the source of borrow material, have performed the geotechnical testing of the material to determine its suitability as a backfill material, transport the material to the project, and place the material to specified soil density. Final determination of the suitability of the material is the responsibility of the Engineer. The Contractor may choose to stockpile suitable material from the pipe trench that is too wet for immediate use as backfill material. The Contractor shall identify a procedure for drying the material to the optimum moisture content; either through air drying or the addition of lime. This procedure is subject the review of the Engineer and acceptance by the Engineer. The Contractor shall transport the material to the project and place the material to specified soil density. Final determination of the suitability of the material is the responsibility of the Engineer.

2.12 FLEXIBLE (TRANSITION) COUPLINGS

- A. Flexible couplings shall be Catalog No. 441 as manufactured by Smith-Blair, JCM 215 Long DI Coupling by JCM Industries, or approved equal.

2.13 PIPE CONNECTION COUPLINGS

- A. Pipe connections between new pipe and existing pipe shall be made with Dresser Style 90 long steel couplings for pipe sizes 2" and below; for pipe sizes above 2", M.J. solid sleeves (long style) shall be used. Spacer rings must be used at all solid sleeve locations. A spacer ring is defined as a short section of pipe cut to fit into the gap between the two plain ends of pipe at the sleeve location.

2.14 FLANGE ADAPTOR

- A. Contractor shall furnish and install ductile iron flange adapters to joint plain-end pipe to flanged pipe where shown on the Drawings. Adapters shall be manufactured to meet ASTM A-536, high strength ductile iron. Flange end of adapter shall mate with ASA 16.1 and B16.5 flanges of the same nominal size. T-head bolts and nuts shall be high-strength, low alloy steel pins conforming to ANSI/AWWA C111/A21.11. Adapters shall be Sigma SIGMAFLANGE, EBAA Iron, Inc. MEGAFLANGE Series 2100, or equal.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

- A. Where necessary, the construction zone will be cleared to allow trenching and pipe laying operations. Clearing will be restricted to easement limits shown on plans, plus areas within the highway right-of-way. The cleared area shall be left free of stumps, limbs, rocks and other debris. Cleared areas in forested zones will be left in a condition suitable for bush-hog cutting; areas adjacent to lawns shall be left suitable for lawn mower cutting and at least in as good a condition as the adjoining property. Trees, brush, stumps and other debris from clearing and grubbing shall be disposed of in accordance with local ordinances (which place restrictions on burning); burial within the right-of-way or easement will not be permitted.
- B. The Contractor is responsible for restoring any property (shrubs, signs, sidewalks, paving, trees, structures, etc.) that is damaged by his operations. It is understood that any item which is not specifically listed as a pay item but which exists at the time the project is bid is included in the overall bid price.

3.2 FENCES

- A. The Contractor shall take down fences on or crossing right of way for such periods of time only as are necessary to prosecute the work of clearing, grubbing, trenching, pipe laying and backfilling. Gaps made in fences shall be closed in substantial manner at night and during any suspension of work, and, upon completion of the pipeline, fences shall be restored to as good condition as before disturbed. No charges shall be made by the Contractor for any expense incurred in taking down or restoring fences, except where listed in the bid proposal.

3.3 PROTECTION OF TREES

- A. The Contractor shall remove only such trees on or along the work as necessary and shall carefully protect all other trees adjacent to the work. He shall not permit excavating machinery or trucks to scrape the bark or tear the limbs from the trees, nor connect ropes or guy cables to them.

3.4 INTERFERENCE WITH EXISTING STRUCTURES

- A. All existing pipes, drains, or other structures on, above, or below ground shall be carefully supported and protected from injury, and if injured, they shall be restored in a satisfactory manner by and at the expense of the Contractor.

3.5 INFORMATION CONCERNING CONDITIONS

- A. The accuracy of information furnished by the Engineer and/or the plans and specifications as to underground and surface structures, foundation conditions, character of soil, position and quantity of ground and subsoil water, etc., are not guaranteed by the Owner.

Bidders must satisfy themselves by personal examination and by such other means as they desire with respect to actual conditions in the nature of the ground and subsoil water and in regard to the locations of existing underground or surface structures. Unforeseen conditions shall not constitute a claim for increased compensation under the terms of the contract, nor constitute a basis for the cancellation thereof.

3.6 CLEAN UP

- A. The Contractor shall remove all unused material, excess rock and earth, and all other debris from the construction site as closely behind the work as practical. All trenches shall be backfilled and tamped before the end of each day's work.
- B. If at any time during the course of the work, the cleanup, grassing and/or pavement replacement falls too far behind the pipe laying (at the discretion of the Engineer) the Contractor shall be required to close down pipe laying operations until the cleanup, grassing and/or pavement replacement is caught up to the work in progress.

3.7 TRENCH EXCAVATION

- A. Pipe trenches shall be straight and true to grade and, in the location, shown on the plans. The bottom of trenches shall be dressed to facilitate laying conditions called for on construction plans. For Type 5 laying conditions, the pipe shall be bedded to its centerline in suitable material as determined by the Engineer excavated from the site or in compacted stabilizer stone with a minimum of 4" under pipe. Suitable materials shall be clean and free of rock larger than 2 inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. The bottom of the trenches shall be dressed so that the pipe has an even bearing on bedding material throughout the entire length of the pipe barrel.
- B. All trenches shall be of sufficient width to provide ample working space on each side of the pipe for maintaining a straight line of pipe, and bell or coupling holes of sufficient size to allow making perfect joints shall be provided at all joints.
- C. Water lines shall have a minimum cover of 48-inches unless otherwise specified or shown on the drawings. The depth of cover shall be a minimum of 48-inches below grade, 48-inches below the edge of pavement, or 48-inches below the drainage ditch paralleling the road, whichever is deepest. All changes in grade shall be made gradually.
- D. In laying pipe across water courses, railroad crossings, or depressions of any kind, the minimum depth herein specified shall be maintained at the bottom of the depression.
- E. Where necessary, the line shall be lowered at valves so that the top of the valve stem is approximately one foot below the finished grade. The trench shall be deepened to provide a gradual approach to all low points of the line, and no additional payment shall be

allowed for extra excavation involved.

- F. The Engineer shall have the right to limit the amount of trench open at any one time.
- G. All excavation material shall be placed so as not to interfere with public travel on the streets and highways along which the lines are laid. All excess excavated material shall be disposed of without extra cost to the Owner.

3.8 LAYING PIPE

- A. All pipes, before being placed in trench, shall be examined, and any pipe showing defects shall be rejected. The inside of the pipe shall be clean and free of trash and dirt, and if necessary a swab or brush shall be used to clean the pipe before lowering it into the trench.
- B. All pipes shall be laid straight, true to line and grade. For all laying conditions, bell and coupling holes shall be dug to allow the pipe to have continuous bearing with bedding throughout the entire length of the barrel between bell or coupling holes. No shimming or blocking up of the pipe will be allowed. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Trench dewatering methods (gravel bedding with pumps, etc.) must be used where necessary to maintain a dry ditch during pipe laying operations.
- C. In making ductile iron joints, the outside of the spigot end of the pipe and the inside of the bell shall be thoroughly cleaned and the gasket inspected to see that it is properly placed. Lubricant shall be applied to the spigot end of the pipe and gasket and it shall be inserted into the bell of the adjoining pipe to the "Stop Mark" shown on the pipe. Joint deflection shall be checked by Contractor for compliance with the pipe manufacturer's recommended limits.
- D. As pipe is installed, each joint shall be air tested for leakage. A dual bladder system allowing for the testing of deflected (up to 5%) DI pipe. The dual bladders shall seal the pipe joint on both sides of the joint permitting the pressuring of the joint up to a minimum of 5 psi for 5 seconds. If the joint fails to maintain the air pressure, the pipe shall be re-installed and re-tested. Equipment shall be similar to equipment produced by Petersen Products Co.

3.9 BACKFILLING

- A. After the pipe has been laid and all joints have been made, the trench shall be backfilled as described on the detail sheet of the construction plans for the Type 5 condition that shall be used throughout this project.
 - 1. Type 5:
 - a. Backfill shall be granular or select material free from rocks and foreign material compacted to the top of the pipe. It shall be tamped in layers not

over 6 inches thick to at least 100% standard proctor, AASHTO T-99. Remainder of backfill to top of trench shall be tamped in layers not over 12 inches thick (6 inches under roads) to 100% standard proctor, AASHTO T-99. Under roadways, the top 12 inches of backfill shall be compacted to 100% standard proctor, AASHTO T-99.

- b. Tamping shall be done with mechanical tamps in such a manner as to meet compaction requirements without moving or injuring pipes. Compaction shall be done with either pneumatic hand tamps, hydro tamps or other approved methods. Compaction tests will be run as directed by Engineer to ensure that the above specifications are being met.
- c. In rock excavation, the backfill from the bottom of the trench to two feet above the top of the pipe shall be finely pulverized soil, free from rocks and stones. The rest of the backfill shall not contain over 50% broken stone, and the maximum sized stone placed in the trench shall not have a weight exceeding 25 pounds. Excess rock and fragments of rock weighing more than 25 pounds shall be loaded and hauled to disposal as directed by the Engineer. If it is necessary, in order to comply with the above specifications, selected backfill shall be borrowed and hauled to the trenches in rock excavation, at no additional cost to the Owner. Under no circumstances shall bottom of pipe rest against rock or unyielding material. Minimum bedding of 4" carefully compacted backfill shall separate bottom of pipe from rock or unyielding material.
- d. Pipe trenches crossing highways shall be backfilled with select material during backfilling; the optimum amount of moisture shall be added and compacted to minimum of 95% standard proctor. The pavement shall be replaced immediately after backfilling is completed.

3.10 ROCK EXCAVATION

- A. All material shall be considered as trench rock if the material has an original volume of at least on-half cubic yard and the material cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kw (165 hp); such as a Caterpillar 322 C L, John Deere 230 C LC or a Komatsu PC220L-C-7; equipped with a short tip radius bucket not wider than 42 inches.
- B. The Contractor shall notify the Engineer when rock is encountered. Rock will be removed to a depth of six inches below normal bottom and this area below the pipe will be backfilled with select material. NO separate payment will be made for rock excavation.
- C. Rock excavation by blasting shall be at least 75 feet in advance of pipe laying.
- D. Before blasting, the Contractor shall cover the excavation with heavy timbers and mats in such manner as to protect the adjacent property Owners from damage. The Contractor

will be held responsible for all damage done.

3.11 THRUST RESTRAINT

- A. General: At changes in direction of the main and at other points shown on the plans or directed by the Engineer, thrust forces in the line shall be absorbed by restrained joints, concrete blocking, or reinforced concrete collars, or a combination thereof.
- B. Restrained Joints: Where restrained joint is called for on the construction plans, they shall be of the type specified in these specifications, and assembly shall be in accordance with manufacturer recommendations. Torque wrenches shall be used to verify that all bolts and nuts have tightened to manufacturer's recommendations.
- C. Concrete Blocking: The Engineer shall be notified by the Contractor before blocking is placed. Blocking will be of the dimensions called for on the construction plans and will be placed against a vertical surface of undisturbed soil that has been cleared of all loose material.
- D. Reinforced Concrete Collars: Reinforced concrete collars shall be cast in place as shown on detailed plans and as specified in ACI 318 83.

3.12 LEAKAGE TEST

- A. Pressurization:
 - 1. After the pipe has been laid, all newly laid pipes or any valved section thereof shall be subjected to a hydrostatic pressure of 150 psi at the lowest point. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.
 - 2. If the Contractor intends to perform hydrostatic testing against existing valves which are in service, the Contractor must obtain permission from the Owner. Prior to testing, the Contractor shall disinfect the pipeline in accordance with the requirements of Paragraph 3.14. If, after repairs are made to the pipeline to correct leakage test deficiencies, the Engineer deems that the sanitation of the pipeline has been compromised, the Contractor shall disinfect the pipeline at the Contractor's expense.
- B. Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation

cocks shall be closed, and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Owner.

- C. Leakage Defined: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipes or any valved section thereof to maintain the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section.
- D. Minimum test period shall be two hours. However, if in the opinion of the Engineer additional testing is required, such additional testing shall be performed by the Contractor at no additional expense to the Owner. Leakage shall NOT exceed the following gallons per hour per 1,000 feet of pipe:

Pipe Size	Allowable Leakage
4	0.38
6	0.57
8	0.76
10	0.96
12	1.15
16	1.53
20	1.91
24	2.29
30	2.87
36	3.44
42	4.01

- E. Test Restrictions:
 - 1. The hydrostatic test shall be of at least 2-hour duration. Test Pressure shall not vary by more than +5 psi for the duration of the test; this may require periodic pumping.
 - 2. Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gate of a double-disc gate valve. For tests at these pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened is desired.
 - 3. Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

3.13 DISINFECTION

- A. After leakage testing and all necessary repairs have been made, the lines shall be flushed clean and then disinfected (water mains only) in strict accordance with AWWA Standard

for Disinfecting Water Mains, C651- latest edition, subject to the following special conditions:

1. The method of disinfection shall be either the Continuous-Feed Method or the Slug Method. The Tablet Method is not acceptable.
 2. The form of chlorine may be either: (1) a 1 percent solution made from either sodium hypochlorite or calcium hypochlorite and pumped and metered into the pipeline; or (2) liquid chlorine fed from a pressurized cylinder through a gas-flow chlorinator and metered into the pipeline. With either form, water must be flowing during the feeding operation and the injection point must be located so that the flow of water will disperse the chlorine throughout the pipeline.
 3. Unless otherwise approved by the Owner, Contractor shall dechlorinate the highly chlorinated water being flushed from the pipeline.
 4. The Owner shall be responsible for bacteriological sampling and testing water from the disinfected pipeline.
 5. Before any flushing or disinfection work is begun, the Contractor shall submit procedures for these tasks in accordance with Section 01 33 00 – Submittal Procedures.
- B. The Contractor is responsible for the installation and removal of sample points as required by AWWA C651 on the water main.

3.14 DECHLORINATION

- A. After the disinfection process has been completed, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or is acceptable for domestic use. The area where the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water.
- B. The chlorine residual of the water being disposed may be neutralized by treating the water with ascorbic acid or sodium ascorbate. Minimum dosage requirements are listed in the table below. Additional dosage for the complete neutralization of chlorine residual is the responsibility of the Contractor.

Chlorine	Ascorbic Acid	Sodium Ascorbate
1 Kg	2.5 Kg	2.8 Kg
1 Lb.	2.5 Lb.	2.8 Lb.

3.15 CONNECTION TO EXISTING MAINS

- A. At beginning of construction, the Contractor shall make exploratory excavation at each location where connections to existing pipes are shown for the purpose of determining the exact location, elevation and type of fittings required to make the connections. Where it is necessary to disrupt service on existing lines, the Contractor shall first obtain permission from the Owner and schedule his work accordingly.
- B. Where existing pipe is to be abandoned, the Contractor shall plug the opening by pouring concrete in and around the opening as needed to completely seal the opening.

3.16 SETTING VALVES

- A. Valves shall be placed where shown on the plans or directed by the Engineer. Valves shall be set plumb and shall have cast iron valve boxes and/or manholes as called for on the plans. The valve boxes shall be placed directly over the valve and set plumb; the top of the box being brought to the surface of the ground. After the boxes are in place, earth shall be filled in the trench and thoroughly tamped around the box, and after all settlement has taken place, each valve box shall have a concrete collar as shown on the plans.

3.17 VALVE STEM EXTENSION

- A. Valve stem extensions shall be installed within two feet of finished grade at all buried valves except for those for which a manhole is being provided.

3.18 INSTALLATION OF SOLID SLEEVES

- A. Spacer rings must be used with all solid sleeves and no exceptions will be allowed. When connecting to existing water lines, one full length joint of pipe must be installed between solid sleeves and adapter pieces.

3.19 FLANGED OUTLETS

- A. Where flanged outlets are shown on the plans, they shall be installed as recommended by the manufacturer. When attaching a valve to the outlet, the valve and tapping machine, when used, shall be supported to relieve stress on the outlet fixture. The hole in the ductile iron pipe may be cut by either a mechanical tapping machine or by use of a cutting torch.

3.20 MEGALUG

- A. When installing the Megalug gland, clean the inside of the pipe bell and lubricate both the Megalug gasket and the spigot end of the pipe. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket. Insert the pipe into the pipe bell and press the gasket firmly and evenly into place. Keep the joint straight during assembly. Push the gland toward the pipe bell and center it around the pipe with the gland lip against the gasket. Install bolts and hand tighten nuts. Make any required deflection after joint assembly and before the bolts are tightened. Tighten the bolts to the

manufacture's recommendation for the gland size. Tighten the twist-off bolts per manufacture's recommendation. Should removal of this application be necessary, this should be done in accordance with manufactures recommendation.

3.21 SPECIALS AND FITTINGS

- A. Specials and fittings shall be properly braced to ensure that they will not be blown off or broken loose under the greatest possible working pressure, where it is necessary to use concrete to block vertical bends, etc., the concrete will be included in the Lump Sum Price as shown on the Bid Schedule.

3.22 REMOVE & DISPOSE OF EXISTING APPURTENANCES

- A. Where called for on the plans, all existing above ground appurtenances shall be removed and disposed of by the contractor after prior approval and refusal from the Owner. The area where these appurtenances are removed shall be re-graded and grassed to match the existing landscaping.

3.23 REMOVE & DISPOSE OF EXISTING WATER MAIN

- A. Where called for on the plans, existing ductile iron piping shall be removed and disposed of by the Contractor after prior approval and refusal from the Owner. The Contractor will be responsible for proper disposal of the existing piping off site.

3.24 REMOVING AND REPLACING PAVEMENT

- A. General: Removing and replacing pavement bituminous or concrete shall consist of removing the type of pavement and base encountered and replacing same as shown on the detailed drawings. Pavement shall be removed only as necessary to install piping.
- B. Subgrade: The trench shall be backfilled in layers not more than 6" thick and shall be thoroughly compacted with mechanical tamps. No base course shall be placed on loose earth or dusty material.
- C. Bituminous Pavement: Bituminous pavement shall be replaced with base as shown on drawings and 1 1/2" of asphaltic concrete topping. Edges of cut pavement shall be neatly squared off. Then the base and edges shall be primed with a tack coat of AC 15 or equal, applied at the rate of 0.25 gallons per square yard prior to placement of asphalt topping. Extreme care shall be executed to assure that the squared edges of existing pavement will not be broken or disturbed during rolling of 1 1/2" asphalt topping.
- D. Binder and Base Pavement Replacement: Replace binder and base bituminous pavement courses following installation in accordance with Contract Drawings.

3.25 REMOVE & REPLACE CONCRETE SIDEWALK

- A. Debris from sidewalks removed shall be collected and hauled away and disposed of by

the Contractor in an approved disposal area. Sidewalks shall be replaced with Portland Cement Concrete of not less than 3,000 psi compressive strength at 28 days of age. Sidewalks shall be replaced to the original width and thickness or a minimum of 4" thick. The sidewalks shall have a broom finish. All instructions in Placing of Concrete in these specifications shall be adhered to.

3.26 REMOVE & REPLACE CULVERTS (ALL SIZES & TYPES)

- A. When culverts are encountered during the construction of the pipeline, the said culvert shall be removed and then replaced upon installation of the pipeline. If the culvert, in the opinion of the engineer, is damaged beyond use the contractor shall be responsible for replacing new culvert pipe to match the existing pipe.

END OF SECTION

**SECTION 33 14 19
HYDRANTS**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The work to be done under this Section of the Specifications consists of furnishing all materials and performing all labor necessary for the complete the installation of fire hydrants, as indicated on the Contract Drawings and/or specified.

1.2 GENERAL

- A. All materials used in the construction shall be new and unused when delivered to the site and shall be subject to inspection by the Engineer before installation.

1.3 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures
- B. Section 01 78 23 Operation and Maintenance Data
- C. Section 01 45 34 Product Delivery Storage and Handling

1.4 SUBMITTALS

- A. Submit for review in accordance with Section 01 33 00.
- B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, and coatings.
- C. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, handle, and store the equipment in accordance with Section 01 45 34.

1.6 WARRANTY

- A. The manufacturer shall warrant in writing all equipment against defects in materials and workmanship for a period of 12 months from the date of final acceptance. Within this 12-month period, any defective or malfunctioning equipment, component, or accessory shall be repaired or replaced upon notice at no additional cost to the Owner.
- B. Refer to Section 01 70 00 for additional information.

PART 2 PRODUCTS

2.1 FIRE HYDRANT

- A. Fire hydrants shall conform to the latest requirements of AWWA C502, be the traffic type, dry top, 5-1/4-inch valve opening with O-ring seals, three-way only.
- B. The three-way hydrants are to have two, 2-1/2-inch NST hose nozzles and one, 4- 1/2-inch NST hose nozzle.
- C. The main valve shall be rubber faced, shall seat against a bronze seat, and shall open against pressure. Hydrants shall range from 3-foot to 5-foot bury with 6-inch mechanical joint inlet connection.
- D. Operating nuts shall be pentagon (1-1/2-inch point to flat) and shall open by turning counterclockwise.
- E. All fire hydrant laterals shall have 6-inch gate valves and valve boxes. Fire hydrants shall be manufactured by Clow or M & H.

2.2 HOSE BIBS

- A. Hose bibs shall be furnished and installed where shown on the Drawings and shall be 3/4", non-freeze type with brass casings and T-handle. Furnish 1 quick female coupling hose fitting for each hose bib.

2.3 WALL HYDRANTS

- A. Wall hydrants shall be cast brass, non-freeze with 1" HPT outlet, T-handle, polished face, brass wall casing, renewable nylon seat, and brass operating parts. Wall hydrants shall be Josam Model 71000-8, Wade Model W8600L6+2, or equal.

2.4 POST HYDRANTS

- A. Post hydrants shall be non-freezing, self-draining type. These hydrants will be furnished with a 2" FIP inlet, a non-turning brass operating rod and galvanized casing pipe. Hydrant shall open to the left. All working parts shall be bronze to bronze design and serviceable from above grade with no digging. The outlet shall also be bronze with a 1" NST nozzle. Hydrants shall be Model TF-300 manufactured by Kupferle Foundry Co., Model 8900-97 manufactured by Wade, or equal.

2.5 YARD HYDRANTS

- A. Yard hydrants shall be 1" post hydrant with galvanized casings 1" inlet and discharge hose connections, non-freeze with vacuum breaker and sanitary siphon drain system. Yard hydrants shall be Josam Model 71400-91, MIFAB MHY-68-0 or equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install hydrants at locations indicated and in accordance with AWWA M17.
- B. All fire hydrants shall be connected to the water main with a 6-inch ductile iron pipe lead. PVC pipe will not be allowed for fire hydrant leads.

3.2 COATINGS

- A. All fire hydrants shall be painted in accordance with AWWA C502, Section 2.22 and Section 4.5. The color shall be silver and red (silver with a red top).

END OF SECTION

**SECTION 33 31 00
SANITARY UTILITY SEWERAGE PIPING**

PART 1 GENERAL

1.1 SCOPE

- A. The work to be done under this Section of the Specifications consists of furnishing all materials and equipment and performing all labor necessary for the complete construction of the gravity sewer system including all sewer pipe, house service lines and other appurtenances as indicated on the Contract Drawings and/or specified.

1.2 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures.
- B. Section 31 23 33 Excavation & Fill for Pipeline.
- C. Section 33 39 00 Sanitary Utility Sewerage Structures.

1.3 GENERAL

- A. All materials used in the construction shall be new and unused when delivered to the site and shall be subject to inspection by the Engineer before installation.

1.4 APPROVED BORING CONTRACTORS

- A. Strack, Inc.
125 Laser Industrial Ct., Fairburn, GA 30213, 770-969-1591, Keith Mayfield
- B. Alpha Boring,
7633 Buchanan Hwy, Dallas, GA 30157, 770-560-7514, David Wiley
- C. Horizontal Unlimited, Inc.
195 Barton Creek Rd., Westminster, SC 29693, 864-647-1338
- D. Metro Horizontal Boring
2200 Commerce Pl., McDonough, GA 30253, 678-577-2122
- E. D&G Boring, Inc.
2690 Cobb Pkwy, Suite A-5 389, Smyrna, GA 30080, 770-794-7083

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe shall be push-on or mechanical joint conforming to AWWA C106 or C108. Pipe thickness shall be in accordance with AWWA C150, Class 50, or pressure

Class 350. The pipe shall be cement-lined in accordance with AWWA C104. Rubber-gasket joints shall conform to AWWA C111.

- B. Fittings for gray iron or ductile iron pipe shall be mechanical joint gray iron or ductile iron fittings conforming to AWWA C153, unless noted otherwise on the drawings, and shall be cement lined.
- C. Use flanged ductile iron pipe with standard cement lining and standard asphaltic coating conforming to AWWA C151. For exposed piping to be painted, use universal phenolic primer. Flanges to be in accordance with AWWA C110 and AWWA C115. Flanges to be Class 150, unless otherwise specified. Bolts for flanges shall be 304 stainless steel.
- D. Where called for on the Contract Drawings Protecto 401 ceramic epoxy lining material shall be an amine cured Novalac epoxy containing at least 20% by volume of ceramic quartz pigment and a permeability rating of 0.00 when tested according to Method A of ASTM E-96. The interior of the pipe shall receive 40 mils nominal dry film thickness and the gasket area and spigot end up to 6 inches back from the end of the spigot must be coated with 6 mils nominal, 10 mils maximum using Protecto 401 Joint Compound.

2.2 PVC GRAVITY SEWER PIPE

- A. PVC sewer pipe and fittings shall be plastic gravity sewer pipe with integral wall bell and spigot joints for the conveyance of domestic sewage. Pipe and fittings shall meet the strength minimum of DR 18 and AWWA C900.
- B. Pipe and fitting markings shall include the appropriate ASTM and Cell Classification Numbers (12454-B or 12454-C or other ASTM approved classifications) and be any color. Unmarked pipes and fittings will be rejected.
- C. Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol to signify it was tested, and date of manufacture. Each rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture and the classes of pipe with which it can be used.
- D. PVC pipe shall be joined with a rubber gasket or PVC ring which is designed to prevent inflow and ex-flow. Mechanical compression joints shall be molded plastic or similar material (with or without the use of rubber or elastic plastic compression rings) as described in ASTM C425 for polyvinyl chloride (slip joint). Precast joints or rubber push-type gaskets for compression joint sealing (ASTM D3312 or F477) are all acceptable. (PVC pipe shall not be joined by a solvent cement joint in which the pipe spigot wedges into the tapered socket and the surfaces fuse together.)
- E. In cases where pipe joints are required to be restrained the pipe shall utilize an internal restraint system suitable for C900/905 PVC pipe such as the CertainTeed Certa-Lok C900/RJ Restrained Joint System, Diamond Plastics Diamond Lok-21, JM Eagle Loc900, RieberLOK or approved equal.

2.3 CASING PIPE

- A. Jacked casing pipe shall be a smooth steel pipe with a minimum yield point of 35,000 psi, meeting ASTM A53 or ASTM A139. The minimum wall thickness shall be as indicated below:

Nominal Diameter (Inches)	Nominal Thickness (Inches)
Under 14	0.188
14	0.219
16	0.219
18	0.250
20	0.281
22	0.312
24	0.344
26	0.275
28	0.375
30	0.406
32	0.438
34	0.469
36	0.469
42	0.500
48	0.625

PART 3 EXECUTION

3.1 STAKING AND GRADING

- A. Owner shall provide all staking including clearing limits, temporary and permanent easements, manholes, mid-point between manholes, force main at 200-LF intervals and at bends, and steel casing.
- B. The Contractor shall be responsible for providing laser beam equipment and using this equipment to grade and align all sewer lines between manholes. The Engineer will provide a list of benchmark elevations from which the Contractor may work.

3.2 INSPECTION OF PIPE AND JOINTS

- A. All pipes shall be subject to inspection by the Engineer for uniform diameter, straightness, and defects before being lowered into trench. Rejected pipe shall be marked in such a way as will not impair its value and separated from accepted pipe and removed from the project.
- B. No backfilling (except for securing pipe in place) over pipe will be allowed until the Engineer has had an opportunity to make an inspection of the joints, alignment and grade in the section laid.

- C. Inspection of piping and joints shall not relieve the Contractor of further liability in case of defective piping and/or joints which prove defective.

3.3 TRENCH WIDTHS

- A. Maximum permissible trench widths from bottom of trench to a point 12" above top of pipe shall be equal to the outside diameter of pipe barrel plus 16", except as noted otherwise.
- B. If the trench walls collapse, or if the excavated trench width up to a point 12" above the top of sewer pipe is greater than the maximum permissible trench width as set forth in Paragraph A above, then the Contractor shall, at no additional cost to the Owner, lay and backfill the line as specified in ASTM D2321.

3.4 JOINT CONSTRUCTION

- A. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe and so as to avoid sudden offsets or inequalities in the flow line. The inside of all bells and the outside of all spigots shall be wiped to remove all dirt, water, or other foreign matter so that their surfaces are clean and dry when the pipes are joined.
- B. Rubber ring gasket joints for PVC pipe shall be installed according to the pipe manufacturer's Specifications and recommendations. Extreme care shall be used in joining large diameter pipes to avoid damaging the rubber ring or displacing it from the proper operating position.
- C. Push-on or mechanical joints on cast iron sewer shall be installed according to the pipe manufacturer's Specifications and recommendations.
- D. After the joints have been completed, they shall be inspected by the Engineer before they are covered up. Any leaks or defects discovered at any time after completion of the work shall be repaired immediately. All pipes in place shall be carefully protected from damage until the backfilling operations have been completed. Any pipe which has been disturbed shall be taken up, the joint cleaned and remade and the pipe re-laid at no addition cost to the Owner.
- E. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the joints are completed or before the trench has been backfilled. The Contractor shall not open up, at any time, more trench than his available pumping facilities are able to dewater.

3.5 PIPE LAYING - GENERAL

- A. Before sewer pipe is placed in position in the trench, the bottom and sides of trench shall be carefully prepared, bedding shall be placed and compacted, and necessary bracing and sheeting shall be installed.

- B. Each piece of pipe and special fitting shall be carefully inspected before it is placed, and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade starting at the lower end of the grade and with the bells upgrade.
- C. All sewer lines shall be laid to constant grades between invert elevations shown on the plans. Grades shown on the Drawings are invert of pipe and not trench subgrade. The pipe lengths shall be fitted together and matched so that when they are laid in the trench, they will form a sewer with a smooth and uniform invert visible as a full circle from manhole to manhole.
- D. No filling of trench with earth to bring pipe to grade will be permitted. If trenches are dug too deep, they must be brought to grade and supported by No. 57 crushed stone for pipe bedding, at no additional cost to Owner. No pipe shall be laid in the trench until subgrade is tested and found correct.
- E. Pipe shall not be laid on solid rock. A pad of crushed stone for pipe bedding as hereinbefore specified at least 6" deep, shall provide support for at least the bottom quadrant of the pipe.
- F. No walking upon the completed pipelines will be permitted until trench has been backfilled to a depth of at least 6" over the top of pipe. Exception may be made at the discretion of the Engineer where it is necessary in order to tamp the backfill around the pipe.
- G. The interior of the pipe shall, as the work progresses, be cleaned of all dirt, jointing materials, and superfluous materials of every description. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell so as to exclude earth and other material, precautions being taken to prevent floatation of pipe by runoff into trench.
- H. Laying of pipe may be delayed by the Engineer until trenching has progressed far enough ahead to remove the possibility of having to change grade or alignment on account of other structures, pipelines, or conduits.
- I. Unless permitted or directed for the following reasons, not less than 100' of pipe shall be laid at one operation:
 - 1. Street crossings.
 - 2. Wet caving trenches; and
 - 3. Business, houses, or institutions which would be damaged by prolonged disconnection from street.
- J. In wet, yielding, and mucky locations where pipe is in danger of sinking below grade or floating out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of the backfill, the pipe must

be weighted or secured permanently in place by such means as will prove effective.

- K. When ordered by the Engineer, mucky and quicksand trench subgrades shall be removed below ordinary trench depth. Pay for such excavation shall be included in the unit prices bid for stone stabilization.
- L. Pipes shall be laid free from all structures other than manholes. Any pipes entering structures underground unsupported by original earth shall be supported by Class "C" concrete or brick and mortar masonry.
- M. Avoid permitting dirt, rubbish, surplus construction material, and other foreign matter to enter structures or pipe during construction. Use whatever means may be necessary to obtain a clean and internally smooth drainage system prior to final acceptance.
- N. Pipe stubbed out of manholes for future connection shall be plugged and tightly sealed with a plug jointed in the bell with joint compound approved by the Engineer. Plugs shall be made of the same material as the pipe used for the stubs.
- O. Sewer pipe laid shall be paid for as specified in the MEASUREMENT AND PAYMENT Section of these Specifications.
- P. No joints that show leakage will be accepted. If, after backfilling and inspection, any joints are found that are allowing groundwater to enter the sewer, such joints must be dug up and corrected at no additional cost to Owner.

3.6 WATER LINE SEPARATION

- A. Horizontal Separation: Sewers shall be laid at least 10 feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the Contractor shall notify the Engineer who may allow deviation on a case-by-case basis. Such deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation, so the bottom of the water main is at least 18 inches above the top of the sewer.
- B. Crossings: Sewers crossing water mains and service lines shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, 10 linear feet of concrete encasement shall be provided for the sewer to prevent damage to the water main.
- C. Special Conditions: When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be installed inside steel casing pipe.

3.7 SERVICE CONNECTIONS TO SEWER MAIN

- A. Branch service pipes shall be laid to serve the abutting property at points to be designated by the Engineer. Such pipes shall be connected to the sewer through tees or wyes with the same run size as the main sewer and 6" side branch and 6" 45-degree bends. Side branches shall be supported from bottom of trench with crushed stone (No. 8 to 3/4") where cover is less than 6'.
- B. Six-inch service pipe shall be laid from the main sewer to the property line of the abutting property. Where practical, due to the slope of the existing ground, the service lines shall end at the property line with a wye which shall provide service connections to two adjacent properties. These locations shall be determined by the Engineer. Payment for service connections to sewer main shall be made at the unit prices stated in the Bid Schedule.
- C. Under normal conditions, where elevations are not critical, branch service sewers to customers shall be laid on not less than 0.025 feet per foot of length grade. Where elevations are critical, minimum grade shall be 0.0125 feet per foot laid with batter boards and grade line string.
- D. In the case of deep sewers, as directed by the Engineer, branch pipes may be brought up to a depth of approximately 4' below ground level with suitable bends and service pipe. These pipes shall be laid on a slant outside sewer trench, so they will be supported on original earth and not dragged down and cracked by backfill settlement. Where depth of cover over wye or tee branches is greater than 6', these wyes or tees shall be encased in concrete. Cost of such concrete shall be included in the price bid for service pipe.
- E. In the case of branches to deep sewers in rock or narrow places, the service pipe shall be brought up to a depth of approximately 4' below ground level with suitable bends and riser pipe and encased in Class "C" concrete or brick and mortar masonry to subgrade of branch trench. The cost of such concrete and forms or masonry above the wye or tee branch shall be included in the price bid for service connections.
- F. The Contractor shall make an accurate dimensional record of the service connections as the installations are made. The following information shall be recorded:
 - 1. Distance from nearest manhole to wye or tee connection at main sewer.
 - 2. Distance from main sewer to end of service line.
 - 3. Angle between main sewer and service line; and
 - 4. Depth at end of service line.
- G. These records shall be kept by the Contractor until all connections are made and then submitted to the Engineer prior to the final work claim.

- H. Exact location of the service connections and stub tee or wyes shall be determined by the Engineer in the field.

3.8 GRAVITY SEWER PIPE LAYING

- A. Gravity sewers, where indicated on the Drawings, shall be laid to line and grade and according to provisions regarding bedding, laying, and jointing of AWWA C400, except that joint shall be made with mechanical or push-on joints, according to the manufacturer's specifications and using manufacturer-recommended tools. A copy of the manufacturer's instructions shall be made available at the site of work at all times when pipe is being laid.
- B. Cutting of pipe may be done with wheeled pipe cutters or with hammer and chisel, as the Contractor may elect; but the Contractor will be held responsible for breakage or damage caused by careless cutting or handling.
- C. No pipe shall be laid on rock, blocking, or other unyielding objects, except where laid above ground on piers or in permanent tunnels.
- D. Materials for use as foundation, embedment and backfill shall be classified in accordance with ASTM D2487.
- E. Class IA Soils: Class IA soils include open-graded, clean manufactured aggregates and should be considered suitable for embedment and backfill.
- F. Class IB Soils: Class IB soils include dense-graded, clean manufactured, processed aggregates and should be considered suitable for embedment and backfill.
- G. Class II Soils: Class II soils include groups GW, GP, SW, SP, GW-GC and SP-SM as defined by the Unified Soil Classification System (USCS) and should be considered suitable for embedment and backfill.
- H. Class III Soils: Class II soils include groups GM, GC, SM and SC as defined by the USCS and should be considered suitable for embedment and backfill.
- I. Class IVA Soils: Class IVA soils include groups ML and CL as defined by the USCS and should be considered suitable for embedment and backfill.
- J. Class IVB and V Soils are not recommended for embedment and should be excluded from final backfill. Class IVB and V soils include groups MH, CH, OL, OH and PT as defined by the USCS.

3.9 COMPACTION REQUIREMENT AND TESTING

- A. Compactions shall be as specified in the PIPELINE EXCAVATION AND BACKFILL Section.

3.10 INFILTRATION TESTS

- A. Weir tests shall be made of flow of water from all sewers before they are put into service.
- B. No more than 3,000 feet of sewer in one section shall be weir tested at one time.
- C. Suitable metal or wooden weirs shall be installed at the lower end of the section of sewer being tested, and measurements of flow shall be made.
- D. Any leaks into the sewer of significant magnitude that can be located shall be repaired or corrected as authorized by the Engineer, regardless of infiltration tests results.

3.11 INFILTRATION ALLOWANCE

- A. Infiltration of groundwater or other leakage into the sewer (including manholes) shall not exceed 25 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours in any section of the completed work.
- B. Inspection during pipe laying shall in no way relieve the Contractor of the responsibility for passing tests or correcting poor workmanship. Before acceptance, infiltration shall be reduced by repair of leaks to the allowable rate.
- C. Hydraulic Testing of Sewers: Measurement shall be performed by the City on any lines with a visible flow of water. In no case will an infiltration rate greater than 25 gallons per inch of pipe diameter per mile of sewer per day is allowed. All visible or audible leaks must be dug up and repaired unless the leak is found to be in a joint and can be repaired by chemical grouting. The testing procedure shall be in accordance with ASTM C1091 (Infiltration Testing), or ASTM C969.

3.12 AIR TESTS

- A. Air Pressure Testing of Sewers: A low pressure test of each sewer should be conducted according to Unibell UNI-B-6 or ASTM F1417.
- B. The Contractor shall air test the completed sewer line between each two consecutive manholes. If the test fails between manholes, the testing shall continue at closer intervals until the faulty construction is located and repaired.
- C. Test manholes and equipment used shall be approved by the Engineer prior to beginning the testing operation.
- D. Test sections shall be cleaned and flushed and shall have all pipe openings plugged and adequately braced to withstand the test pressure.
- E. The test section shall be pressurized until the internal pressure reaches 4.5 psig. Allow sufficient time for the air temperature in the test section to stabilize.

- F. Reduce the internal pressure to exactly 3.5 psig and accurately determine the time required for the pressure to drop to 3.0 psig.
- G. The minimum time required for the pressure drop shall be 5 minutes for 8-inch pipe and 10 minutes for 16-inch pipe.
- H. Any section of the sewer line which fails to meet the requirements stated above, shall be repaired as necessary to eliminate all detectable leaks and shall be retested until satisfactory test results can be obtained. The Engineer shall approve final test results.
- I. The prescribed test pressure shall be in excess of the hydrostatic pressure of the groundwater above the top of the pipe. The pressure drop shall remain as indicated above.
- J. All Gravity Sewer pipe shall be air tested after installation in accordance with this specification.

3.13 VIDEO INSPECTION OF SEWER LINES

- A. All sewer lines shall be video inspected.
- B. Video should show pipe free of dirt and debris. Prior to test, pipe should be jetted, flushed and vacuumed.
- C. Televising cable attached to a video monitor shall be directed through pipe to view for the following deficiencies:
 - 1. Cracks in pipe and liner material.
 - 2. Rolled gaskets.
 - 3. Leaking joints.
 - 4. Deviations from line and grade.
 - 5. Other deficiencies.
- D. Contractor shall repair all deficiencies noted by the Owner. Method of repair must be approved by the Owner's Engineer.
- E. Test shall be considered acceptable when the televised pipe does not reveal deficiencies as described above in paragraph C.
- F. The Owner's inspector must witness televising.

3.14 HIGHWAY CROSSINGS

- A. Installation of the gravity sewers and appurtenances along or crossing State, Federal and County Highway rights-of-way shall be done only with written consent and in strict

accordance with the specifications of the right-of-way owner.

- B. Sewers crossing State and Federal Highways shall be inserted in a steel casing pipe. Casing pipe shall be of a size as shown on the Drawings. Carrier pipe shall be PVC C900 DR 18 restrained pipe inserted in the casing as described on the Drawings. Casing pipe shall be installed with a minimum cover of 48".
- C. Casing pipe may be bored or jacked, and payment shall be per foot of casing actually installed. Jetting or wet boring will not be permitted.
- D. Sewer mains crossing City or County Highways shall be open cut, unless otherwise shown on the Drawings. Compaction and pavement replacement shall be as specified in the PIPELINE EXCAVATION AND BACKFILL Section.
- E. Following construction on highway right-of-way, Contractor shall be responsible for dressing, shaping, and re-seeding as required to return the highway ditches, shoulders, and ditch back slopes to a condition as close as possible to original condition before the beginning of construction operations.
- F. It shall be the responsibility of the Contractor to notify the right-of-way owner's field engineer before doing any work within the right-of-way.

3.15 AS-BUILT DRAWINGS

- A. At the completion of the job, and prior to the request of Final Payment, the Contractor shall furnish the Engineer As-Built drawings for the entire project. The drawings shall show the locations and elevations of all manhole tops and inverts, locations of all service laterals and their depths, and the locations, type and size of all pipes and casings. As-Built drawings shall be to scale and neatly drawn.
- B. The Contractor agrees to indemnify the Owner, the Engineer, its agents, representatives, etc., and hold them harmless from any work performed by the Contractor or its subcontractors, outside of the easements shown on the drawings.

3.16 PAYMENT

- A. No separate payment will be made for the work of this Section, except as may be specifically set forth in the Bid Schedule. The cost of the work of this Section, and all costs incidental thereto, except the work which may be specifically set forth in the Bid Schedule, shall be included in the price bid for the item to which the work pertains.

END OF SECTION

**SECTION 33 35 00
PROCESS VALVES AND APPURTENANCES**

PART 1 GENERAL

1.1 SCOPE

- A. The work to be done under this Section of the Specifications consists of furnishing all materials and performing all labor necessary for the complete construction of the valves, as indicated on the Contract Drawings and/or specified.
- B. Valves herein are for chemical, reuse water and process. Refer to other Sections for potable water and plumbing valves.

1.2 GENERAL

- A. All materials used in the construction shall be new and unused when delivered to the site and shall be subject to inspection by the Engineer before installation.

1.3 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures
- B. Section 01 78 23 Operation and Maintenance Data
- C. Section 01 45 34 Product Delivery Storage and Handling
- D. Section 09 91 00 Painting

1.4 SUBMITTALS

- A. The following information shall be submitted for review in accordance with Section 01 33 00:
 - 1. Submit valve manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings, and coatings.
 - 2. Submit manufacturer's affidavit of compliance with referenced standards.
- B. Submit Warranty and Certification Form per Section 01 33 00.
- C. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23.
- D. Test Reports to be Submitted:
 - 1. Copies of all test results, as specified in Part 3 of this Section.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, handle, and store the equipment in accordance with Section 01 45 34.

1.6 WARRANTY

- A. The manufacturer shall warrant in writing all equipment against defects in materials and workmanship for a period of 12 months from the date of substantial completion. Within this 12-month period, any defective or malfunctioning equipment, component, or accessory shall be repaired or replaced upon notice at no additional cost to the Owner.
- B. Refer to Section 01 70 00 for additional information.

PART 2 PRODUCTS

2.1 GENERAL

- A. Valves are identified by both type and style.
 - 1. The type and style of valve to be used for each application is indicated on the Drawings.
- B. General Valve Requirements
 - 1. Select such that it is suitable for the intended service.
 - 2. Use the following in metal pipelines unless otherwise shown on the Drawings or as specified:
 - a. Two-inch diameter and smaller:
 - (1) All brass or bronze except for the handwheel.
 - (2) Screwed or soldered ends.
 - b. Two and one-half inches in diameter and larger
 - (1) Iron body, bronze mounted.
 - (2) Flanged or mechanical joint ends for valves 4-inches in diameter and larger.
 - (3) Screwed connections may be used for smaller valves.
 - 3. Make valve the same size as connecting piping. Drawings indicate nominal size unless otherwise noted.
 - 4. Provide end connections that are compatible with connecting piping.
 - a. Cast flanges and mechanical joint bells at right angles to the casting axis.

- b. Drill and shop coat with a rust preventive compound prior to shipment.
 - c. Provide a union adjacent to all valves with screwed or soldered connections to facilitate removal.
 - 5. Open counterclockwise.
 - 6. Equip non – rising stem valves with a suitable position indicator.
 - 7. Provide rising stem valves with a clear stem guard that is calibrated to indicate stem position.
 - 8. Connect extension stems to valves using bronze couplings. Size to withstand all stresses without deformation. Use a minimum safety factor of six.
 - a. Fabricate and install stems to operate valve without binding.
 - 9. Provide the manufacturer’s name and valve size on the body or bonnet of the valve. Use
 - a. Cast letters, or
 - b. Provide permanently attached plate with information stamped in raised letters.
- C. Furnish valves complete with operators, bonnets, extension stems, floor stands, operating wrenches, and all other appurtenances necessary for them to perform as designed. Mount actuators and appurtenances in the factory and ship as a unit.
 - 1. Manual operators
 - a. Provide a handwheel for conveniently accessible valves.
 - b. Provide a chainwheel operator for all manual valves greater than 6 feet above the finished floor or working surface.
 - (1) Extend the chain to within 4 feet of the floor or working surface.
 - (2) Secure chain using hooks fastened to walls or other parts of the structure. Locate hooks so that the chain does not obstruct access ways.
 - c. Size handwheels and chainwheels and provide actuator gearing to limit the maximum operating force to 80 pounds. Include floor stands, floor boxes, and extended actuators where shown on the Drawings.
 - d. Include stem extensions, valve boxes, position indicators, and Tee wrenches for buried valves.
 - (1) Provide 2-inch square AWWA operating nut.

- (2) Locate operating nut no more than 12 inches below grade.
- 2. Automatic operators
 - a. Comply where shown on the Drawings.

2.2 BALL VALVES FOR HOT/COLD AND COMPRESSED AIR

- A. Size: ¼ inch to 3 inch for hot and cold water or compressed air service
- B. Body: Forged brass
- C. Ball: Chrome plated brass
- D. Stem: Nickel plated brass
- E. Seat: Virgin PTFE
- F. End Connections:
 - 1. Threaded up to 3 inches
 - 2. Soldered up to 2 inches
- G. Actuator
 - 1. Provide type as specified in the attached valve schedule.
 - 2. One-quarter turn to open or close.
- H. Manufacturers
 - 1. Jamesbury, Series 300
 - 2. Or equal

2.3 PVC BALL VALVES

- A. Size: ½ inch to 4- inch true union PVC ball valves
- B. Design Standard
 - 1. ASTM D2467.
- C. Body, ball, and stem:
 - 1. PVC conforming to ASTM D1784, Classification 12454-B
- D. Seat:

- 1. Teflon
- E. End Connections:
 - 1. True union
 - 2. Socket
- F. Actuator:
 - 1. One-quarter turn to open or close.
- G. Manufacturers
 - 1. NIBCO
 - 2. Hayward
 - 3. Or Equal

2.4 DIAPHRAGM VALVE

- A. Type: PVC weir type diaphragm valve
- B. Size: 4 inch
- C. Body and Bonnet
 - 1. Molded of solid thermoplastic.
 - 2. PVC conforming to ASTM D1784, Type I, cell classification 12454-A
 - 3. CPVC conforming to ASTM D1784, Type IV, cell classification 23447.
- D. Diaphragm: EPDM backed Teflon
- E. Stem: Stainless Steel with adjustable position indicator.
- F. End Connections:
 - 1. Flanged
 - 2. Conforming to ANSI B16.5
- G. Actuator: Provide the type indicated in the attached valve schedule.
- H. Manufacturers
 - 1. Hayward

2. TVI Thermoplastic Valves, Inc.
3. Or equal

2.5 AIR /VACUUM AND COMBINATION VALVES

- A. Air release and vacuum break valve shall be the compact single chamber design with solid cylindrical HDPE control floats housed in a tubular stainless-steel body with epoxy powder coated cast iron or steel ends secured by stainless steel tie rods. The valve shall have an integral orifice mechanism, which shall operate automatically to limit transient pressure rise induced by closure to twice valve rated working pressure. The intake orifice shall be equal to the nominal size of the valve. The flat face or the control float seating against a nitrile rubber O-ring housed in a dovetail groove circumferentially surrounding the orifice shall affect large orifice sealing. The seating and unseating of a small orifice nozzle on a natural rubber seal affixed into a control float shall control discharge of the pressurized air. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seat is prevented. All components shall be easily replaced. Connection to valve inlet shall be flanged.
- B. The valve shall be either Vent-O-Mat series RBX or Vent-Tech Model WTR. No substitution permitted.

2.6 PRESSURE RELIEF VALVES

- A. Size ½ inch thru 2 inches
- B. Outlet pressure range: 0 to 2 psi
- C. Inlet pressure Range: 20 to 40 psi
- D. Design flow: 0 to 10 gpm.
- E. E.Manufacturers
 1. GA Industries, Inc. Fig. 667-D
 2. Ross Valve Manufacturing Co., Inc.
 3. Cla-Val

2.7 REDUCED PRESSURE BACKFLOW PREVENTER

- A. Size: 2-1/2 inch to 10 inch
- B. Design Standard: AWWA C511
- C. Body: Cast iron conforming to ASTM A126

D. Valves

1. Main valve: bronze conforming to ASTM B61. Make seats and springs replaceable.
2. Differential relief valve: bronze conforming to ASTM B61 with 316 stainless steel trim. Make seats and springs replaceable.
3. Isolation valves: NRS gate valves (GV-1 or 2 as appropriate).

E. End Connections: Flanged conforming to ANSI B16.1, Class 125.

F. Coatings and Linings: Fusion bonded epoxy on the interior and exterior.

G. Miscellaneous

1. Pipe relief chamber to drain.
2. Provide test cocks for in-line testing.

H. Manufacturers

1. Cla-Val
2. Hersey
3. Or equal

2.8 MUD VALVES

A. Size: 4 inch to 12 inch

B. Body: Iron

C. Mounting: Bronze

D. Flange: Drilled for Class 125, ANSI 16.1

E. E.Seat: Resilient

F. Stem:

1. Non-rising with stainless steel extensions.
2. Fit with 2-inch operating nut.

G. Valve Box:

1. Provide a valve box cast into the concrete floor above the mud valve. Include valve box cover.

2. Provide integral, bronze guides in the bottom of the valve box.

H. Stem Guides:

1. Provide adjustable, split sleeve, bronze mounted stem guides.
2. Space at no more than ten (10) foot centers.

I. Anchor Bolts: Stainless Steel

J. Manufacturers

1. Troy
2. Clow
3. Waterman Industries Inc.
4. Or equal

2.9 GLOBE BODIED FLOW CONTROL VALVE

- A. Flanged bodied globe valve with electric actuator suitable for use with polyaluminum chloride.
- B. Materials - PVDF
- C. Stem seal – PTFE
- D. Linear flow characteristics
- E. Cv of 4.0
- F. Electric actuator for use with 120- volt AC power
 1. Responds to 4-20 mA set point signal for flow control from SCADA system.
 2. Provides 4-20 mA position signal for input to SCADA system
 3. Furnished with open/close limit switches for input to control panel and SCADA system
 4. Provision for manual override
- G. Control Panel
 1. Provide with NEMA 4X FRP control panel
 2. Provisions for local off remote selector switch with remote position output for use

with SCADA system

3. Provisions for open stop close selector switch
 4. Provision for valve open close indicator lights. When not fully open or closed both lights to be on.
- H. Manufacturer
1. Valve
 - a. Asahi/America
 - b. Approved equal
 2. Operator
 - a. RTK
 - b. Approved equal.

2.10 SWING CHECK VALVE

- A. Check Valves to be APCO Model CVS-6000 style as manufactured by DeZurik or equal.
- B. Air cushion shall be totally enclosed. The cylinder shall have an anodized aluminum alloy cap, head, and barrel. The bottom cylinder head shall be hinged mounted to follow the change of angular force as the lever rises and lowers. The primary closing speed of the air cushion cylinder is to field adjustable.
- C. Body shall be constructed of ASTM A536 ductile iron. End connections shall be flat faced, flanged per ASME 125/150 lb. standard. The valve shall be rated for 250 psi CWP full waterway design.
- D. Body Seat shall be Type 316 stainless steel. All external fasteners shall be stainless steel.
- E. Disc and Disc Arm shall be ASTM A536 ductile iron. The disc shall be attached to the disc arm with a Type 304 stainless steel nut. Disc Seat shall be Acrylonitrile-Butadiene (NBR) and securely held in place by stainless steel screws. The disc seat shall be replaceable and provide drip tight shutoff.
- F. Shaft shall be one-piece Type 303 stainless steel. The Pivot shaft shall be keyed and protrude through both sides of the body.
- G. Lever & Spring or Lever & Weight arm and adjustable counterweight are to be Carbon Steel. Valve shall meet or exceed the latest revision of AWWA standard C508.
- H. Warranty Valves and actuators shall be warranted by the manufacturer for defects in

materials and workmanship for a period of two years (24 months) from date of shipment.

2.11 RUBBER FLAPPER CHECK VALVES

- A. The check valve shall conform to the design, materials of construction, testing and laying length required by AWWA C508 (latest revision).
- B. The valve shall have integral flanged connections that are faced, drilled and of the thickness required by ANSI/ASME B16.1 Class 125.
- C. The body shall have its seat on a 45-degree angle to minimize closure time. There shall be a bottom threaded port to permit installation of a backflow device. The cover shall be domed and have a threaded port to permit the installation of the visual position indicator.
- D. The flexible disc shall have been cycle tested by an independent laboratory to a minimum of 1 million cycles as required by AWWA C508 without evidence of deterioration, damage or wear and seal drop tight upon the conclusion of testing.
- E. The valve body and cover shall be rated for 250 PSI and made from ductile iron conforming to ASTM A536 Grade 65-45-12.
- F. The flexible disc shall be the only moving part and made from precision molded Nylon reinforced Buna-N rubber with an integral O-ring seating surface. An alloy steel plate shall be imbedded in the rubber to provide rigidity.
- G. Cover bolts, nuts, studs, and pipe plugs shall be Type 316 stainless steel. Valves 10-size and larger shall have a minimum of 2 lifting eye-bolts.
- H. The interior and exterior ferrous surfaces of the valve shall be shop coated with minimum 6 mil NSF-61 certified 2-part epoxy. Rubber flapper swing check valves shall be GA Industries Figure 200, VAG USA, LLC Mars, PA USA

2.12 PLUG VALVES

- A. Plug valves shall be of the eccentric non-lubricated, manually operated type, and be designed for the use and working pressure intended.
- B. Valves shall have flanged ends or mechanical joint ends, as shown on the Drawings. Valve body shall be of semi-steel.
- C. Seats shall have a welded-in overlay of not less than 90% pure nickel on all surfaces which will contact the plug face.
- D. The plug shall be totally encapsulated with Buna-N rubber.
- E. Plug stem bushing shall be of stainless steel, and permanently lubricated type.
- F. Valves shall have a 2" square operating nut, with worm gear actuator and open LEFT.

- G. Valves placed in a valve box shall have a handwheel operator.
- H. Plug valves shall be manufactured by DeZurik, Homestead, Milliken, GA Industries or approved equal.

2.13 SEWAGE AIR RELEASE VALVE

- A. The sewage air release & vacuum break valve shall consist of all stainless-steel fabricated body.
- B. Connection to the valve inlet shall be facilitated by flanged ends conforming to ANSI B16.1 Class 125 or Class 250 Standards.
- C. Valves shall respond to the presence of air/gas by discharging it through the small orifice at any pressures within a specified design range, i.e., 7 psi to 150 psi and shall remain leak tight in the absence of air.
- D. Valves shall react immediately to pipeline drainage or liquid column separation to allow unobstructed air intake at the lowest possible negative internal pipeline pressure.
- E. The sewage air release valves shall be Vent-O-Mat Model No. 050RGX1021, DeZurik/APCO ASU, Vent Tech Model SZG or A.R.I. Model D-020, with 2-inch inlet size.

2.14 GATE VALVES

- A. These valves shall be non rising stem design, ductile iron body, bronze mounted with compression resilient seat manufactured in accordance with AWWA Standard C-515. Valves shall be designed for a minimum working pressure of 250 psi (except where plans call for a higher-pressure rating) and shall have 2" square operating nuts, except in meter vaults where handwheels shall be installed. The wedge shall be constructed of ductile iron fully encapsulated with EPDM rubber. Valves shall have non rising stems, shall open when turned to the left and shall meet AWWA Specifications. The valves shall have a flange connection conforming to ANSI B 16.1 when flanges are shown on the plans.
- B. Restrained valve ends shall employ a boltless positive joint restraint equal to the Flex-Ring joint. Friction style restrainers, which point load the adjoining pipe, will not be allowed.
- C. Gate valves shall be Series 2500 Flex-Ring RW Ductile Iron Resilient Wedge Gate Valve as manufactured by American Flow Control or approved equal.

2.15 VALVE BOXES

- A. Valve boxes shall be provided for all buried valves. Valve boxes for valves shall be approved standard cast iron, adjustable-shaft boxes having a minimum shaft diameter of 5-1/4 inches. The casting shall be coated with two coats of coal tar pitch varnish. The lids

of all boxes shall bear the word "Water" or the letter "W". Boxes shall be equal to Vulcan Pattern VVB-4. Valve boxes shall be flush with the final grade after grading and / or paving

- B. Valve extension stems shall be constructed with standard valve operating nut, 4-½” diameter x ¼” steel guide plate, 1-1/4” square solid steel stem, and standard operating wrench coupling with four 3/8” set screws. The material shall be galvanized. The extension stem must be capable of surviving a torque test to 1000 ft-lb without failure. Extension stem shall be terminated two feet from finished grade.
- C. The valve box top and lid shall be constructed of ductile iron.

2.16 VALVE MARKER

- A. One concrete valve marker shall be furnished and set at each line valve. The valve marker shall be FRP utility marker as manufactured by Carsonite or equal. Provide 3 rail design.

2.17 ACCESSORIES

A. Floor Boxes

- 1. Provide for each valve shown on the Drawings with an extended operating nut.
 - a. Mount flush with the top of the slab and make the length of the box equal to the slab thickness.
 - b. Use bushing type to support stem at the floor and preserve stem alignment.
 - c. Include cover to protect the operating nut.
- 2. Manufacturer:
 - a. Clow
 - b. Or equal.

B. Floor Stands

- 1. Cast iron construction.
- 2. Design for handwheel operator, gear operator or motor operator as shown on the Drawings. Provide floor stand bracket where necessary to locate floor stand where shown on the Drawings.
- 3. Use indicating type for non-rising stem applications. Provide clear stem covers with graduations to show valve position for rising stem applications.
- 4. Manufacturer:

- a. Clow
 - b. Mueller or Equal
- C. Extension Stems and Guides
- 1. Size for the maximum valve torque.
 - 2. Use stem guides to limit the stem L/R ratio to less than or equal to 200.
 - a. Cast iron construction.
 - b. Bronze bushed at the stem support.
 - c. Adjustable in two directions at right angles in a plane perpendicular to the stem.
 - d. Secure with 304 stainless steel angle bolts.
 - e. Manufacturer
 - (1) Clow
 - (2) Mueller
 - (3) Or equal.
- D. Chain Wheel Operators
- 1. Provide galvanized or cadmium plated wheels, guides, and chains.
 - 2. Include chain guides to prevent the chain from slipping off of the wheel.
 - 3. Size chain as recommended by the valve manufacturer.
 - 4. Provided by the valve manufacturer.

2.18 BUTTERFLY VALVES

- A. Unless otherwise shown or specified, butterfly valves shall be of the resilient seated, tight-closing type and shall conform in all respects to the applicable material and dimensional requirements of AWWA C504. Wafer-type butterfly valves in sizes 24 inches and larger shall conform to all general requirements of AWWA C504 except laying length. Butterfly valves shall operate from fully open to fully closed with a 90-degree rotation of the valve stem.
- B. Valves shall be designed for the working pressures and/or pressure class designations shown on the drawings or specified in these Specifications. If a working pressure or pressure rating is not given, the following requirements shall apply:

Service	AWWA	Pressure Rating
Low Pressure Air		25 psi – 16 fps
Wastewater of Sludge		150 psi – 16 fps
Potable or Plant Water		150 psi – 16 fps

- C. Wafer-type valves shall have a pressure rating of not less than 150 psi. Valves shall be drip-tight and bubble-tight at rated pressure differential across the valve in both directions.
- D. Valve body shall be 1-piece, constructed of cast iron conforming to ASTM A126, Class B. Diameter of the opening shall be not less than the diameter of the corresponding pipe size. Unless otherwise specified, valve body shall be of the short-body style in accordance with Table 3 of AWWA C504. This requirement shall not apply to wafer-type valves. No part of the valve internals shall extend beyond the valve ends when the valve is in the closed position. Short-body valves shall have 125-pound flanged ends per ANSI B16.1. Wafer-style valves shall be designed to fit between 125-pound flanges per ANSI B16.1.
- E. Disc shall be cast bronze conforming to ASTM B 143, Alloy 1A, cast iron conforming to ASTM A48, Class 40, Ni-resist ductile iron conforming to ASTM A 439, Type D2. When used in wastewater or raw water, disc shall be streamlined with no exterior ribbing or openings.
- F. Shafts shall be polished stainless steel conforming to ASTM A276, Type 304 or Type 316. All keys and pins used in securing valve disc to shafts shall be stainless steel or Monel.
- G. Valve seat shall be of 1-piece, molded synthetic rubber, Buna-N (Hycar) for wastewater and Buna-N or neoprene for air. Where temperatures exceed 180 degrees F, EPDM or Viton seats shall be used. Retaining rings, if used, shall be stainless steel. The method of mounting valve seat shall conform to applicable requirements of AWWA C504, Section 3.5. Valve seats in sizes 24 inches and larger shall be field replaceable without necessity of shipping, burning, or cutting. Seats secured with retaining rings shall be fully adjustable. Metal seat mating surfaces shall be smoothly contoured and polished 18-8 stainless steel or Monel. Alloy cast iron will not be acceptable as a seat-mating surface. Sprayed or plated seat mating surfaces will not be acceptable.
- H. Shaft seals shall be O-ring or self-adjusting chevron packing of Buna-N or neoprene. Shaft seals shall conform to the requirements of AWWA C504 and shall be of a design that allows replacement of the seal without removing the valve shaft. Alternately, pull-down packing is acceptable if the packing is adjustable and replaceable without removing valve operator.
- I. Valve bearings shall be self-lubricating, sleeve-type bearings of corrosion resistant

materials. Bearing load shall not exceed 2,500 psi. Valves 24 inches in size and larger shall be provided with an adjustable, 2-way thrust bearing to center the disc in the valve and allow the valve to be installed with the valve stem vertical. Bearing shall be easily accessible for adjustment.

- J. Where the valve is installed, adjacent to a fitting, flow meter, another valve, or similar items, a spool piece or adaptor coupling shall be furnished as a spacer so that valve disc does not interfere with operation of the adjacent meter or valve or contact cement linings on pipe or fittings.
- K. Valve shall be furnished with a lever operator, rotary manual operator, electric motor operator, or pneumatic cylinder operator as shown on the Drawings. Unless otherwise shown or specified, a lever operator shall be furnished on valves 6 inches and smaller, and a rotary manual operator shall be furnished on valves 8 inches and larger. Extension stem and floor stand shall be furnished, where shown or required.
- L. Butterfly valves shall be as manufactured by DeZurik or equal.

2.19 STATIC MIXER

- A. The Contractor shall furnish and install as shown on the Drawings, a wafer static mixer. The mixer shall be manufactured by Komax, Chemineer or equal. The mixer shall be designed to provide complete mixing within 694 gpm to 3,472 gpm flow ranges with a maximum head loss range of 0.07 psi to 0.35 psi.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install valves as shown on the Contract Drawings and in accordance with manufacturer's requirements.
- B. Install all valves and appurtenances in accordance with the manufacturer's instructions, referenced AWWA standards and the Contract Documents.
- C. Close valve ends using caps, plugs or wooden flange covers to prevent dirt, building materials or other foreign matter from entering.
- D. Leave no more than two threads exposed on a completed threaded connection. Use Teflon tape joint sealer when making the connection.
- E. Install plug valves and butterfly valves such that the valve operating stem is horizontal, and the seat is as shown on the Drawings.
 - 1. If no seat position is shown, flow shall produce a seating pressure.
 - 2. Make the plug open toward the highest portion of the valve.

- F. Support all valves as shown on the Drawings and in accordance with manufacturers recommendations.
- G. Locate valves such that they are readily accessible for maintenance. Provide access doors in finished walls or enclosed ceilings.
- H. Provide a line size ball valve or gate valve upstream of each solenoid valve, in-line flow switch or similar control device. Use the same construction materials as the connecting pipeline.

3.2 FIELD PAINTING

- A. A. Field prepare, and paint required surfaces as specified in Section 09 91 00.

END OF SECTION

**SECTION 33 39 00
SANITARY UTILITY SEWERAGE STRUCTURES**

PART 1 GENERAL

1.1 SCOPE

- A. The work to be done under this Section of the Specifications consists of furnishing all materials and equipment and performing all labor necessary for the complete construction of manholes and wet well including all appurtenances as indicated on the Contract Drawings and/or specified.

1.2 GENERAL

- A. All materials used in the construction shall be new and unused when delivered to the site and shall be subject to inspection by the Engineer before installation.

1.3 RELATED SECTIONS

- A. Section 01 33 00 Submittals
- B. Section 31 23 00 Pipeline Excavation and Backfill

PART 2 PRODUCTS

2.1 PRECAST CONCRETE MANHOLES

- A. Manholes shall have flexible pipe connectors manufactured in accordance with ASTM C923. Manholes shall have eccentric type of manhole cone.
- B. Precast manholes shall consist of precast reinforced concrete riser section, eccentric top section and a base section conforming to detail shown on the Contract Drawings. Precast manhole sections shall be manufactured in accordance with ASTM C478, as amended to date, and these Specifications. Concrete shall have a minimum compressive strength of 4,000 psi when tested in accordance with ASTM C39, as amended to date. Steel reinforcements shall be as specified in ASTM C478, as amended to date. Wall and bottom section shall have a minimum thickness of five inches (5").
- C. Base sections for precast manholes shall have a bottom poured monolithically with the walls. Base section shall be furnished with inside diameter of 4 feet as required. Base sections shall be furnished with a minimum height of 24 inches for pipes having a diameter of 8, 10 or 12 inches and a minimum height of 36 inches for pipes having a diameter of 15 or 18 inches. Minimum height for 5 or 6-foot diameter base sections shall be 48 inches regardless of pipe size. Base sections with 5 or 6 foot inside diameters shall be reduced to 4 foot inside diameter by means of an adapter ring or transition top. The openings in the base section for the accommodation of the pipe shall be cast to closely conform to job conditions and shall provide a minimum clearance of three inches (3")

between the inside bottom of the base and outside bottom of the pipe barrel.

- D. The riser sections shall be furnished in a minimum of six inch (6") increments and shall be four feet (4') in diameter with, (a) tongue and groove joint to be sealed with approved butyl rubber or bitumastic material, similar to "E-Z Stik" as manufactured by Concrete Supply Company. The gasket joint shall be thoroughly cleaned of all loose materials and brushed with an approved epoxy to give a smooth surface free of any honeycomb.
- E. In the event that the manhole has to be altered after delivery to the job site, the Contractor may, with permission of the Engineer, connect the pipe to the manhole with a collar of mortar and brick. The opening between the pipe and manhole shall have a minimum clearance of one inch (1") and shall be filled from the inside of the manhole with a non-shrink grout.
- F. Repaired and patched sections will not be acceptable unless each individual section so repaired or patched shall have first been inspected and approved by the Engineer, for repair and patching at the manhole plant. Repairs to and patching of O-ring grooves and shoulders WILL NOT BE permitted.
- G. Absorption shall not exceed 6 percent when determined in accordance with ASTM C497, as amended to date.
- H. An inspection, by an independent testing laboratory approved by the Engineer, of the manufacturer's plant and product will be required to assure conformity of the precast manholes to these Specifications, and the minimum requirements of ASTM C478, as amended to date. Each section of precast concrete manhole shall be stamped with the laboratory's stamp. Each stamped section shall indicate the laboratory's configuration that it was accepted in accordance with applicable ASTM Specifications. A copy of such reports will be furnished to the Engineer with submittal of shop drawings for approval. Job site inspection shall be visual for shape, uniformity and density.

2.2 MANHOLES AND CASTINGS - GENERAL

- A. Manholes shall be precast concrete manholes and shall be located as shown on the Drawings. All manholes shall be 48" inside diameter, unless noted otherwise, and shall be installed level, true and plumbed.
- B. Where the difference in the invert elevation of two or more sewers intersecting in one manhole is 2' or more, a drop manhole shall be constructed. Drop manholes shall be similar in construction to the standard manhole except that a drop connection of pipe and fittings of the proper size and material shall be constructed outside the manhole as detailed on the Drawings.
- C. Where the difference in invert elevation of two or more sewers intersecting in one manhole is less than 2-feet, the invert shall be filleted to prevent deposition of solids.

- D. Pipe to manhole connection shall be made with a mechanically compressed flexible joint system. The joint system shall consist of an internal expanding band which clamps and seals a neoprene boot to opening in wall of manhole and an external band which contracts around the boot to clamp and seal to the pipe. Flexible Joint Connections shall be "Korn-seal", as manufactured by National Pollution Control System, Inc., Nashua, New Hampshire, or approved equal.

2.3 MANHOLE CASTINGS

- A. All castings shall be made accurately to the required dimensions and shall be sound, smooth, clean and free of blisters and other defects. Defective castings which have been plugged or otherwise treated shall be rejected. The contact surfaces between the cover and its corresponding supporting ring in the frame shall be machined so that the cover will rest on the ring for the full perimeter of the contact surfaces. Castings shall be thoroughly cleaned and, before rusting begins, shall be painted with a bituminous coating so as to present a smooth finish, tough and tenacious when cold, but not tacky nor with any tendency to scale. There shall be no holes or perforations in the covers.
- B. Manhole castings shall consist of cast iron frames and 23-1/4" diameter covers. Castings shall be Class II, weighing at least 350 and 460 pounds, as detailed on the Contract Drawings. Manhole covers must be set neatly in the frames with contact edges machined for even bearing and tops flush with the tops of the frames. They shall have sufficient corrugations to prevent slipperiness and be marked in large letters GRAVITY SEWER". Covers shall have two (2) pick holes about 1-1/2" wide and 1" deep with 5/8" undercut all around.
- C. Manhole frames and covers shall be bolt down type with four stainless steel bolts 1/2" in diameter.
- D. Manhole steps shall be cast iron, 10" x 10" minimum size, having corrugated treads, or approved equal. Payment for manhole steps shall be included in the unit price bid for manhole.

2.4 INVERTS

- A. Manhole inverts shall be constructed of cement mortar and shall have the same cross-section as the invert of the sewers which they connect. The manhole invert shall be carefully formed to the required size and grade with gradual and uniform changes in sections and shall be made to a true curve with as large a radius as the size of the manhole will permit.

2.5 MANHOLE COATINGS

- A. Unless noted or called out on the Drawings, manholes requiring coating shall be coated with one (1) prime coat of Tnemec Series 218 and two (2) finish coats of Tnemec Series 104, 8 to 10 mils dft, or approved equal.

- B. SpectraShield Barrier coating system for specific manholes is noted on the Drawings.

PART 3 EXECUTION

3.1 STAKING AND GRADING

- A. The Engineer shall be responsible for providing benchmarks from which the Contractor shall work. The Contractor shall set offset stakes for line and grade.
- B. The Contractor shall be responsible for providing laser beam equipment and using this equipment to grade and align all sewer lines between manholes. The Engineer will provide a list of benchmark elevations from which the Contractor may work.

3.2 MANHOLE INFILTRATION TEST

- A. Each manhole shall be tested for watertightness.
- B. All connecting piping shall be plugged and manhole filled with water, allowed to stand for one (1) hour, and then refilled. If measurable water level drop occurs after a second one-hour period, the Contractor shall repair the leakage and retest at no additional cost to the Owner.

3.3 VACUUM TESTING OF MANHOLES

- A. Test Method: Each manhole shall be vacuum tested in accordance with ASTM C1244-94.
- B. Plug Lift Holes: All lift holes shall be plugged with approved non-shrink grout.
- C. NO grout will be placed in the horizontal joints before testing.
- D. Pipes Entering Manhole: All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.
- E. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer’s recommendation.
- F. Vacuum Requirements: A measured vacuum of 10-inches of mercury shall be established in the manhole. The time for the vacuum to drop to 9 inches of mercury shall be recorded.
- G. Leakage: Acceptance standards for leakage shall be established from the elapsed time for a negative pressure change from 10 inches to 9 inches of mercury. The maximum allowable leakage rate for a 4-foot diameter manhole shall be accordance with the following:

Manhole Depth	Minimum Elapsed Time for a Pressure Change of 1 Inch Hg
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10 feet or less	60 seconds
>10 feet but <15 feet	75 seconds
>15 feet but <25 feet	90 seconds

- H. Test Failure: If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Re-testing shall proceed until a satisfactory test is obtained.
- I. Test Equipment: Vacuum test equipment shall be equal to that of P.A. Galzier, Inc., Worcester, MA.

END OF SECTION

**SECTION 40 05 14
PLASTIC PROCESS PIPING**

PART 1 GENERAL

1.1 SUMMARY

- A. Provide under this specification all labor, equipment, and materials required to install and test: PVC SDR 21, Schedule 40, Schedule 80, CPVC plastic and PVC tubing, including valves, unions, fittings, couplings, adapters, and accessories as shown on contract drawings and/or specified suitable for the intended service.
- B. Contract drawings are schematic in nature and are not necessarily complete. Provide all piping, fittings, and accessories necessary for the proper operation of the equipment and services requiring such piping.

1.2 REFERENCES

- A. ASTM (American Society for Testing and Materials):
- B. D-1784: Standard Specification for Rigid Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVC) Compounds
- C. D-1785: Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120
- D. D-2466: Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
- E. D-2467: Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
- F. D-2672: Standard Specification for Joints for IPS PVC Pipe using Solvent Cement
- G. D-2855: Standard Practice for Making Solvent Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings
- H. F-1498: Standard Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings
- I. F-402: Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
- J. F-437: Standard Specification for Threaded Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
- K. F-441: Standard Specification for Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe,

Schedules 40 and 80

- L. ASME/ANSI (American Society of Mechanical Engineers / American National Standards Institute):
- M. B16.5: Flanges and Flanged Piping
- N. B1.20.1: National Pipe Thread Taper - Pipe Thread Dimensions
- O. NSF/ANSI (National Sanitation Foundation/American National Standards Institute):
- P. Standard 14: Plastic Piping Systems Components and Related Materials
- Q. Standard 61: Drinking Water Systems Components – Health Effects

1.3 SYSTEM DESCRIPTION

- A. Piping shall be suitable for use with the following services:
 - 1. Non-potable water,
 - 2. Potable water,
 - 3. Polymer,
 - 4. Acid polymer solution.

1.4 QUALITY ASSURANCE

- A. The manufacturer must have adequate equipment and quality control facilities to ensure that each extrusion of pipe is uniform in texture, dimensions, and strength. Test and inspect all pipe for all requirements of the latest ASTM and Commercial Standard tests and provide certified copies of test reports for each shipment to the Engineer prior to installation of pipe.
- B. For each length of pipe and fitting, mark each piece with the following data:
 - 1. Nominal Size
 - 2. Type and grade of material and ASTM standard.
 - 3. SDR, class, or schedule rating
 - 4. Manufacturer
 - 5. National Sanitation Foundation’s seal of approval
- C. Install all new materials.

1.5 SCHEDULING

- A. Coordinate all work.

1.6 RELATED WORK

- A. Valves and Appurtenances in Section 33 35 00.
- B. Operation and maintenance manuals included in Section 01 78 23.
- C. Submittals Section 01 33 00.

1.7 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01 33 00, copies of all materials required to establish compliance with this Section. Submittals shall include the following:
 - 1. Piping layouts as required and material schedule.
 - 2. Descriptive literature cut sheets and/or catalogues.
 - 3. Operation and maintenance materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. PVC piping shall be as manufactured by United States Plastic Corporation or approved equal.
- B. PVC tubing shall be NYLOBRADE, braid-reinforced PVC hose as manufactured by New Age Industries, Inc. or approved equal.

2.2 PVC AND CPVC PIPING

- A. General:
 - 1. Provide Schedule 80 pipe and fittings, unless noted otherwise.
 - 2. Furnish materials in full compliance to following material specifications:
 - a. PVC: Type 1, Grade 1 (12454-B) Polyvinyl Chloride per ASTM D1784.
 - b. CPVC, Type IV, Grade 1, Chlorinated Polyvinyl Chloride per ASTM D178 and F441.
 - c. Manufacture pipe, fittings and valves from materials that have been tested and approved for conveying potable water by the National Sanitation

Foundation (NSF).

B. Joints:

1. Pipe 2 IN and less to be solvent welded.
2. Pipe larger than 2 IN may be either flanged or solvent welded unless shown otherwise on Drawings.
3. Provide joint solvent cement specifically formulated for use with the chemicals being transported. Provide IPS 724 solvent cement or equal.

C. Fittings:

1. PVC: ASTM D2467 PVC socket type fittings having the same pressure and temperature rating as the pipe.
2. CPVC: ASTM D1784 CPVC socket type fittings having the same pressure and temperature rating as the pipe.

D. Flanges/Unions:

1. Furnish flanges and unions at locations shown on Drawings.
2. Provide either flanges or unions at valves, penetrations through structures and equipment connections.
3. For pipe larger than 2 IN, provide 150 LB socket type PVC or CPVC flange.
4. For pipe 2 IN and less, provide socket type PVC or CPVC union with O-rings.
5. Use flat, full faced gaskets at flanged connections.
 - a. Furnish heavy hex head bolts, each with one heavy hex nut, ASTM F593 Type 316 stainless steel.
6. Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.

E. Flexible Couplings:

1. Provide flexible couplings at locations shown on the Drawings and required for pipe flexibility and expansion/contraction purposes.
2. Unless otherwise specified, provide rubber expansion joints as manufactured by General Rubber Corporation or equal.

2.3 PVC TUBING

- A. PVC tubing shall be made from non-toxic raw materials that conform to Food and Drug Administration (FDA) standards. It shall be NSF 61 listed. It shall have a Tensile Strength of 2500 psi.
- B. Braid Reinforced Clear PVC Tubing shall be NSF Listed for potable water (NSF-61). The open mesh polyester braiding permanently encapsulated in walls of clear, flexible PVC tubing. The interior shall be smooth permitting flow, the tubing shall be clear to see visually flow, and tubing shall be corrosion and abrasion resistant with flexibility similar to rubber. The tubing shall have the following Physical Properties:

Hardness, Shore A \pm 5	80
Tensile Strength, psi	2500
Elongation at Break, %	300
Brittle Temperature	-50°F
Max. Operating Temperature	175°F
Max. Operating Temp. for NSF	140°F

PART 3 EXECUTION

3.1 INSTALLATION

- A. Employ installation and pipe support practices and solvent welding in compliance with manufacturers recommendations.
- B. Testing
 - 1. PVC tubing and piping shall be hydraulically tested to a maximum of 150% of the designed working pressure.

3.2 SUPPORTS

- A. Unless noted otherwise, continuously support PVC piping at liquid temperatures in excess of 100 degrees F.
- B. Support PVC and CPVC piping per manufacturers design and engineering guidelines.

3.3 REPAIR/RESTORATION

- A. Repair all defective work.

3.4 FIELD QUALITY CONTROL

- A. Provided documentation of all testing.

3.5 CLEANING

- A. Clean all piping upon completion of installation.

END OF SECTION

**SECTION 40 05 59
ALUMINUM STOP GATES**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install and ready for operation aluminum stop gates as shown on the Contract Drawings and as specified herein.

1.2 SUBMITTALS

- A. Provide the following information to confirm compliance with the specification in addition to the submittal requirements specified in Section 01 30 00.
 - 1. Complete description of all materials including the material thickness of all structural components of the frame and slide.
 - 2. Installation drawings showing all details of construction, details required for installation, dimensions and anchor bolt locations.
 - 3. Maximum bending stress and deflection of the slide under the maximum design head.
 - 4. The location of the company headquarters and the location of the principle manufacturing facility. Provide the name of the company that manufactures the equipment if the supplier utilizes an outside source.
- B. Provide O & M Manuals – Section 01 78 23.

1.3 QUALITY ASSURANCE

- A. Qualifications
 - 1. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 20 years' experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects.
 - 2. The specification is based on the Whipps 500 Series Aluminum Stop Gate manufactured by Whipps.

PART 2 EQUIPMENT

2.1 GENERAL

- A. Gates shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings. Refer to the gate schedule.

- B. Leakage shall not exceed 0.1 gpm/ft of wetted seal perimeter in seating head and unseating head conditions.
- C. The gate shall utilize self-adjusting seals. Gates that utilize adjustable wedges or wedging devices are not acceptable.
- D. All structural components of the frame and slide shall be fabricated of aluminum having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
- E. All welds shall be performed by welders with AWS certification.
- F. Finish: Mill finish on aluminum. All aluminum in contact with concrete shall be field coated by the CONTRACTOR with a heavy coat of bitumastic paint. Welds shall be cleaned to provide a uniform finish.
- G. Materials:

Components

Frame Guides and Invert
Slide and Stiffeners
Anchor Studs, Fasteners and Nuts
Invert Seal
Seat/Seal and Facing

Materials

6061-T6 Aluminum
6061-T6 Aluminum
Stainless Steel, Type 316, ASTM A276
Neoprene ASTM D-2000 or EPDM
Ultra-High Molecular Weight Polyethylene
ASTM D4020

2.2 FRAME

- A. The frame guides and invert member shall be constructed of extruded aluminum with a minimum thickness of 1/4-inch.
 - 1. Frame design shall allow for embedded mounting or mounting directly to a wall with stainless steel anchor bolts and grout. Mounting style shall be as shown on the Contract Drawings.
 - 2. A rigid aluminum invert member shall be provided across the bottom of the guides. The invert member shall be of the flush bottom type.

2.3 SLIDE

- A. The slide and reinforcing stiffeners shall be constructed of aluminum plate with a minimum thickness of 1/4-inch.
 - 1. The slide shall not deflect more than 1/360 of the span or 1/16 inch, whichever is smaller, under the maximum design head.

2. Reinforcing stiffeners shall be welded to the slide and mounted horizontally.
3. An aluminum lifting handle shall be welded to the top of the slide. Stop gates with widths in excess of 24 inches shall be provided with dual lifting handles.

2.4 SEALS

- A. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification.
 1. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
 2. All stop gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member of the frame, or the bottom of the slide and it shall be held in place with stainless steel attachment hardware.
 3. The seal system shall be durable and shall be designed to accommodate frequent operation without loosening or suffering damage.
 4. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit and/or held in place with adhesives are unacceptable.
 5. The seals shall be mounted so as not to obstruct the water way opening.

2.5 ANCHOR BOLTS

- A. Anchor bolts shall be provided by the gate manufacturer for mounting the gates.
 1. Quantity and location shall be determined by the gate manufacturer.
 2. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts.
 3. Anchor bolts shall have a minimum diameter of 1/2-inch.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation of the gates and appurtenances shall be done in a workmanlike manner. It shall be the responsibility of the Contractor to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.
- B. The contractor shall review the installation drawings and installation instruction prior to installing the gates.

- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. The contractor shall fill the void in between the gate frame and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.

3.2 FIELD TESTING

- A. After installation, all gates shall be field tested in the presence of the Engineer and Owner to ensure that all items of equipment are in full compliance with this Section. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting.

END OF SECTION

**SECTION 40 05 60
ALUMINUM SLIDE GATES**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish gates and appurtenances in accordance with the latest edition of AWWA C562 Standard for Fabricated Aluminum Slide Gates as modified herein.
- B. Refer to the Gate Schedule on the drawings for details.

1.2 QUALITY ASSURANCE/QUALIFICATIONS

- A. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 10 years of experience designing and manufacturing water control gates.
- B. The manufacturer's shop welds, welding procedures, and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX or AWS D1.2 Structural Welding Aluminum.
- C. The specification is based on the aluminum slide gate manufactured by Rodney Hunt, Inc of Orange, MA.

1.3 RELATED WORK

- A. Submittals in Section 01 33 00.
- B. Testing & Startup are included in Section 01 79 00.
- C. Manufacturer services and training included in Section 01 79 01.
- D. Miscellaneous metals are included in Section 05 10 00.
- E. Operation and maintenance manuals included in Section 01 78 23.
- F. Delivery, Storage and Handling is included in Section 01 45 34.

1.4 SUBMITALS

- A. Submit the following per Section 01 33 00:
 - 1. Drawings with dimensions, elevations and details.
 - 2. Cut sheets.
- B. Setting plans with tolerances for anchor bolts.

- C. Supplied tools and spares.
- D. Weights and lifting points of all equipment and subassemblies.
- E. Identify any special handling requirements.
- F. Field-testing procedures.
- G. Submit manufacturers certificate of installation per Section 01 33 00.

1.5 WARRANTY

- A. The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or part which has been altered, applied, operated, or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence, or accident.

PART 2 PRODUCTS

2.1 GENERAL

- A. Each slide gate will be manufactured as detailed here and will be supplied fully tested as per requirements. To the maximum extent possible, the gate assembly comprising of frame, guides and slide will be supplied as a factory assembled unit and shipped to site ready to install on the wall thimble or wall.
- B. The aluminum slide gates will be manufactured in accordance with AWWA C-562.
- C. The gate manufacturer will be Rodney Hunt, Inc. , Whipps or equal.
- D. The slide gates will be designed for water tightness for both seating and un-seating differential head per the actual site requirement as detailed in the Gate Schedule.
- E. The slide gates will be shop tested to verify the leakage performance at operating head in the un-seating direction. Where sealing configuration permits, hydrostatic testing will be conducted at 1.5 times operating head, to demonstrate structural integrity. Testing for opening load at the unseating operating head to verify actuating mechanism sizing will also be conducted.
- F. The slide gates will be of rising stem type unless site geometry prohibits it. Operation will be by means of a manual hoist, electric actuator or hydraulic cylinder as detailed in the Gate Schedule.

- G. The slide gate will be supplied complete with all accessories such as:
- a. gate assembly.
 - b. gasket.
 - c. studs and nuts for mounting.
 - d. stem.
 - e. thrust nut.
 - f. stem couplings.
 - g. stem guides.
 - h. Pedestal.
 - i. operating mechanism as required.
 - j. gate opening indicating arrangement.
- H. The allowable leakage rate for the aluminum gates in this specification shall be 1/2 the allowable leakage listed in the latest revision of AWWA C562, 0.05 gpm/ft of wetted seal perimeter in seating head and unseating head conditions.
- I. All structural components of the frame and slide shall be fabricated of aluminum having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
- J. All welds shall be performed by welders with AWS certification for the material grades used in fabrication.

2.2 FINISH

- A. Mill finish on aluminum.
- B. Welds shall be cleaned by buffing or brushing. Aluminum in contact with concrete or cementitious grout shall be coated with epoxy paint to provide isolation.
- C. All iron and steel components shall be properly prepared, and shop coated with a primer.

2.3 FRAME

- A. The frame assembly, including the guide members, invert member and yoke members, shall be constructed of shapes with a minimum thickness of 1/4-inch for all wetted members.

- B. Frame design shall allow for embedded mounting, mounting directly to a wall with stainless steel anchor bolts and grout or mounting to a wall thimble with stainless steel mounting studs and a mastic gasket material. Mounting style shall be as shown on the Contract Drawings.
- C. All wall mounted or wall thimble mounted gates shall have a flange frame. Flat frame gates are not acceptable.
- D. Gussets shall be provided as necessary to support the guide members in an unseating head condition.
- E. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening gates or downward opening weir gates.
- F. On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide.
- G. A rigid aluminum invert member shall be provided across the bottom of the opening. The invert member shall be of the flush bottom type on upward opening gates.
- H. A rigid aluminum top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.
- I. A rigid aluminum member shall be provided across the invert of the opening on downward opening weir gates.

2.4 SLIDE

- A. The slide and reinforcing stiffeners shall be constructed of aluminum plate and shapes. All structural components shall have a minimum thickness of 1/4-inch.
- B. The slide shall not deflect more than 1/360 of the span or 1/16 inch, whichever is smaller, under the maximum design head.
- C. Reinforcing stiffeners shall be stitch welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement.
- D. The stem connector shall be constructed of two angles or plates. The stem connector shall be continuously welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

2.5 SEALS

- A. All gates shall be provided with a self-adjusting seal system to restrict leakage in

accordance with the requirements listed in this specification.

- B. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
- C. The seat/seals shall extend to accommodate the full height of the slide in all positions.
- D. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member, or the bottom of the slide and it shall be held in place with stainless steel attachment hardware.
- E. All downward opening weir gates shall be provided with UHMW polyethylene seat/seals across the invert member.
- F. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
- G. All seals must be bolted or otherwise mechanically fastened to the frame or slide.
- H. The seals shall be mounted so as not to obstruct the water way opening.
- I. The seal system shall have been factory tested to confirm negligible wear (less than 0.01”) and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

2.6 OPERATING STEM

- A. The slide gates will be supplied with rising type operating stems unless non-rising stems are required by installation geometry.
- B. The stem will be supplied with ACME full or stub threading. The stem will be designed to allow for elevation deviations of up to 2” The stem shall be constructed of solid stainless-steel bar for the entire length, the metal having a tensile strength of not less than 90,000 psi for stems that are 3 inches or less in diameter. Stems that are in excess of 3 inches in diameter shall have a tensile strength of 85,000 psi.
- C. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
- D. The design of stem will be per the provision in AWWA C-562. The L/r ratio will not exceed 200. For buckling, Euler’s formula will be used with an end condition of 2.0. For threaded sections, the radius of gyration will be based on the minor diameter. At the stem design load as follows, the yield strength of the material will not be exceeded.
- E. As a minimum for manual hoists, the stem design load is the load produced with a 100 pound effort on the crank or handwheel.

- F. For electric actuators, the stem design load is the greater of the load produced with a 100 pound handwheel effort and 1.50 times the load produced at a locked rotor condition.
- G. For hydraulic actuation, the stem design load will be 1.25 times the thrust produced at system relief pressure.
- H. Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be threaded and bolted to the stems.
- I. Stems shall be provided with adjustable stop collars to prevent over closing of the slide.

2.7 STEM GUIDES

- A. Stem guides will be provided as required to meet the stem design criteria.
- B. Wall mounted stem guides will be adjustable in two directions, providing at least 0.50” of adjustment in both directions. Wall brackets will be stainless steel.
- C. Wall mounted stem guides will have machine bored, split bushings to facilitate erection. Bushings will be bronze or UHMWPE. Stem guides mounting at the base of the pedestal do not require adjustment.

2.8 MANUAL OPERATOR MECHANISMS

- A. Unless otherwise shown in the Drawings, gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the yoke of self-contained gates or on the pedestal of non-self-contained gates.
- B. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb. effort when the gate is in the closed position and experiencing the maximum operating head.
- C. An arrow with the word “OPEN” shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
- D. Handwheel operators shall be fully enclosed and shall have a cast aluminum or ductile iron housing.
- E. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
- F. Handwheel operators shall be equipped with roller bearings above and below the operating nut.
- G. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
- H. The handwheel shall be removable and shall have a minimum diameter of 15 inches.

- I. Crank-operated gearboxes shall be fully enclosed and shall have cast aluminum or ductile iron housing.
- J. Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
- K. Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
- L. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.
- M. Gears shall be steel with machined cut teeth designed for smooth operation.
- N. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.
- O. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
- P. The crank shall be cast aluminum or cast iron with a revolving nylon grip. The crank shall be removable.
- Q. All gates having widths in excess of 72 inches and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation. Interconnecting shafting shall be constructed of aluminum or stainless steel. Flexible couplings shall be provided at each end of the interconnecting shaft. One crank shall be provided to mount on the pinion shaft of one of the gearboxes. An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the crank or handwheel, on a non-gear operator, is located over 48 in above the operating floor. Chain wheels are not acceptable.
- R. A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets.
- S. The extended operator system shall lower the centerline of the pinion shaft to 36 in above the operating floor.
- T. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60 in or less above the operating floor.
- U. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
- V. The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36 in above the operating floor.

- W. Wall brackets shall be used to support floor stands where shown in the Drawings and shall be constructed of stainless steel.
- X. Wall brackets shall be reinforced to withstand compression at least two times the rated output of the operator with a 40 lb. effort on the crank or handwheel.
- Y. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.

2.9 STEM COVER

- A. Operators shall be equipped with polycarbonate plastic stem covers. The top of the stem cover shall be closed and vented. Gate opening indication will be provided on the stem cover for all non-rising stem gates. A full height scale will be mounted on the side of the stem cover and an indicator nut mounted on the rising stem to show gate position. The scale graduation will be 1". The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
- B. When shown on the Contract Drawings, provide 2-inch square nut, mounted in a floor box, with a non-rising stem. The square nut shall be constructed of stainless steel. The floor box shall be constructed of stainless steel or cast iron and shall be set in the concrete floor above the gate as shown.

2.10 WALL THIMBLES

- A. Wall thimbles shall be provided when shown in the Contract Drawings.
- B. The wall thimble depth shall be equal to the thickness of the concrete wall in which the thimble is to be mounted.
- C. Wall thimbles shall be fabricated stainless steel construction of adequate section to withstand all operational and reasonable installation stresses.
- D. Wall thimbles shall be constructed of 1/4-inch minimum thickness stainless steel and the front face shall have a minimum thickness of 1/4-inch.
- E. The fabrication process shall ensure that the wall thimble is square and plumb, and the front face is sufficiently flat to provide a proper mounting surface for the gate frame. The face of the wall thimble shall only be machined if recommended by the gate manufacturer. If the wall thimble is to be machined, the front face shall have a minimum thickness of 1/4-inch after machining.
- F. A water stop shall be welded around the periphery of the thimble. Wall thimbles shall be designed to allow thorough and uniform concrete placement during installation.
- G. Studs and nuts shall be stainless steel. Water stop may be stitch welded.

- H. A suitable gasket or mastic shall be provided to seal between the gate frame and the wall thimble. Electrical isolation between the thimble and gate frame shall be provided.

2.11 ANCHOR BOLTS

- A. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances.
- B. Quantity and location shall be determined by the gate manufacturer.
- C. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts.
- D. Anchor bolts shall have a minimum diameter of 1/2-inch.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation of the gates and appurtenances shall be done in a skillful manner. It shall be the responsibility of the CONTRACTOR to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.
- B. The CONTRACTOR shall review the installation drawings and installation instruction prior to installing the gates.
- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. The CONTRACTOR shall fill the void in between the gate frame and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.
- E. The CONTRACTOR shall add a mastic gasket between the gate frame and wall thimble (when applicable) in accordance with the manufacturer's recommendations.

3.2 FIELD TESTING

- A. After installation, all gates shall be field tested in the presence of the ENGINEER and OWNER to ensure that all items of equipment are in full compliance with this Section.
- B. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting. The effort to open and close manual operators shall be measured and shall not exceed the maximum operating effort specified above. smoothly and without interruption.
- C. Each gate shall be water tested by the CONTRACTOR, at the discretion of the ENGINEER and OWNER, to confirm that leakage does not exceed the specified allowable leakage.

3.3 FIELD TESTS /START-UP SERVICES

- A. Furnish the services of a factory representative, having complete knowledge of the operational and maintenance requirements of the system to instruct the Owner's personnel in the proper operation of the equipment. Provide (2) hours of training. Training may be scheduled concurrent with trip to site required for purposes of start-up.
- B. After the equipment in this Section has been completely installed, under the direction of the manufacturer's factory representative, conduct in the presence of the Engineer preliminary and pre-final testing in accordance with 01 79 00 to ensure that all equipment conforms to this Section.
- C. If any part of the system does not meet the requirements specified, corrective measures shall be taken, and/or equipment shall be removed and replaced with equipment that satisfies the conditions specified. All expenses associated with field testing, including any corrective action, shall be borne by the Contractor.

END OF SECTION

**SECTION 40 24 00
PIPING SPECIALTIES**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide those piping specialties and miscellaneous accessories specified herein, shown on the Contract Documents or required for a complete and functional piping system.
 - 1. Required specialty items are not necessarily shown on the Drawings.
 - 2. Provide items required by code or standard industry practice. Also provide those items necessary to ensure the piping system operates as required.
 - 3. Locate specialty items where shown on the Drawings or as required to ensure they are accessible for control and maintenance.
- B. Related sections specified elsewhere:
 - 1. Submittals – Section 01 33 00.
 - 2. O & M Manuals – Section 01 78 23.

1.2 1.2 QUALITY ASSURANCE

- A. Comply with applicable portions of Section 01 40 00.
- B. Provide components that are the standard product of a manufacturer regularly engaged in the production of the required materials and equipment.
- C. Comply with applicable standards.
- D. Design to provide satisfactory performance under the specified operating conditions.

1.3 SUBMITTALS

- A. Comply with Section 01 33 00. Include the following information:
 - 1. Manufacturer’s catalog information that describes each item provided. Include:
 - a. Specifications
 - b. Catalogue information including descriptive literature.
 - c. A complete bill of materials that identifies all materials of construction.
 - 2. Special shipping, storage, protection, and handling instructions.

3. A list of manufacturer's recommended parts required to maintain the equipment for a period of one year, with current price information.
4. A list of special tools, materials, and supplies furnished with the equipment for use prior to and during startup, and for future maintenance.
5. Manufacturer's installation instructions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, handle, and store the equipment in accordance with Section 01 45 34.
- B. Handle components with equipment designed to prevent damage. Protect finishes, coatings, lubrication, etc.
- C. Store components off the ground. Protect from dirt and moisture and prevent foreign material from entering the ends.

PART 2 PRODUCTS

2.1 WALL CASTINGS

- A. Use wherever shown on the Contract Drawings and for all pipes 4-inches in diameter and larger passing through reinforced concrete walls with liquid on one side and a personnel area on the other side.
 1. Construct castings of cast iron or ductile iron.
 - a. Comply with ANSI A21.11, A21.15 or A21.51 as appropriate.
 - b. Provide double cement lining per ANSI A21.4.
 2. Use same diameter and wall thickness as the connecting piping.
 3. Provide flanges for interior connections and mechanical joint or push-on bells for exterior connections unless otherwise shown on the Drawings.
 4. Include water stop flange.
- B. Make the casting length as shown on the drawings or as required to make the piping connection, whichever is longer.
 1. Do not use flanges set flush with the wall face unless approved by the Engineer.
 2. If flush mounted casting is used, provide taps for bolts. Do not use studs.
- C. Install castings integral with the reinforced concrete wall. Do not box out the concrete so that the casting can be installed at a later date.

D. Manufacturers

1. American Cast Iron Pipe Company
2. U. S. Pipe and Foundry
3. Or approved equal.

2.2 PIPE SLEEVES

A. Use where shown on the Drawings or where approved by the Engineer.

1. Construct sleeves of minimum schedule 40 steel conforming to ASTM A53.
2. Include a continuously welded flange to prevent water migration and anchor the sleeve into the wall or floor.
3. Hot dip galvanizes the sleeve assembly after fabrication. Conform to ASTM A123.
4. Size the sleeve to pass both the pipe and insulation (where required). Use full thickness insulation and carry it completely through the sleeve. Also accommodate the mechanical sealing system specified below.
5. Use core drilled holes in existing walls rather than sleeves.

B. Seal the opening between the pipe and the sleeve with a modular mechanical sealing system. Caulking is not acceptable.

1. The sealing system shall consist of interlocking synthetic rubber links designed to completely seal the annular space between the pipe and the sleeve.
 - a. Seal against a head of 40 feet of water without leaks.
 - b. Provide fire rated service where necessary.
2. Use 316 stainless steel fasteners and corrosion resistant pressure plates under each bolt head.

C. Manufacturers

1. Thunderline Corporation.
2. Or approved equal.

2.3 FLANGE FILLERS

A. Construct of cast or ductile iron. Comply with ASTM A48 or A536 as applicable.

- B. Provide flat, beveled or reducing flanges as required by the piping system.
- C. Face both sides and drill flanges to comply with ANSI B16.1, Class 125.
- D. Provide extra length bolts to make the piping connection.

2.4 MECHANICAL COUPLINGS

- A. Provide where shown on the Drawings and where required to facilitate pipe disassembly and the removal of valves and other equipment.
 - 1. Size to match the outside diameter of the pipe ends to be joined. Allow at least ½-inch space between adjacent pipe ends to accommodate thermal expansion and contraction.
 - 2. Use transition couplings to join pipes of different outside diameters.
 - 3. Restrain all couplings in pressure piping as shown on the Drawings. Design to resist the force developed by the test pressures specified.
 - 4. Use fusion bonded epoxy lined and coated steel middle rings and followers. Comply with AWWA C213.
 - 5. Nuts and bolts
 - a. Zinc plated
 - b. High strength steel per AWWA C111 when used with cast iron and ductile iron couplings.
 - c. Type 304 stainless steel for submerged applications.
- B. Manufacturers
 - 1. Dresser
 - 2. Smith-Blair
 - 3. Or approved equal.
- C. Model Numbers

<u>Coupling Type</u>	<u>Dresser</u>	<u>Smith-Blair</u>
Flexible Coupling – Steel	38	411
Flexible Coupling – Ductile Iron	38 or 153	411
Transition Coupling	162	413
Flanged Coupling Adaptor – Steel	128	913

Flanged Coupling Adaptor – DIP	127 or 128	912
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2.5 SERVICE SADDLES

A. Construction

1. Ductile iron body conforming to ASTM A536. Provide fusion bonded epoxy coating for maximum corrosion protection. For PVC pipes, use Ford style brass saddle.
2. Use double bale type with bales, nuts and washers constructed of ASTM A108 carbon steel, electro-galvanized per ASTM B633.
3. Provide Buna N gasket.
 - a. Comply with NSF 61.
 - b. Seal up to the full pressure rating of the pipe on which it is installed.

B. Manufacturers

1. Dresser, Style 291.
2. Smith-Blair, Series 313 or 366.
3. Or approved equal.

2.6 QUICK DISCONNECTS

A. Provide a quick-connect coupling for the dry, pebble or granular type quicklime fill piping as shown on the Drawings.

1. Select and size to mate with male end coupling used by the lime supplier. Connection shall be leak free.
2. Provide dust cap. Secure dust cap to the coupler.

B. Manufacturers

1. OPW Engineered Systems
2. Ever-tite couplings by American Packing and Gasket Co.
3. Or approved equal.

2.7 INSULATING FLANGES, COUPLINGS, AND UNIONS

- A. Provide to prevent galvanic corrosion when two dissimilar metals are connected.
 - 1. Use screwed or soldered joint for piping 2-inches in diameter and smaller. Use flanged joint with bolt insulators and a dielectric gasket or an insulating coupling for pipelines 2-1/2 inches in diameter and larger.
 - 2. Select working pressure to be compatible with piping system.
- B. Manufacturers
 - 1. Epcos Sales, Inc.
 - 2. Capital Insulation Unions
 - 3. Smith-Blair
 - 4. Romac Industries, Inc.
 - 5. Or approved equal.

2.8 ESCUTCHEON PLATES

- A. Provide where exposed pipes pass through walls, partitions, floors, or ceilings in a finished area.
 - 1. May be one piece or split and stamped or solid as applicable.
 - 2. Use chrome plated brass or stainless steel for interior walls, partitions, and ceilings.
 - 3. Use rough chrome plated cast brass or cast nickel bronze alloy for floors and exterior walls.

2.9 PIPE MARKING TAPE

- A. Use detectable tape to mark the location of all underground utilities. Use for non-metallic pipe buried PVC.
 - 1. Use solid aluminum foil encased in a protective, high visibility, inert polyethylene plastic jacket.
 - 2. Color: Comply with APWA Uniform Color Code for Temporary Marking of Underground Utility Locations.
 - 3. Minimum size: 12-inches wide and 5.5 mils thick
 - 4. Identify the type of utility on the tape in minimum 1-inch high, permanent black

lettering imprinted continuously over entire length.

5. Joining clips: Tin or nickel coated. Provided by tape manufacturer.

B. Manufacturers:

1. Reef Industries – Terra “D”
2. Allen – Detectatape
3. Or approved equal.

2.10 EXPANSION JOINTS/FLEXIBLE PIPING CONNECTION

A. For ductile iron pipe:

1. Size as shown on Drawings.
2. Red Valve, General Rubber, or equal.
3. Flanged ends with inner tube, body and outer cover. Flanges to be ANSI B 16.5, Class 150 lb.
4. Body constructed of fabric and rubber compounds reinforced with steel wire.
5. Three arch design. Arch to be filled on all lines except NPW applications.
6. Retaining rings to be 304 stainless steel.
7. Provide joint control units. Number and size of rods and gusset plate shall be in accordance with the manufacturer’s recommendations. Control units to be 304 stainless steel.

2.11 WASHDOWN HOSE

- A. Hose shall be 1" I.D. reinforced rubber discharge hose. The hose shall provide high resistance to abrasion, aging and weathering. All hose materials shall be mildew and moisture resistant. Hoses shall remain flexible under all conditions. Hose couplings shall be compatible with supply connection and nozzles. Couplings adapters shall be provided where necessary. Hose shall be Goodyear Plicord, Eaton or equal. Epcos Sales, Inc.
- B. Nozzles: Each hose shall be provided with a nozzle. Nozzles shall be rugged brass of the combination fog and straight stream type. The nozzle stream shall be adjustable for washing tank walls. The nozzle shall have stream-shaping teeth for even flow distribution.
- C. Hose Reels: Hose reels shall be provided for each hose. Hose reels shall be provided with a hand crank. The hose reel shall be capable of containing the entire length of hose

specified. Hose reels shall be Coxreels Model 1175-6-100 or equal. Contractor to mount hose reel to wall or slab.

2.12 PIPE SADDLE

- A. Saddle shall be a double strap saddle with brass body, brass straps and grade 60 nitrile rubber (Buna-N) gaskets. Saddles shall be Ford Meter Box Company Style 202B or equal.

2.13 WATER METER

- A. Provide a Sensus OMNI C2 or equal water meter consisting of two basic assemblies: the maincase and the measuring chamber. The measuring chamber assembly includes the floating ball impeller with a coated titanium shaft, hybrid axial bearings, integral flow straightener, and an electronic programmable register with protective bonnet. The maincase is made from ductile iron with an approved NSF epoxy coating. Maincase shall be equipped with a high-pressure O-ring, testing port and an AWWA compliant strainer.
- B. Magnetic Drive: Meter registration is achieved by utilizing a fully magnetic pickup system. This is accomplished by the magnetic actions of the embedded rotor magnets and the ultra-sensitive register pickup probe. The only moving component in water is the floating ball impeller.
- C. Measuring Element: The hydro-dynamically balanced impeller floats between the bearings. The floating ball technology allows the measuring element to operate virtually without friction or wear, thus creating the extended upper and lower flow ranges.
- D. Strainer: The AWWA compliant “V” shaped strainer uses a stainless steel screen along with floating ball technology. A removable strainer cover shall be provided to allow access to the screen for maintenance.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install each of the items specified above, including appurtenances, in accordance with the instructions of the manufacturer and in accordance with the Contract Documents.
- B. List additional requirements, if applicable.

END OF SECTION

**SECTION 40 71 69
PARSHALL FLUME**

PART 1 GENERAL

1.1 SCOPE

- A. The work to be done under this Section consists of furnishing all material and equipment and performing all labor necessary to install new fiberglass Parshall flume as indicated on the Contract Drawings and/or as specified herein.

1.2 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures
- B. Section 01 78 23 Operating and Maintenance Data
- C. Section 26 00 00 Electrical

1.3 APPROVED SUPPLIERS

- A. Tracom, Warminster.
- B. The basis of design for this project is Tracom.

1.4 SUBMITTALS

- A. The following information shall be submitted for review in accordance with Section 01 33 00:
 - 1. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions and materials of construction by specification reference.

PART 2 EQUIPMENT

- A. Flume Type:
 - 1. Size: 9-inch.
- B. Construction:
 - 1. One-piece construction.
- C. Materials:
 - 1. Fiberglass reinforced plastic.
 - 2. Gloss inside surfaces, free of irregularities.

3. Minimum 3/16 inch wall thickness.
4. Minimum 30% glass by weight.
5. Isophthalic polyester resin.
6. Removable pultruded fiberglass bracing at top of flume with T-304 stainless steel hardware.
7. 2-inch (minimum) top and end stiffening flanges.
8. Molded-in stiffening ribs, maximum 12-inch center to center spacing.
9. 15 mil Isophthalic U.V. resistant gel coat on all surfaces, white interior, grey exterior.
10. Anchor clips, pre-drilled with a 3/4 inch hole, pultruded fiberglass construction.
11. Tensile strength (ASTM D 638): 14,000 PSI.
12. Flexural strength (ASTM D 790): 27,000 PSI.
13. Flexural modulus (ASTM D 790): 1,000,000 PSI.

D. Accessories:

1. Laminated, high visibility staff gauge:
 - a. Graduated in 1/10 foot and MGD increments.
2. Ultrasonic mounting bracket:
 - a. Horizontally and vertically adjustable stainless steel.
 - b. Ultrasonic device (provided and installed by Contractor).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that the flume dimensions are correct and project conditions are suitable for installation. Do not proceed with installation until condition deficiencies have been corrected.

3.2 INSTALLATION

- A. Install products in accordance with vendor recommendations.

1. Ensure that the product is installed plumb and that the upstream floor is level. Set the flume at the elevation indicated on the engineer's drawings.
2. Embed the flume in concrete or grout; pour concrete or grout in maximum 6 inch lifts; internally line and brace the flume as necessary to ensure bowing or distortion does not occur.
3. Clean surfaces in accordance with the manufacturer's instructions.
4. Remove trash and debris and leave the site in a clean condition.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Refer to Section 01 79 01.
- B. The Manufacturer's field service technician shall check the installation of the equipment, assist in the start-up, and provide training on the maintenance of the equipment. A minimum of two (2) trips, and a total of two (2) days on the site shall be provided, exclusive of travel time.

3.4 FIELD TESTS

- A. Refer to Section 01 79 00.
- B. Complete System Commissioning and Training. Refer to Sections 01 79 00 and 01 79 01.
- C. If the performance of any part of the system does not meet the requirements specified, corrective measures shall be taken, and equipment shall be removed and replaced with equipment that satisfies the conditions specified. All expenses associated with field testing, including any corrective action, shall be borne by the Contractor.

END OF SECTION

**SECTION 40 72 14
ULTRASONIC LEVEL TRANSMITTER (4 WIRE)**

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

- A. The Contractor shall furnish all labor, equipment and materials required to install, test and place into satisfactory operation, the ultrasonic level transmitters listed below:
 - 1. LAS Parshall Flume
 - a. Central City Pump Station Flow
 - b. Parshall Flume

1.2 QUALITY ASSURANCE

- A. The equipment and materials to be furnished under this Contract shall be new and of first quality.
- B. The manufacturer of each piece of equipment shall be responsible for furnishing, supervising installation, testing, calibration and start-up of the systems.
- C. The manufacturer shall verify that the level transmitters being furnished are compatible with the intended chemicals.

1.3 SUBMITTALS

- A. Submit product data.

1.4 SPARE PARTS

- A. One complete set of spare parts as recommended by manufacturer for each installation shall be furnished.

1.5 WARRANTY

- A. A period of one (1) year commencing upon equipment acceptance by the OWNER and Engineer.
- B. The warranty shall cover all equipment, components and systems provided with each control system.
- C. The warranty shall provide for replacement and/or repair of faulty or defective components at no cost to the OWNER during the WARRANTY period.
- D. Where deemed necessary, the manufacturer will be responsible for the labor of removal

and reinstalling the defective or faulty components without cost to the OWNER.

PART 2 PRODUCTS

2.1 ULTRASONIC LEVEL – 4 WIRE

- A. Type: Microprocessor based ultrasonic level transmitter. Unit shall have input or output filter capability.
- B. Sensor: Sensors shall have minimum 26 foot range, unless noted otherwise, and shall be supplied with sufficient cable length for arrangement indicated. Sensor shall have a NEMA 4X (minimum) enclosure. Unit shall be supplied with automatic temperature compensation as required below. Sensor face material shall be Kynar or Teflon as required.
- C. Accuracy: ± 1.0 percent of calibrated range or better for ranges greater than 25-inches (with temperature compensation).
- D. Output: Isolated 4-20 mA DC into loop loads of 0 to 500 ohms (minimum), two (2) Form “C” Relay Contacts rated at 5A, 250 VAC, non-inductive.
- E. Enclosure: NEMA 4X, polycarbonate or fiberglass.
- F. Power Supply: 120 VAC
- G. Mounting: Handrail
- H. UV Protection: Provide a rubber flap over LCD display to protect from sunlight
- I. The transmitter shall include algorithms for a Parshall flume, v-notch weir, and Palmer Bowlus flume.
- J. The transmitter shall include Hart protocol.
- K. Stainless Steel tags.
- L. Acceptable Manufacturers: Pulsar, Endress Hauser, or Siemens-Milltronics.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Devices shall be installed in accordance with Manufacturer’s instructions.
- B. Instrument Tagging: Provide stainless steel tag with loop numbers on sensor & transmitter.

3.2 START-UP SERVICE

- A. Provide manufacturer’s Field Service Technician (certified, factory trained) for a minimum of one 4-hour day on site. Field Service Technician shall calibrate instruments, check all installed equipment, perform initial start-up, make all tests, adjustments and related items as required to ensure that the flow meters are performing and operating as specified and required, and train operators in daily operational procedures, O & M, trouble shooting, and computer operations.
- B. Field Service Technician will verify installation is in accordance with Drawings, Specifications and as instructed by manufacturer. The technician will schedule site visits at scheduled points of construction completion, coordinated with Contractor, to ensure proper installation of equipment, structures and facilities. Technician will coordinate with other manufacturers Field Service Technicians as required.
- C. Field Service Technician will instruct Owner’s personnel in operational, maintenance and troubleshooting procedures.

3.3 CERTIFICATION OF INSTALLATION

- A. Upon completion of the installation, the manufacturer shall furnish a certificate of compliance detailing that the instruments and materials have been installed and calibrated in accordance with the manufacturer’s instructions.
- B. An operational and maintenance manual shall be provided in accordance with 01 33 00.

END OF SECTION

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**SECTION 40 72 17
SUBMERGED LEVEL TRANSMITTER**

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

- A. The Contractor shall furnish all labor, equipment and materials required to install, test and place into satisfactory operation, the ultrasonic level transmitters listed below:
 - 1. Central City Pump Station 1
 - 2. Post Equalization Tank

1.2 QUALITY ASSURANCE

- A. The equipment and materials to be furnished under this Contract shall be new and of first quality.
- B. The manufacturer of each piece of equipment shall be responsible for furnishing, supervising installation, testing, calibration and start-up of the systems.
- C. The manufacturer shall verify that the level transmitters being furnished are compatible with the intended chemicals.

1.3 SUBMITTALS

- A. Submit product data.

1.4 SPARE PARTS

- A. One complete set of spare parts as recommended by manufacturer for each installation shall be furnished.

1.5 WARRANTY

- A. A period of one (1) year commencing upon equipment acceptance by the OWNER and Engineer.
- B. The warranty shall cover all equipment, components and systems provided with each control system.
- C. The warranty shall provide for replacement and/or repair of faulty or defective components at no cost to the OWNER during the WARRANTY period.
- D. Where deemed necessary, the manufacturer will be responsible for the labor of removal and reinstalling the defective or faulty components without cost to the OWNER.

PART 2 PRODUCTS

2.1 SUBMERGED LEVEL TRANSMITTER

- A. Instrument Function: Level Measurement
- B. Instrument Description: Submerged Level Transmitter - Wastewater
- C. Power Supply: 10-30 VDC
- D. Signal Output: 4 to 20 milliamperes
- E. Process Connection: Submerged, suspended
- F. Product Requirements:
 - 1. Sensor/Transmitter: Accuracy of 0.10% of full scale and operating temperature from -40°F to 185°F. Provide cable length to reach remote mounted transmitter or junction box without splicing. Diaphragm technology- Ceramic.
 - 2. Manufacturers:
 - a. Flygt LTU-801
 - b. Accepted equal.
- G. Execution:
 - 1. Installation: Install in accordance with manufacturer's instructions.
 - 2. Manufacturer to provide sensor/transmitter, full length cables.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Devices shall be installed in accordance with Manufacturer's instructions.

3.2 START-UP SERVICE

- A. Provide manufacturer's Field Service Technician (certified, factory trained) for a minimum of one 4-hour day on site. Field Service Technician shall calibrate instruments, check all installed equipment, perform initial start-up, make all tests, adjustments and related items as required to ensure that the sensor is performing and operating as specified and required, and train operators in daily operational procedures, O & M, trouble shooting, and computer operations.
- B. Field Service Technician will verify installation is in accordance with Drawings, Specifications and as instructed by manufacturer. The technician will schedule site visits at

scheduled points of construction completion, coordinated with Contractor, to ensure proper installation of equipment, structures and facilities. Technician will coordinate with other manufacturers Field Service Technicians as required.

- C. Field Service Technician will instruct Owner's personnel in operational, maintenance and troubleshooting procedures.

3.3 CERTIFICATION OF INSTALLATION

- A. Upon completion of the installation, the manufacturer shall furnish a certificate of compliance detailing that the instruments and materials have been installed and calibrated in accordance with the manufacturer's instructions.

END OF SECTION

**SECTION 43 25 00
SUBMERSIBLE WASTEWATER PUMPS**

PART 1 GENERAL

1.1 SCOPE

- A. The work to be done under this Section consists of furnishing all material and equipment and performing all labor necessary to install new submersible wastewater pumps as indicated on the Contract Drawings and/or as specified herein.
- B. This specification section covers both variable and constant speed submersible pumps. Controls panel for the pumps are included in this section.

1.2 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures
- B. Section 01 78 23 Operating and Maintenance Data
- C. Section 26 00 00 Electrical
- D. Section 31 23 00 Excavation & Fill for Pipeline.
- E. Section 31 23 34 Excavation & Fill for Structures.
- F. Section 33 31 00 Sanitary Utility Sewerage Piping
- G. Section 33 35 00 Process Valves and Appurtenances
- H. Section 33 39 00 Sanitary Utility Sewerage Structures

1.3 APPROVED SUPPLIERS

- A. Pumps and controls to be supplied by Xylem, Homa or approved equal.
- B. The basis of design for this project is Xylem.

1.4 SUBMITTALS

- A. The following information shall be submitted for review in accordance with Section 01 33 00:
 - 1. Submit pump manufacturer's catalog data, descriptive literature, and assembly drawings. Show dimensions and materials of construction by specification reference.

1.5 REQUIREMENTS

A. CENTRAL CITY PUMP STATION 1

1. Provide three (3) submersible non-clog wastewater pumps.
2. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The installed pump shall be supplied with a mating cast iron discharge connection. Each pump shall be fitted with lifting chain or stainless-steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

- | | |
|------------------------------|-----------------------------|
| a. Basis of Design | Flygt Model NP 3202 ht3~462 |
| b. Maximum RPM | 1770 |
| c. Minimum Shutoff Head, ft | 140 |
| d. VFD | Required |
| e. Outlet Size, inches | 6-inches, minimum |
| f. Motor Horsepower, HP | 45 HP, maximum |
| g. Motor Voltage, volts | 460 V |
| h. Motor Frequency, Hz60 Hz, | Variable speed |
| i. Phase, Poles | 3 Phase, 4 |
| j. Number of Pumps | 3 |

3. Duty Point Table for Pump Operation

Duty Point	GPM/pump	TDH, feet	Speed, Hz	Pump Efficiency
Condition 1 1- Pump	1670	65	60	70
Condition 2 2- Pump	1290	82	60	75.7
Condition 3 1-Pump	500	60	45	NA

B. SITE PUMP STATION

1. Provide two (2) submersible non-clog wastewater pumps.
2. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The installed pump shall be supplied with a mating cast iron discharge connection. Each pump shall be fitted with lifting chain or stainless-steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

- | | |
|-----------------------------|----------------------------|
| a. Basis of Design | Flygt Model NP 3153 HT~454 |
| b. Maximum RPM | 1800 |
| c. Minimum Shutoff Head, ft | 110 |
| d. Outlet Size, inches | 4-inches, minimum |
| e. Motor Horsepower, HP | 20 HP, maximum |
| f. Motor Voltage, volts | 460 V |
| g. Motor Frequency, 60 Hz, | Constant speed |
| h. Phase, Poles | 3 Phase, 4 |
| i. Number of Pumps | 2 |

3. Duty Point Table for Pump Operation

Duty Point	GPM/pump	TDH, feet	Speed, Hz	Pump Efficiency
Condition 1 1- Pump	650	75	60	73

PART 2 PRODUCTS

2.1 PUMP DESIGN

- A. The pump shall be automatically and rigidly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet well. Sealing of the pumping unit to the discharge connection shall be accomplished by machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring, or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

2.2 PUMP CONSTRUCTION

- A. Major pump components shall be of gray cast iron, ASTM A48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
- B. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.
- C. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease, or other devices shall be used.

2.3 COOLING SYSTEM

- A. Each unit shall be provided with an adequately designed cooling system. Thermal radiators integral to the stator housing cast in one unit are acceptable. Where water jackets alone or in conjunction with radiators are used, separate circulation shall be provided. Cooling media channels and ports shall be non-clinging by virtue of their dimensions. Provision for external cooling and flushing shall be provided as necessary.

2.4 CABLE ENTRY SEAL

- A. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary, using the same entry seal. The cable entry junction chamber and motor shall be separated by a terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

2.5 MOTOR

- A. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%.

- B. All units with variable speed operation, the motor shall be inverted duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws, or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.
- C. The motor service factor (combined effect of voltage, frequency, and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of $\pm 10\%$. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.
- D. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the control panel without the need for any splices. The outer jacket of the cable shall oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.
- E. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

2.6 BEARINGS

- A. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two-row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

2.7 MECHANICAL SEAL

- A. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationery and one

positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

- B. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.
- C. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.
- D. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.
- E. Seal lubricant shall be FDA Approved, nontoxic.

2.8 PUMP SHAFT

- A. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel, ASTM A479 S43100-T. Shaft sleeves will not be acceptable.

2.9 IMPELLER

- A. The impeller shall be of ASTM A-48, Class 35B gray iron dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt, and shall be coated with alkyd resin primer.

2.10 VOLUTE/SUCTION COVER

- A. The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of (ASTM A-48, Class 35B gray iron or ASTM A532 (Alloy III A) 25% chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

2.11 PROTECTION

- A. Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule and inspection.
- B. The thermal switches and float switch shall be connected to a Mini CAS control and status monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel.
- C. Provide watertight cables for thermal switches and leak sensor. The cables shall be of adequate length to reach the control panel without splicing.

2.12 CONTROL PANELS

- A. Provide and install one common control panel at each pump station location.
- B. Control panel enclosure:
 - 1. Enclosure shall be a 14 gauge, NEMA 4X rated enclosure manufactured from 304 stainless steel. The enclosures shall be a free-standing type (at Central City 1) and wall mounted type (at Site Pump Station) with a minimum depth of 12”, sized to adequately house all the components. The door gasket shall be rubber composition with a retainer to assure a positive weatherproof seal. The door shall open a minimum of 180 degrees.
 - 2. A polished, aluminum dead front shall be mounted on a continuous aircraft type hinge. It shall contain cutouts for mounted equipment, and provide protection for personnel from live, internal wiring. Cutouts for breaker handles shall be provided to allow operation of breakers without entering the compartment. All control switches, indicator pilot lights, elapsed time meters, duplex receptacle, and other operational devices shall be mounted on the external surface of the dead front. The dead front shall open a minimum of 150 degrees to allow access to equipment for

maintenance. A 3/4” break shall be formed around the perimeter of the dead front to provide rigidity.

3. The back plate shall be manufactured of 12-gauge steel and be finished with a primer coat and two (2) coats of baked on, white enamel. All hardware mounted to the subpanel shall be attached with machine thread, tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified.
4. The panel power distribution shall include necessary components and be completely wired stranded copper conductors rated at 90 degrees. All conductor terminations shall be as recommended by the device manufacturer.
5. Circuit breakers shall be heavy duty thermal magnetic or motor circuit protectors similar and equal to Square D Type FAL. Each motor breaker shall be adequately sized to meet the pump motor operating characteristics with minimum interrupting capacity of 35,000 A R.M.S. symmetrical at 480 volts. The control circuit shall be controlled by heavy duty breakers.
6. Circuit breakers shall be indicating type, providing “on-off-trip” positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating “trip.”
7. Thermal magnetic breakers shall be quick-make and quick-break on manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip.
8. Breakers shall be designed so that an overload on one pole automatically trips and opens all legs. Field installed handle ties shall not be accepted.
9. Motor starters or variable frequency drives shall be installed in their respective control panels. For VFD drive see electrical specification.
10. Include:
 - a. On-time delay relays to prevent multiple pumps from starting simultaneously.
 - b. Voltage monitor.
 - c. Ethernet/IP interface to transmit information to the plant SCADA.
11. Emergency High Level Alarm: Provide float-type level sensor for emergency high level.
12. The control system shall include, but not be limited to, the ancillary equipment listed below.
13. The alarm light shall be a weatherproof, shatterproof, red light fixture with a 40-

watt bulb to indicate alarm conditions. The alarm light shall be turned on by the alarm relay.

14. Each complete suppression unit shall be UL listed as a secondary surge arrester and bear CSA certification and meet ANSI/IEEE C62-11-1987; suitable for indoor and outdoor applications; suitable for use in service entrance location; meet requirements of NEC Article 280; rated at 650V phase-to-ground maximum.
15. Control transformers shall be provided to produce the 120 VAC and/or 24 VAC for control circuits. Transformers shall be fused on the primary and secondary circuits. The secondary circuits shall be grounded.
16. A line voltage rated, adjustable phase monitor shall be installed to sense low voltage, loss of power, reverse phase, and loss of phase. Control circuit shall de-energize upon sensing any of the faults and shall automatically restore service upon return to normal power.
17. For the Central City 1 pump station control panel include dry contacts for “Pump #1 Fail”, “Pump #2 Fail”, “Pump # 3 Fail” , High- High Level Alarm”, “Pump #1 Run”, “Pump #2 Run”, “Pump #3 Run”.
18. For the Site Pump station control panel include dry contacts for “Pump #1 Fail”, “Pump #2 Fail” , Hi-Level Alarm”, “Pump #1 Run”, “Pump #2 Run”.
19. A final, “As-built” drawing encapsulated in mylar shall be attached to the inside of the front door. A list of all legends shall be included.
20. All component parts in the control panel shall be permanently marked and identified as they are indicated on the drawing. Marking shall be on the back plate adjacent to the component. All control conductors shall be identified with wire markers at each end, as close as practical to the end of the conductor.
21. All panels shall be tested to the power requirements as shown on the plans to assure proper operation of all components. Each control function shall be activated to check for proper indication.
 - a. Level Control System for the Central City 1 pump station: Pump starts, and discharge shall be controlled by a submersible transducer provided by the pump manufacturer. The controller shall be SC2000—44E as manufactured by MPE Electronics, Apopka, Florida or equal. The level transducer shall be provided to control the operation of the pumps under normal operation. A high, high-high and low-level float control type system shall be installed as a backup to the transducer system. The float system shall take over operation of the pumps in the event the transducer system fails. Floats shall incorporate simple relay circuit, 24 volts.
 - b. Level Control System for the Site pump station: Pump starts, and discharge

shall be controlled by float system. Floats shall incorporate simple relay circuit, 24 volts. Lead-lag pump operation with automatic alternation of lead and lag pumps. These pumps are connected to the emergency generator.

- c. Pump Monitor Relay: The MINI-CAS pump monitor relay shall provide motor over temperature and seal leakage alarms in one unit for Xylem Flygt submersible pumps equipped with FLS or CLS sensors. The MINI-CAS shall be capable of being powered by either 120VAC, 24VAC, or 24VDC, and shall provide relay contacts rated for 8 Amps at 120VAC.
- d. Float Switch: Mechanical float switches shall be supplied for level control and be suspended at the desired height from its own cable. The float switch case shall be made of polypropylene and the cable sheathed with a special PVC compound. The float switch cables shall be supplied with 40' of cable. Flygt 14-403222 ISR relays required.
- e. Level Transducer: The submersible transducer shall be MPE model LM with cable length and pressure range to suit installation. The submersible transducer shall be supplied with a transducer vent bellows (TVB1) to prevent moisture from entering the vent tube. Provide a two-stage surge suppressor circuit using both an MOV and TVS to provide high voltage transient protection for the transducer circuitry. A stainless steel diaphragm and silicone oil fill shall be provided.
- f. All equipment shall be guaranteed for a period of three (3) years from date of shipment. The guarantee is effective against all defects in workmanship and/or defective components. The warranty is limited to replacement or repair of defective equipment.
- g. The manufacturer shall be a UL listed shop for industrial control systems and shall serialize evidence of such on the control panel enclosure.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The pumping unit shall be leveled, plumbed, and aligned into position to fit the piping by the Contractor. Installation procedures shall be as recommended by the pump manufacturer.
- B. The pump base shall be grouted after initial fitting and alignment but before final bolting of the connection piping. After final alignment and bolting, pump connection shall be tested for applied stress by loosening the flange bolts. If any movement or opening of the joints is observed, piping shall be adjusted to ensure that piping stresses are not transmitted to the pump flanges.

3.2 MANUFACTURER’S FIELD SERVICES

- A. Refer to Section 01 79 01.
- B. The Manufacturer's field service technician shall check the installation of the equipment, assist in the start-up, and provide training on the maintenance of the equipment. A minimum of two (2) trips, and a total of two (2) days at the site shall be provided, exclusive of travel time.

3.3 FIELD TESTS

- A. Refer to Section 01 79 00.
- B. Complete System Commissioning and Training. Refer to Sections 01 79 00 and 01 79 01.
- C. If the performance of any part of the system does not meet the requirements specified, corrective measures shall be taken, and equipment shall be removed and replaced with equipment that satisfies the conditions specified. All expenses associated with field testing, including any corrective action, shall be borne by the Contractor.

END OF SECTION

**SECTION 46 21 13
MECHANICAL FINE SCREEN**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish and install one (1) fully automatic bar screen for collecting and removing debris from the incoming wastewater flow.
- B. The bar screen shall be provided complete with all accessories, spare parts, mounting anchor bolts, and other appurtenances as specified and as may be required for a complete operational system.
- C. It shall be the Contractor's responsibility to ensure that the mechanical bar screen and appurtenances furnished and installed shall be compatible with and have the necessary operating clearances to the structural elements and associated equipment shown on the Contract Drawings.
- D. The bar screen manufacturer shall provide the shaftless screw conveyor specified in Section 46 21 76 of these specifications.
- E. The main control panel for the bar screen shall include the main controls for the shaftless screw conveyor.

1.2 RELATED WORK

- A. Testing & Startup are included in Section 01 79 00.
- B. Manufacturer services and training included in Section 01 79 01.
- C. Miscellaneous metals are included in Section 05 10 00.
- D. Field painting is included in Section 09 91 00.
- E. Operation and Maintenance manuals included in Section 01 78 23.
- F. Delivery, Storage and Handling is included in Section 01 45 34.
- G. Shaftless Screw Conveyor in Specification Section 46 21 76

1.3 REFERENCES

- A. American Gear Manufacturers Association (AGMA)
- B. National Electrical Manufacturers Association (NEMA)

- C. American Federation of Bearing Manufacturers Association (AFBMA)
- D. American Society for Testing and Materials (ASTM)
- E. American Welding Society (AWS)
- F. Steel Structures Painting Council, American National Standards Institute (SSPC)
- G. Underwriters Laboratory (UL)

1.4 WARRANTY

- A. The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or part which has been altered, applied, operated, or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence, or accident.

1.5 SUBMITALS

- A. Shop Drawing Submittals shall include at least the following:
 - 1. Certified shop and erection drawings showing important details of construction dimensions, anchor bolt locations, and field connections.
 - 2. Descriptive literature, bulletins, and catalogs of the equipment, including details of the motor, gear reducer and lubrication points.
 - 3. Installation, operation, and start-up procedures including lubrication requirements.
 - 4. Motor Manufacturer's data sheets and drawings.
 - 5. Total weight of the equipment including the weight of the single largest item.
 - 6. A list of spare parts that are supplied with the equipment.
 - 7. Control panels wiring diagram, layout and materials of construction.
- B. Submit manufacturers certificate of installation per Section 01 33 00.
- C. Operation and maintenance manuals included in Section 01 78 23.

1.6 DESIGN REQUIREMENTS

- A. Number of Units (1)

B. Minimum Daily Flow	0.65 MGD each
C. Peak Hour Flow	3.6 MGD each
D. Flow Channel Width	3'-0"
E. Flow Channel Depth	6'-6"
F. Discharge Height EL.	764.50 (Minimum)
G. Channel Top EL.	760.50
H. Invert EL.	754.00
I. Bar Rack Spacing	1/4-inch
J. Setting Inclination	80 degrees from horizontal

1.7 STORAGE AND HANDLING OF EQUIPMENT

- A. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested, and finally accepted.
- B. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.
- C. Temporarily connect equipment with built in motor space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.
- D. The unit shall be erected and lubricated in strict accordance with the instructions of the Manufacturer's field engineer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers are Vulcan and Infilco.
- B. Model FT-36 "Severe Duty™ Mensch Crawler™ Screen" as manufactured by Vulcan Industries.
- C. Basis of design is Vulcan Industries, Inc.

2.2 GENERAL

- A. The equipment furnished shall positively clean and remove debris from the incoming

wastewater by means of a bar rack, installed in a concrete channel designed to retain debris and a traveling rake mechanism which removes and elevates the debris to a discharge mechanism. The bar rack shall be cleaned by a single rake engaging the bar rack from the upstream side at the bottom of the channel and removing the debris. The debris shall be lifted above the top of the channel and discharged through the downstream side to a shaftless screw conveyor.

- B. The mechanically cleaned bar screen system shall be fully automatic and shall consist of the following components:
 - 1. Bar Rack
 - 2. Frame, Supports and Guides
 - 3. Pin Racks
 - 4. Cog Wheels
 - 5. Dead Plate
 - 6. Drive Machinery
 - 7. Rake Assembly
 - 8. Discharge Chute
 - 9. Anchor Bolts
 - 10. Wiper Assembly
 - 11. Electrical Cable Assembly
 - 12. Electrical Controls and Control Panel
- C. In addition, any other components required to provide a system, which will be capable of fully performing the functions specified.
- D. All platforms, ladders or other safety devices required, as a part of this equipment design shall be in accordance with applicable OSHA regulations.
- E. The design shall be such to ensure that all Manufacturer recommended preventive maintenance to the raking mechanism can be accomplished at the operating floor level.
- F. No moving parts shall be located permanently below the channel water surface at maximum design flow. Only the cleaning rake head and rake arm shall enter the wastewater flow.
- G. The drive output shaft rotation shall be constant and in one direction during normal

operation in order to reduce maintenance requirements.

- H. All equipment shall be designed and built for 24-hour intermittent service and for moderate shock without overheating, excessive vibration, or strain.

2.3 FRAME ASSEMBLY

- A. The side frames shall be formed from plate with a minimum of four (4) engineered bends to form a rigid assembly capable of withstanding all operating forces when installed in accordance with Manufacturer's instructions.
- B. The frame shall be manufactured of 304 stainless steel plate, having a minimum thickness of 3/8-inch. The frame shall have a minimum width of 36-inches and extend fully from the bottom of the channel to the top of the bar screen assembly.
- C. Each side frame shall include a fixed roller track to guide and position the rake assembly. Separate roller tracks shall be provided for the drive shaft rollers and the guide shaft rollers. The fixed roller track shall be manufactured of 304 stainless steel.
- D. Two sets of access plates shall be provided on each side frame to allow personnel to remove and replace the guide shaft rollers and drive shaft rollers without the need to remove the rake assembly from the side frames.

2.4 RAKE ASSEMBLY

- A. A dual arm rake assembly shall be provided to remove the collected debris from the bar rack. The rake assembly shall consist of fixed upper rake arms and spring-loaded, lower rake arms that pivot to permit movement over lodged or excessively large objects during the raking cycle. Each upper and lower rake arm shall be connected through a two-pin linkage system. After an object has been overridden, the rake teeth shall reengage and continue to clean the bar rack.
- B. All structural components of the rake assembly shall be 304 stainless steel.
- C. The rake assembly shall have the capability of lifting a load of no less than 100 lbs./ft. of rake width each cycle. The rake teeth shall remain fully engaged in the bar rack until the specified lifting capacity of rake width limit is reached.
- D. Single rake arms, rake assemblies that rotate at the drive shaft and rake assemblies that gradually retreat as the load increases, prior to reaching the specified capacity, are specifically excluded and shall not be allowed.
- E. The rake assembly shall be driven by a pair of cogwheels that are specially machined to mesh with a fixed pin rack. A drive shaft and guide shaft, outfitted on each end with rollers, shall travel in fixed roller tracks to position the rake assembly. The guide shaft shall be located below the drive shaft for stability. All shafting shall be of the highest quality in conformance with ASTM specifications and shall be free of any defects.

Materials of construction for the shafting shall be 303 stainless steel.

- F. The rake head shall have teeth sized to fit between the spacings of the bar rack. The rake teeth shall fully engage the bar rack. The rake head shall be attached to two rake arms. The rake head shall be 3/8-inches thick by 10-inches deep. The rake teeth shall attach to the rake head in multiple replaceable sections and shall have a minimum thickness of 3/4-inch. The rake arms shall be constructed of structural rectangular tubing that is a minimum of 3-inches by 5-inches by 7-gauge thick with a nominal length of 6-feet.

2.5 DRIVE ASSEMBLY

- A. The bar screen shall be provided with an integrated drive assembly consisting of a Class 1, Division 1, Group D explosion-proof electric motor with spring-set motor brake, gear reducer, rake assembly mounting bracket and one pair of drive cogwheels. The travel speed of the rake assembly shall be a nominal 20-feet per minute.
- B. Cogwheels shall be pitched to match the pin rack rollers and shall be ANSI 1045 steel with teeth flame hardened to approximately RC 50. The cogwheels shall have a minimum diameter of 7-1/2-inches. The cogwheels shall be of the involute gear design. Standard sprockets shall not be acceptable.
- C. The electric motor shall be close-coupled to the reducer. The brakemotor shall be a minimum 2.0 horsepower with a service factor of 1.15. Electrical characteristics shall be 230/460-volt, 3 phase, 60 Hertz, Class F/B rise insulation, 40-degree C Ambient.
- D. The gear reducer shall be of the helical worm gear type and shall be capable of elevating the weight of the drive assembly plus its maximum calculated debris load.
- E. Gear reducers shall have ball or roller bearings throughout with all moving parts immersed in oil.
- F. Worm shall be of alloy steel with threads precision ground and polished after casehardening.
- G. The worm gear shall be of all high strength alloy bronze or alloy bronze-rimmed semi-steel.
- H. Shafts shall be of high strength alloy steel ground to required tolerances.
- I. All ball or roller bearings shall be rated and manufactured by a member of the Antifriction Bearing Manufacturer's Association. At least one bearing on each shaft shall be of the combined radial and thrust type.
- J. Gear reducer units shall meet the standards of the AGMA for such equipment under moderate shock, 24-hour service with a minimum service factor of 1.25.
- K. The output capacity of the gear reducer shall be equal to the motor horsepower less

reducer losses at the rated service factor.

2.6 MOTOR POWER CABLE & CARRIER TROUGH

- A. Provide electric power to the screen drive motor through a suitably mounted electrical power cable. The power cable shall be an “SO” type cord suitable for severe duty use, consisting of an internal cord surrounded by stranded conductors. Cord will be contained in a flexible nylon cable carrier. The cable carrier shall be flexible in one direction and consist of interconnected molded links and stainless steel mounting brackets. The cable carrier shall be designed for high-strength, durability, repetitive articulation, and a smooth, non-abrasive contact surface for the electrical cables.
- B. The power cable carrier shall be installed in a 10-gauge thick, 304 stainless steel guide trough to protect and contain the power cord. The guide trough shall be C-shaped to protect the cable carrier on three sides.

2.7 BAR RACK

- A. The bar screen shall be provided with a removable bar rack. The bar rack shall consist of equally spaced, parallel bars having 1/4-inch clear spacing between each bar. The bars shall be straight and inclined at 80 degrees above the horizontal plane.
- B. The bottom of the bars shall be attached to a flush bottom, base plate. The bar rack shall extend from the base plate to the connection point on the dead plate.
- C. Each bar shall be provided with rectangular bars, at the bottom of the bar rack which allows the raking mechanism to engage the bottom most portion of the bar rack prior to reaching the inclined section of the rack. Curved plate substituted for arced gussets are not acceptable.
- D. The inclined section of the bar rack shall consist of trapezoidal bars that shall be 5/16-inches thick by 3/16-inches thick by 2 1/2-inches deep. The bars shall extend to the top of the channel.
- E. The bar rack shall be manufactured of 304 stainless steel.

2.8 DEAD PLATE

- A. The bar screen shall be provided with a fixed dead plate extending from the upper portion of the bar rack connection to the screenings discharge point.
- B. The plate shall be flat without undulation so that the rake head teeth will ride no closer than 1/16-inch from the dead plate and no further than 1/4-inch from the dead plate. It shall be securely fastened to the side frames.
- C. The dead plate shall be manufactured of 304 stainless steel having a minimum thickness of 1/4-inch.

- D. Designs in which the dead plate does not extend to the point of discharge shall not be acceptable.

2.9 DISCHARGE CHUTE

- A. The rake assembly shall be designed to reach a predetermined discharge height above the floor elevation. A directing (discharge) chute positioned a minimum 45 degrees from horizontal and located at the top of the dead plate shall be a part of the bar screen and shall be manufactured of 304 stainless steel having a minimum thickness of 1/8-inch.
- B. A full discharge chute enclosure shall be provided. The enclosure shall be manufactured of 14-gauge 304 stainless steel and shall be provided with an access door to facilitate wiper replacement.

2.10 WIPER ASSEMBLY

- A. A pivoting wiper mechanism will be positioned at the point of discharge and shall have a replaceable ultra-high molecular weight polyethylene (UHMW) wiper blade.
- B. During each cycle, the wiper blade shall contact the rake heads at its inner surface during upward travel and shall scrape the debris off the end of the rake head and through the discharge chute. The entire wiper mechanism including the wiper arms shall be fully contained inside the framework of the bar screen.
- C. The wiper mechanism, excluding the wiper blade, shall be manufactured of 304 stainless steel. No moving parts shall extend beyond the framework or the discharge chute.
- D. The design shall be such that the rake repositions the wiper mechanism. The wiper mechanism design shall allow the rake assembly to be operated in reverse, through the wiper mechanism, without the need to manually lift the wiper assembly.
- E. The grease fittings for the wiper arms shall be extended and secured to the side frames in an area where they can be easily accessed by plant personnel.
- F. Shock absorbers shall be provided to cushion the release of the wiper.

2.11 PIN RACK

- A. The bar screen shall be provided with a stationary pin rack on each side of the frame. The pin rack shall consist of individual rollers and bushings attached with threaded fasteners to facilitate easy removal without requiring removal of the rake or drive assembly.
- B. Bushing and roller diameter shall conform to ANSI standards. Rollers and bushings shall be manufactured of carbon steel, casehardened to minimum RC50.
- C. Pin bolts shall be type 304 stainless steel with a minimum diameter of 7/16-inches.

- D. Pin rack designs that do not conform to ANSI standards shall be specifically excluded.

2.12 IN RACK LUBRICATON AND CLEANING SYSTEM

- A. A pin rack lubricating/cleaning system shall be mounted to the rake assembly to allow for periodic lubrication and/or cleaning of the pin racks.
- B. The system shall comprise of an air/oil reservoir, air fill fitting, oil fill fitting, safety relief valve, manual ball valve, pressure gauge, hoses, nozzles and fittings.
- C. The system shall allow personnel to lubricate and/or clean the pin racks from the operating floor without the need for ladders or scaffolding.
- D. The system shall require manual filling of the reservoir with lubricating oil or cleanser as well as manually charging the reservoir with air. Air supply shall be supplied by others.
- E. All metal components shall be manufactured of 304 stainless steel.

2.13 SAFETY CAGE

- A. Safety cages shall be provided to enclose the three open sides (front and both sides) of the bar screen. Cages shall have hinged, (front - side) opening doors with lockable hasps. Cages shall be a minimum of seven feet tall above the operating floor level. Structural members shall be constructed of minimum 1 1/2-inch x 1 1/2-inch x 1/4-inch type 304 stainless steel angle. Panel filler shall be minimum 3/4-inch x 9 weight, flattened expanded metal type 304 stainless steel sheet.

2.14 CONTROLS / INSTRUMENTATION

- A. The control system for the bar screen and the conveyor specified in Section 46 21 76 , shall be designed and manufactured by the bar screen Manufacturer.
- B. Bar Screen Local Controls
 1. One (1) NEMA 7 frame mounted end of travel proximity switch for the screen to park the rake assembly at the top of the bar screen following completion of a cleaning cycle and to count rake cycles for initiation of a run cycle for the screw conveyor. Proximity switch shall be single pole, double throw (SPDT) and rated not less than 10 amps at 120 volts AC.
 2. One (1) NEMA 6P/7 rake mounted proximity switch for each screen to prevent damage to the rake assembly when the rake encounters an obstruction that causes excessive rake arm rotation. Proximity switch shall be single pole, double throw (SPDT) and rated not less than 10 amps at 120 volts AC.
 3. One (1) NEMA 4X local control station for each screen with FORWARD-OFF-REVERSE and HAND-OFF-AUTO selector switches and a mushroom head

EMERGENCY STOP push-button. The FORWARD-OFF-REVERSE switch shall be spring return from REVERSE to OFF. The electrical components on the bar screen shall be pre-wired to the local control station. PVC coated aluminum conduit shall be furnished unless otherwise specified. The local control station shall be mounted on the side frame unless otherwise specified.

4. Two (2) channel mounted ultra-sonic differential level transducers with cable. Transducers shall be shipped loose for field installation and field wiring by others.

C. Bar Screen and Conveyor Main Control Panel

1. Furnish one (1) main control panel for bar screens and associated screw conveyor. The main control panel shall be totally enclosed, front access type with top/side/bottom entry. All controls shall be manufactured by a U.L. listed control panel facility and shall bear a U.L. label.
2. Construction of the main control panel shall be NEMA 4X, 304 stainless steel construction with indicating devices and switches mounted on the front door.
3. Main control panel wiring shall be neatly cabled and supported in nonflammable wiring raceways. Wiring shall be minimum 16-gauge MTW stranded wire.
4. The main control panel wiring shall contain all power and control devices shown on the drawings (wiring diagrams), which shall include, but not be limited to, the following:
 5. One common E-Stop.
 6. One (1) control power ON-OFF selector switch for the bar screen.
 7. One (1) control power ON-OFF selector switch for the conveyor.
 8. One (1) red pilot light for “Screen Running” indication.
 9. One (1) red pilot light for “Conveyor Running” indication.
 10. Two(2) amber pilot light for “Over Current” indication (1 for screen, 1 for conveyor)
 11. One (1) amber pilot light for “Over Rotate” indication for bar screen.
 12. Two (2) white pilot lights for control power (one for bar screen , one for conveyor)
 13. One (1) momentary bar screen “Reset” push-button for over current/over rotate reset for the bar screen.
 14. One (1) momentary “Reset” push-button for over current reset for conveyor.
 15. Two (2) Spare dry contact for remote indication of “Over Current” (one for

conveyor and other for bar screen).

16. Spare dry contact for remote indication of “Over Rotate” for bar screen.
17. Spare dry contact for remote indication of "Screen Run" condition.
18. One (1) adjustable repeat cycle timer to automatically initiate operation of the bar screen and shaftless screw conveyor.
19. Control relays, wiring, and circuitry required to implement the control logic.
20. One (1) full voltage, NEMA rated, reversing starter for the bar screen. The magnetic starter shall be of the heaterless design and provide phase loss protection, short circuit self-protection and thermal memory. The solid-state overload shall be self-powered.
21. One (1) full voltage NEMA rated starter for the conveyor. The magnetic starter shall be of the heaterless design and provide phase loss protection, short circuit self-protection and thermal memory. The solid-state overload shall be self-powered.
22. Screen cycle counter, control relays, wiring and circuitry required to implement control logic.
23. One (1) circuit breaker for screen.
24. One (1) circuit breaker for conveyor.
25. One (1) 480 VAC to 120 VAC step-down control power transformer.
26. One (1) current sensing relay for screen. The current sensing relay shall continuously monitor the motor current to prevent damage to the drive assembly due to a jam obstruction or system malfunction.
27. One (1) current sensing relay for the conveyor.
28. One (1) Milltronics HydroRanger 200 HMI ultrasonic differential level controller for the bar screen.
29. Two (2) elapsed time meters (1 for screen and 1 for conveyor)
30. One (1) surge suppressor to protect the control circuitry.
31. All selector switches, pushbuttons and pilot lights shall be NEMA rated components. IEC rated components are not acceptable.

2.15 SEQUENCE OF OPERATION

- A. The bar screen shall be manually operable from the local control station. The conveyor

shall be manually operable from its own local control station.

- B. During normal timer-based operation, the traveling rake assembly shall operate for a single cycle in a continuous up and down direction at a nominal speed of 20 ft/min. A proximity switch shall be used to detect the upper end-of-travel limit to park the rake assembly. During predetermined differential level, the rake assembly shall operate in a continuous up and down direction at a speed of 20 ft/min. until the differential condition returns to normal. The operator can manually reverse the rake assembly travel direction by using the HAND-OFF-AUTO and FORWARD-OFF-REVERSE selector switches.
- C. With the HAND-OFF-AUTO selector switch in the HAND position, the bar screen shall run as dictated by the FORWARD-OFF-REVERSE selector switch. In the AUTO position, the bar screen shall be automatically started based on a timed function as described below:
 - 1. The bar screen shall be cycled on and off by remote control signals from the main control panel repeat cycle timer. Cycle frequency and duration times shall be set through the local timer.
- D. The shaftless screw conveyor operation shall include HAND-OFF-AUTO selector switches. When in HAND the conveyor will operate from the local control panel. When placed in AUTO, the conveyor will initiate operation from a signal counter to RUN from the bar screen. When the bar screen stops, the conveyor will continue to operate for an additional 30 seconds to clear the screw conveyor of debris.
- E. The bar screen normal timer start shall be overridden by a demand signal generated from a differential level controller. The differential level controller located within the bar screen local control panel shall measure the head loss across the bar screen. Once a preset level differential has been reached, a signal in the form of a dry contact closure is generated for starting the bar screen. Once directed to start, the bar screen system will continue to operate at a nominal speed of 20-feet per minute until the head loss is reduced to a preset operating differential level. Differential level shall be measured by ultrasonic transducers mounted upstream and downstream of the bar screen. During predetermined high differential level flow conditions, the bar screen rake assembly will operate in a continuous mode until the high differential condition returns to normal.
- F. Control logic shall be included to stop the rake assembly at the full-up position at the completion of any mode of operation.
- G. The rake assembly shall be protected with a current sensing relay. The current sensing relay shall continuously monitor the motor current preventing damage due to a jam obstruction or a unit malfunction. A normally open and a normally closed contact shall be furnished in the device. Reset shall be manually performed after correction for any cause of a trip out.

2.16 FASTENERS

- A. All fasteners shall be 304 stainless steel unless otherwise indicated in this specification. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly.

2.17 ANCHOR BOLTS

- A. Anchor bolts shall be provided by the Manufacturer.
- B. All anchor bolts shall be 304 stainless steel unless otherwise indicated in this specification. Anchor bolts shall be ample size and strength for the purpose intended and as shown on the Contract Drawings.

2.18 LUBRICATION

- A. Equipment shall ship completely lubricated, ready for commissioning.
- B. The Manufacturer shall state in the operating manual the amount of and specification for any lubricant required.

2.19 PROTECTIVE COATINGS

- A. Stainless steel and plastic components shall not be coated. The stainless steel structural components shall be passivated per the methods described in ASTM A380-99, after fabrication to remove embedded iron, surface rust and weld burn.
- B. All other surfaces shall be solvent cleaned to remove dirt, oil and foreign materials. Cleaned surfaces shall be coated with one (1) coat of TNEMEC Series N69-1212 primer, or equal, to attain a minimum dry film thickness of 3-5 mils. The motor and gear reducer shall be finish coated with one (1) coat TNEMEC Endura-Shield, or equal, to attain a total minimum dry mil thickness of 3-5 mils. The finish coat shall be red in color and semi-gloss in finish, unless otherwise specified.
- C. Non-stainless steel controls panels shall have Manufacturer's standard paint finish.

2.20 SPARE PARTS

- A. The Manufacturer shall furnish the following spare parts as the total amount of spare parts for this specification section.
- B. Four (4) proximity switches.
- C. Two (2) sets of brake discs and spring kit.
- D. Two (2) wiper blades.
- E. Four (4) cogwheels.

- F. Twenty-feet of pins, rollers and bushings for the pin rack.
- G. All spare parts shall be properly packaged, labeled and stored where directed by the Owner or Engineer.

PART 3 EXECUTION

3.1 TESTING

- A. The screen shall be factory assembled and factory run tested. The main control shall also be factory tested. If the screen is manufactured outside of the United States, the screen shall be factory tested at the point of manufacture and factory tested a second time as a complete assembly (including the motor and control panel) in the United States prior to shipment to the jobsite.
- B. The screen shall also be field tested after erection in the presence of the Owner and Engineer to confirm and verify the structural and mechanical compliance to the specification. The field acceptance test shall include demonstrating that the rake teeth properly engage the bar rack along the length of the bar rack, that the rake assembly can pivot over debris at the base of the bar rack that is 4-inches in height without jamming, and that the screen can be run continuous for 4-hours without overheating, binding, or show other signs of misalignment.

3.2 INITIAL START-UP AND TRAINING

- A. The Contractor shall provide the services of a factory-employed service technician who shall adequately inspect the installation, test the equipment furnished under this Contract and instruct the Owner's operating personnel in its maintenance and operation. Factory personnel are required. Manufacturer's representatives are not deemed acceptable to provide the start-up service. The services of the technician shall be provided as follows:
- B. One (1) trip of two (2) days of service to inspect and certify the installation prior to startup and instruct Owner's personnel in proper operation and maintenance of the equipment.
- C. Start-up service and training for the bar screen can be combined with the service for the screw conveyor if the same company provides both pieces of equipment.

END OF SECTION

**SECTION 46 21 76
SHAFTLESS SCREW CONVEYOR**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The screw conveyors shall be provided by the equipment manufacturer providing the bar screen. The two pieces of equipment to share a common control panel.
- B. Furnish and install one (1) fully automatic shaftless screw conveyor for the receiving and conveyance of screenings material removed from the incoming wastewater flow by a mechanical bar screen.
- C. The shaftless screw conveyor shall be designed to accommodate screenings taken from the flow stream of a municipal wastewater treatment plant.
- D. The shaftless screw conveyor shall be provided complete with accessories, drive assembly, spare parts, mounting anchor bolts, and other appurtenances as specified and as may be required for a complete operational system.
- E. It shall be the Contractor's responsibility to ensure that the screw conveyor and appurtenances furnished and installed shall be compatible with and have the necessary operating clearances to the structural elements and associated equipment shown on the Contract Drawings.

1.2 RELATED WORK

- A. Testing & Startup are included in Section 01 79 00.
- B. Manufacturer services and training included in Section 01 79 01.
- C. Miscellaneous metals are included in Section 05 10 00.
- D. Field painting is included in Section 09 91 00.
- E. Operation and maintenance manuals included in Section 01 78 23.
- F. Delivery, Storage and Handling is included in Section 01 45 34.
- G. Mechanical Fine Screen in Specification Section 46 21 13.

1.3 REFERENCES

- A. American Gear Manufacturers Association (AGMA)
- B. National Electrical Manufacturers Association (NEMA)

- C. American Federation of Bearing Manufacturers Association (AFBMA)
- D. American Society for Testing and Materials (ASTM)
- E. American Welding Society (AWS)
- F. Steel Structures Painting Council, American National Standards Institute (SSPC)
- G. Underwriters Laboratory (UL)

1.4 WARRANTY

- A. The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are accepted by the Owner. This warranty shall not apply to any goods or part which has been altered, applied, operated, or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence, or accident.

1.5 SUBMITTALS

- A. Shop Drawing Submittals shall include at least the following:
 - 1. Certified shop and erection drawings showing important details of construction dimensions, anchor bolt locations, and field connections.
 - 2. Descriptive literature, bulletins, and catalogs of the equipment, including details of the motor, gear reducer and lubrication points.
 - 3. Installation, operation, and start-up procedures including lubrication requirements.
 - 4. Motor Manufacturer's data sheets and drawings.
 - 5. Total weight of the equipment including the weight of the single largest item.
 - 6. A list of spare parts that are supplied with the equipment.
- B. Submit manufacturers certificate of installation per Section 01 33 00.
- C. Operation and maintenance manuals included in Section 01 78 23.

1.6 DESIGN REQUIREMENTS

- A. Number of Units (1)
- B. Minimum Daily Flow 0.65 MGD each

C. Peak Hour Flow	3.6 MGD each
D. Flow Channel Width	3'-0"
E. Flow Channel Depth	6'-6"
F. Discharge Height EL.	764.50 (Minimum)
G. Channel Top EL.	760.50
H. Invert EL.	754.00
I. Bar Rack Spacing	1/4-inch
J. Setting Inclination	80 degrees from horizontal

1.7 STORAGE AND HANDLING OF EQUIPMENT

- A. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested, and finally accepted.
- B. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.
- C. Temporarily connect equipment with built in motor space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.
- D. The unit shall be erected and lubricated in strict accordance with the instructions of the Manufacturer's field engineer.

PART 2 PRODUCTS

2.1 GENERAL

- A. The screw conveyor shall be provided to convey screenings material received from mechanical bar screens. Screenings material shall enter the inlet hopper and be transported by the rotating screw to the point of discharge.
- B. All equipment shall be designed and built for 24-hour intermittent service and for moderate shock without overheating, excessive vibration or strain.

2.2 INLET HOPPER

- A. The inlet hoppers shall be designed to direct wet screenings material into the screw housing from the mechanical bar screens. The inlet zone will be completely shrouded to contain the screenings. The inlet hopper shall be 12-gauge thick minimum and be

constructed of 304 stainless steel. All attachment hardware shall be of 304 stainless steel.

2.3 SCREW HOUSING

- A. The screw housing shall be a U-shaped trough constructed of minimum 10-gauge thick 304 stainless steel. The interior of the housing shall incorporate a nominal 1/4-inch thick UHMW replaceable liner to prevent metal-to-metal contact between the screw housing and the screw. The entire housing shall be supported by 304 stainless steel legs.
- B. The transport area of the screw housing shall be furnished with removable cover panels. The cover panels shall have a minimum thickness of 20-gauge and be constructed of 304 stainless steel.

2.4 SHAFTLESS SCREW

- A. The conveyor screw shall be of the shaftless spiral design and shall be connected to the drive unit and a sealing system shall be provided to prevent water from entering the drive unit.
- B. The spiral shall be formed from continuous solid bar stock with a minimum nominal thickness of 3/4-inches and nominal outside diameter of 7-inches. A 2-inch minimum diameter drive shaft shall be attached to the screw and shall be direct coupled to the gear reducer.
- C. The screw shall be constructed of high strength carbon steel and have a minimum Brinell hardness of 200.

2.5 DRIVE ASSEMBLY

- A. The shaftless screw conveyor shall be complete with an integrated drive assembly consisting of a TEFC electric motor close-coupled to a parallel shaft helical bevel gear double reduction gear reducer.
- B. The motor shall be a minimum 1.0 horsepower, 230/460-volt, 3 phase, 60 Hertz with a service factor of 1.15. The motors shall be rated at 40°C ambient with Class F insulation and shall have a Class B temperature rise at full load. The nominal motor speed shall be 1800 rpm.
- C. The gear reducer shall have ball or roller bearings throughout with all moving parts immersed in oil. Worm shall be of alloy steel with threads precision ground and polished after casehardening. The worm gear shall either be of all high strength alloy bronze or alloy bronze-rimmed semi-steel. Shafts shall be of high strength alloy steel ground to required tolerances. All ball or roller bearings shall be rated and manufactured by a member of the Antifriction Bearing Manufacturer's Association. At least one bearing on each shaft shall be of the combined radial and thrust type.

2.6 CONTROLS / INSTRUMENTATION

A. The control system shall include a local control panel. The main controls will be located in the Bar Screen Control panel. Refer to Section 46 21 13 for specific details.

1. Local Controls

a. One (1) NEMA 4X local control station with HAND-OFF-AUTO selector switches and an EMERGENCY STOP cable. The emergency stop cable shall run the length of the unit and shall be mounted in eyebolts attached to the screw conveyor. The local controls, emergency stop cable, and motor shall be factory wired to a terminal strip located inside the local control station.

2. Main Control Panel

a. The main control panel wiring shall contain all power and control devices shown on the drawings (wiring diagrams) and described within the Specifications.

2.7 SEQUENCE OF OPERATION

A. The screw conveyor shall be manually operable from the local control station or automatically via the bar screen control panel.

B. A cycle counter generated by the mechanical screen shall initiate the screw conveyor to run.

2.8 FASTENERS

A. All fasteners shall be 304 stainless steel unless otherwise indicated in this specification. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly.

2.9 ANCHOR BOLTS

A. Anchor bolts shall be provided by the Manufacturer.

B. All anchor bolts shall be 304 stainless steel unless otherwise indicated in this specification. Anchor bolts shall be ample size and strength for the purpose intended and as shown on the Contract Drawings.

2.10 LUBRICATION

A. Equipment shall be shipped completely lubricated, ready for commissioning.

B. The Manufacturer shall state in the operating manual the amount of and specification for any lubricant required.

2.11 PROTECTIVE COATINGS

- A. Stainless steel and plastic components shall not be coated. The stainless steel structural components shall be passivated per the methods described in ASTM A380-99, after fabrication to remove embedded iron, surface rust and weld burn.
- B. All other surfaces shall be solvent cleaned to remove dirt, oil and foreign materials. Cleaned surfaces shall be coated with one (1) coat of TNEMEC Series N69-1212 primer, or equal, to attain a minimum dry film thickness of 3-5 mils. The motor and gear reducer shall be finish coated with one (1) coat TNEMEC Endura-Shield, or equal, to attain a total minimum dry mil thickness of 3-5 mils. The finish coat shall be the Manufacturer's standard.
- C. Non-stainless steel control panels shall have Manufacturer's standard paint finish.

2.12 SPARE PARTS

- A. The Manufacturer shall furnish the following spare parts as the total amount of spare parts for this specification section.
 - 1. One (1) set of UHMW liners.

PART 3 EXECUTION

3.1 TESTING

- A. TESTING
 - 1. The shaftless screw conveyor shall be factory assembled and factory run tested in the United States. The main control shall also be factory tested.
 - 2. The screw conveyor shall also be field tested after erection in the presence of the Owner and Engineer to confirm and verify the structural and mechanical compliance to the specification. The field acceptance test shall include demonstrating that the screw conveyor operates without vibration, jamming or overheating and performs its specified function satisfactorily.

3.2 INITIAL START-UP AND TRAINING

- A. The Contractor shall provide the services of a factory-employed service technician who shall adequately inspect the installation, test the equipment furnished under this Contract and instruct the Owner's operating personnel in its maintenance and operation. Factory personnel are required. Manufacturer's representatives are not deemed acceptable to provide the start-up service. The services of the technician shall be provided as follows:
- B. One (1) trip of two (2) days of service to inspect and certify the installation prior to startup and instruct Owner's personnel in proper operation and maintenance of the equipment.

END OF SECTION

**SECTION 46 61 41
DISK FILTERS**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to install, test and commission two (2) disk filters.
- B. The scope includes furnishing two (2) Model ADSFC-54x8E-PC AquaDisk filter(s) as manufactured by Aqua-Aerobic Systems, Inc., of Loves Park, Illinois.
- C. Filter Supplier to provide:
 - 1. Equipment
 - 2. Field services and training
 - 3. Shop Drawing Submittals, include at a minimum.
 - 4. Operation and maintenance manuals.
 - 5. Start-up and training services.
- D. Each filter unit will include:
 - a. Basin Mounting Brackets and Hardware.
 - b. Drive Assembly.
 - c. Centertube Assembly with Cloth Media Disks.
 - d. Backwash System.
 - e. Backwash/Waste Pump Assembly.
 - f. Valves.
 - g. Influent Weir.
 - h. Pressure Transducer Assembly.
 - i. Float Switch.
 - j. Vacuum Transmitter.
 - k. Electrical Controls with Internal Components.
- E. All motors, pumps, and bearings shall be designed for continuous duty and long operating life in a high humidity atmosphere. All motors and pumps shall be 460 volt, 60 hertz, 3 phase.
- F. Through the wall spool piping and all external piping shall be provided by the installation Contractor.

G. Effluent weir assembly shall be provided by the installation Contractor.

1.2 RELATED WORK

- A. Testing & Startup are included in Section 01 79 00.
- B. Manufacturer services and training included in Section 01 79 01.
- C. Miscellaneous metals are included in Section 05 10 00.
- D. Field painting is included in Section 09 91 00.
- E. Operation and maintenance manuals included in Section 01 78 23.
- F. Delivery, Storage and Handling is included in Section 01 45 34.

1.3 SYSTEM DESIGN AND PERFORMANCE CRITERIA

- A. The disk filters shall be capable of filtering effluent from a Secondary Activated Sludge process.
 - 1. Design proposed filters as follows:
 - a. 10 mg/l average daily flow, as influent total suspended solids.
 - b. 15 mg/l maximum daily flow, as influent total suspended solids.
 - c. Filter effluent total suspended solids concentration shall not be greater than 5 mg/l based on a monthly average.
 - d. Filter influent total phosphorus concentration shall be 2 mg/l daily average.
 - e. Filter effluent turbidity shall not be greater than 3 NTU based on a daily average.
 - f. Filter effluent total phosphorus shall not be greater than 1 mg/l based on a monthly average.
 - 2. Overall system performance is shown in the Table below.

Filter Design Parameter	Phase 1	Phase 2
Average day flow, mgd	1.0	2.0
Maximum day flow, mgd	2.5	4.0
Peak hour flow, mgd	5.0	5.0
Number of filters	2	
Number of disks per filter	8	
Effective area per filter, sf	430.4	
Proposed Total Effective Filter Area, sf	860.8	
Proposed Average day loading rate, gpm/sf ¹	0.81	1.63
Proposed Max day loading rate, gpm/sf ¹	2.01	3.22
Proposed Peak Hr. loading rate, gpm/sf ¹	4.03	4.03
¹ All filters in service		

3. Overall, Max day solids loading rate: 0.58 lbs. TSS/square foot at 4 mgd.
4. The filtration system shall be able to treat 75% of the maximum design flow to meet the above design conditions with one unit offline.

1.4 WARRANTY

- A. The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date of acceptance. This warranty shall not apply to any

goods or part which has been altered, applied, operated, or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence, or accident.

1.5 PROJECT CONDITIONS

- A. The drawings indicate the extent and general arrangement of the equipment, piping and electrical.
 - 1. Fit the equipment into the space allocated and allow adequate clearance for entry, installation, replacement, servicing, and maintenance.
 - 2. Verify actual and final arrangement, locations, grade, elevations.
 - 3. If adjustments and modifications are necessary, submit to the Engineer details of such adjustments and reasons for approval. Make no adjustments without Engineer's approval.
 - 4. Filter equipment to be installed in concrete basins.

1.6 SUBMITALS

- A. Submit the following per Section 01 33 00:
 - 1. Drawings with dimensions, elevations and details.
 - 2. Cut sheets.
 - 3. Media area calculations.
 - a. Calculations verifying the effective filtration surface area.
 - 4. Hydraulic loading rate calculations.
 - 5. Solids loading rate calculations.
 - 6. Hydraulic profile through the filter showing the following:
 - a. Influent weir length
 - b. Influent weir elevation
 - c. Influent weir nappe at design and peak flow
 - d. Effluent weir length
 - e. Effluent weir elevation

- f. Effluent weir nappe at design and peak flow
- 7. Elongation and breaking strength test report from ISO certified textile laboratory
- 8. Title 22 Conditional Approval letter
- 9. Control Panel shop drawings to include:
 - a. Outline.
 - b. AC schematics, wiring diagrams.
 - c. Equipment interconnects drawings
 - d. Bill of materials
 - e. Clarifications and exceptions
 - f. Sequence of operations including list of functions monitored, controlled, and alarmed.
- B. Setting plans with tolerances for anchor bolts.
- C. Supplied tools and spares.
- D. Weights and lifting points of all equipment and subassemblies.
- E. Identify any special handling requirements.
- F. Field-testing procedures.
- G. Submit manufacturers certificate of installation per Section 01 33 00.
- H. Operation and maintenance manuals included in Section 01 78 23.

PART 2 PRODUCTS

2.1 FILTER BASIN AND INFLUENT VALVE

- A. Each filter shall be installed in a concrete basin. Each filter shall include one influent valve. Valve shall be 16” mechanical joint plug valve with square nut operator. The influent valves shall be supplied and installed by the General Contractor.

2.2 BASIN MOUNTING BRACKETS AND HARDWARE

- A. Each filter basin shall be fitted with 304 stainless steel mounting brackets to accommodate attachment of the filter components to inside of the basin. All mounting brackets shall be attached to the inside of basin wall with stainless steel anchors and

hardware. Through the wall spool piping and all filter external piping shall be provided by the Installing Contractor.

2.3 FILTER DRIVE ASSEMBLY

- A. Each filter shall include an adjustable drive assembly with a gearbox, nylon drive sprocket, acetal drive chain with 304 stainless steel link pins, and a 304 stainless steel chain guard. The gearbox shall be parallel in-line helical type, with a 1/2 HP drive motor rated for 460 volt, 3 phase, 60 Hz. Gear reducer shall be Nord or approved equal. Drive motor shall be Nord, Weg, Baldor, or approved equal.
- B. To reduce energy demand, the drive assembly shall rotate the disks only during backwash. Systems requiring constantly rotating disks during filtration will not be acceptable. Belt drive systems or systems with multiple drive units per filter will not be acceptable.
- C. If motors and gearboxes require routine maintenance and are not accessible from the outside tank side walls, the equipment manufacturer shall provide an internal access platform between the tank side walls and motors and gearboxes.

2.4 CENTERTUBE ASSEMBLY

- A. Each centertube assembly shall include a minimum 3/16" thick 304 stainless steel centertube weldment, driven sprocket, wheel assemblies, 304 stainless steel disk segment rods, and frame and cloth assemblies. Each centertube assembly shall also include a Viton v-ring effluent port seal which provides superior chlorine resistance. Materials other than Viton are not acceptable for seal materials. Systems with swivel joints requiring routine lubrication are not acceptable. The driven sprocket shall be multi segment made of UHMW polyethylene. All fasteners shall be stainless steel.

2.5 CLOTH FRAME

- A. Each cloth disk assembly shall be comprised of six (6) individual segments, each consisting of a cloth media sock supported by an injection molded glass filled polypropylene frame with corrosion resistant assembly hardware. Cloth/frame assemblies shall be constructed such that each segment is easily removable from the centertube, without special tools, to allow for removal and replacement of the cloth at the point of installation. Systems requiring special tools and/or the return of media segments to the factory for replacement will not be considered.
- B. Disks shall be spaced a minimum of 8 inches on center and have a 5 inch open space between the adjacent disks.

2.6 FILTER MEDIA

- A. Each cloth disk assembly shall have a minimum of 53.8 square feet of effective submerged filtration area. Each disk shall be divided into no more than six (6) segments and shall be easily removable for service.

- B. If the wet weight of the filter disk segment is greater than 50 pounds, a lifting mechanism shall be provided.
- C. Each basin shall include eight cloth disk assemblies.
- D. Each filter unit shall have a total of 430.4 square feet of minimum effective submerged filtration area.
- E. Cloths shall be of fiber pile construction having a nominal filtration rating of 10 microns. Granular media and screens having structured identical openings shall not be allowed.
- F. Cloth filter media must have obtained conditional acceptance under California Title 22 regulations. The approval letter associated with this acceptance must be included with submittals.
- G. The cloth media shall have an active filter depth of 3 to 5 mm to provide additional collisions between solids particles and the media within the media depth, resulting in capture of solids across a broader particle range. The cloth depth shall also provide storage of captured solids, reducing backwash volumes while maintaining an operational headloss.
- H. Individual pile fibers shall be held in place by a support backing integral to the media. To facilitate proper flow of backwash water through the cloth, the medium's back side shall be of open construction consisting of 10% open area at least 50 times larger than the nominal filtration media in any direction. Media that uses sewn in support structures, which have the potential to prevent free flow through the media, shall not be allowed.
- I. Cloth strength is critical to ensure long term performance of the media. Cloth media breaking strength and elongation shall be tested in accordance with ASTM Standard D5035 2R-E method by an ISO certified laboratory specializing in textile testing. Breaking strength shall be in excess of 200 lbf (890 N) in the warp and the weft direction. Elongation shall be less than 10% at 60 lbf (270 N) in the warp and the weft direction. Test reports shall be provided with submittals to demonstrate compliance with this requirement.
- J. To avoid excessive media movement, deformation and folding during backwash, the maximum distance between cloth restraints must not exceed 36 inches.

2.7 FILTER HYDRAULICS

- A. During filtration, the filter unit shall operate in a static condition with no moving parts. The filter system shall provide for the collection of filtered solids on the outside of the cloth media surface to allow for the direct contact of cleaning systems. Filtered effluent shall be used for backwashing. The filter flow path shall be from the outside of the cloth frame to the inside. Systems with flow paths from the inside to the outside of the cloth frame that collect filtered solids and plastic debris on the interior surfaces of the cloth

frame will not be acceptable.

- B. Only media area below the effluent weir elevation will be considered in the filtration area calculation since this is the only area that is submerged and available for filtration 100% of the time.
- C. Submittal information shall include calculations that verify the effective filtration surface area. Media surface fused directly to support structure such that water cannot pass through the media shall not be included in these calculations.
- D. The operator shall be able to bring a drained filter online by simply opening the influent valve. If the filter design is such that it must be filled with water before the influent isolation device is opened to prevent damage to the filter media, an automated process that sequentially brings the filter back online with a single switch shall be provided to prevent accidental media damage. The automated process shall activate a minimum 6” diameter motorized valve to fill the filter with effluent or other clean water source in not more than five minutes, verify that the filter is full, and open the motorized influent isolation device.
- E. Because of the frequency of the backwash and misting associated with spray systems, designs that utilize high pressure spray or a moving vacuum head as the sole means of solids removal will not be acceptable.

2.8 BACKWASH SYSTEM

- A. The backwash function shall incorporate a pump that draws filter effluent through the cloth as the media rotates past the fixed backwash shoe, thereby removing accumulated solids from the cloth surface. Each disk shall be cleaned by a minimum of two backwash shoes, one on each side. The backwash shoes shall remain in a fixed position. Springs shall be used to maintain the proper tensioning of the backwash shoe against the media surface.
- B. The backwash shoe shall be in direct contact with the cloth to ensure effective media cleaning. Systems utilizing media cleaning mechanisms that do not contact the filter media will not be acceptable.
- C. Neither the cloth / support assemblies nor the backwash shoes shall include any gridwork overlays or other interferences that would prevent direct contact of the backwash shoes with the cloth fibers.
- D. The backwash system shall include 304 stainless steel backwash shoe supports with UHMW backwash shoes, 316 stainless steel springs reinforced PVC flexible hose with stainless steel hose clamps, 304 stainless steel backwash manifolds, and PVC sludge collection manifold.

2.9 BACKWASH/WASTE PUMP ASSEMBLY

- A. Each backwash/waste pump assembly shall include two backwash/waste pump(s), valves and gauges external to the basin. System utilizing internal backwash pumps shall not be permitted. In the external piping shall be backwash and solids waste valves, 3” recirculation ball valve(s), 3” manually operated flow control gate valve) for each pump, vacuum gauge(s), and pressure gauge(s).
- B. The backwash/waste pump(s) shall be shipped loose for field installation by the installing contractor. Backwash piping between the filter basin and pump(s) as well as piping following the pump(s) shall be supplied by the installing contractor. Installing contractor shall supply unions or flanges for service, and interconnecting wiring.
- C. The backwash/waste pump(s) shall be a Gorman Rupp model 12B20-B, externally mounted centrifugal pump. Pump shall be provided with a 2 HP, 460 volt, 3 phase, 60 Hz motor and operate at 1750 RPM. Pump shall be rated for 130 gpm at 23.2 ft TDH with 12.2 ft allowable discharge head after losses in internal filter piping have been accounted for. Motor shall be Baldor, Teco, Weg or approved equal. Backwashing shall be initiated by tank water level, timer, or manually through the operator interface. Operator shall have the ability to specify backwash time interval elapses through the operator interface. The backwash water shall be pressurized by the filter’s backwash/waste pump for discharging from the filter system. Systems utilizing non-pressurized backwash flow will not be accepted.
- D. Each pump shall be provided with a painted steel support stand with wedge anchors.
- E. Pump manually operated 3” threaded gate valve shall be class 125 bronze with screw in bonnet, non-rising stem, and solid wedge. Valve shall conform to MSS SP-80 and shall be Nibco or approved equal.
- F. The 3 inch threaded ball valves shall be a two-piece, full port, with a brass body. Valves and shall be Nibco or approved equal.
- G. The vacuum gauge(s) shall have a minimum 2.5” dial with all stainless steel welded construction, 0-30” Hg vacuum range, liquid filled, ¼” NPT process connection, 316 stainless steel bourdon tube and tip material, and bronze socket material, Ashcroft or approved equal.
- H. The pressure gauge(s) shall have a 2.5” dial with a black painted steel case, 0-15 psi, heat resistant polycarbonate window, ¼” NPT process connection, “C” shaped bronze bourdon tube, and brass socket material, Ashcroft or approved equal.
- I. Filtering shall not be interrupted during normal backwashing and sludge discharge.
- J. Each filter shall include one 2” solids waste valve. Valve shall be 2 piece, flanged end, ASTM A351 Grade CF8M stainless steel body, 316 stainless steel ball and stem, full port, with a 115 volt, single phase, 60 Hz, open / close service electric actuator. Valve /

actuator combination shall be TCI / RCI (RCI, a division of Rotork), Nibco, or equal. Valve actuator shall include a compartment heater and limit switch feedback to the microprocessor in both the open and closed positions.

- K. Each filter shall include a solids waste removal system consisting of perforated manifold, mounted on the floor of the filter basin. The manifold shall be designed to siphon settled solids for waste discharge through the backwash/waste pump. The operation of the solids waste removal system shall be automatic with user adjustable intervals and duration through the operator interface. Filters that are designed without a solids waste removal system will not be acceptable.

2.10 INFLUENT WEIR BOX

- A. Each filter shall include a 304 steel influent weir box. The weir box shall be mounted to the filter basin interior using 304 stainless steel wedge anchors and hardware. The basin wall must be smooth and plumb to facilitate a quality installation.

2.11 PRESSURE TRANSDUCER

- A. A submersible pressure transducer shall be supplied for each filter basin. The pressure transducer shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of 0 psi to 5 psi. Units shall monitor the water level in the filter basin. Pressure transducer shall be provided with a mounting bracket and stainless steel anchors. A bellows providing vented gage atmospheric reference shall be supplied for Contractor installation in junction box. The installation Contractor shall provide junction box, bellows mounting and interconnecting wiring. Transducers shall be Keller Levelgauge series or approved equal.

2.12 FLOAT SWITCH

- A. A float switch shall be furnished to indicate emerging overflow level. The float switch shall be Anchor Scientific Model GSI 40NONC-STO or approved equal. The float shall contain a non-mercury switch, chemical resistant polypropylene casing and a PVC #18 AWG three conductor cable. Switch rating shall be minimum 4.5 amps non-inductive at 120 VAC.

2.13 VACUUM TRANSMITTER

- A. The vacuum transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of -30 to 0 inHg. Transmitter shall be an IFM Effector PX series or approved equal.

2.14 CONTROL SYSTEM

- A. The automatic and manual controls for operation of the Aqua Disk® Filter system shall be furnished, fully assembled, wired and pre-programmed in a UL 508A Certified Industrial Control Panel. Controls shall be provided to control or monitor equipment as

described in the contract drawings.

- B. One control panel shall be provided to operate the proposed filters.
- C. The control system shall include the following control components and practices:
 - 1. CONTROL PANEL WIRING AND ASSEMBLY
 - a. All control enclosures shall be custom assembled and wired in an Underwriters Laboratories (UL) certified cabinet shop using quality materials and labor. Short circuit rating of control enclosure shall be 5 kA RMS symmetrical @ 480VAC maximum.
 - b. All control panel single conductor wire shall be 16 AWG multi-strand machine tool wire (MTW) minimum, with PVC insulation.
 - c. Wire colors are as follows:
 - (1) 208 VAC or higher - Black
 - (2) 120 VAC control power - Red
 - (3) Neutral - White
 - (4) Ground - Green with Yellow Stripe
 - (5) Power from remote source - Orange
 - (6) Neutral from remote source - White with Orange Stripe
 - (7) 24 VDC (+) - Blue
 - (8) 24 VDC (-) - White with Blue Stripe
 - (9) Intrinsically Safe - Light Blue
 - d. All wires shall be clearly marked with an identification number consistent with the wiring schematic drawing. Wire markers shall be a thermal transfer printable type. The material shall be self-laminating vinyl. Labels shall be Brady THT-9-427-10 or approved equal.
 - e. Wiring inside the control panel shall be run in PVC wiring duct rated for continuous temperatures up to 122° F (50°C). Devices mounted in the enclosure door shall have wires run in spiral wrap to avoid pinch points when opening and closing the door.
 - f. Control components mounted internal and external to the enclosure shall be mounted with stainless steel hardware and clearly labeled with a plastic identification nametag. The tag shall be white with black lettering.

2. CONTROL PANEL QUALITY ASSURANCE

- a. All Control panels shall be UL certified. Testing by manufacturer’s electrical engineering prior to release for shipment shall be completed. Testing shall consist of the following:
 - (1) Point to point testing of all wiring prior to application of power.
 - (2) Intended supply voltage shall be applied to the enclosure.
 - (3) All components shall be tested for proper operation and calibration.
 - (4) The PLC and operator interface program shall be loaded and functionally checked.
 - (5) All components shall be checked to confirm proper mounting specifications have been followed.
 - (6) Enclosure shall be inspected for defects and repaired if necessary.
 - (7) All labeling of wires and devices are correct, properly installed and clean.
 - b. The manufacturer shall finalize the factory checkout by completing a control panel checklist to document all testing completed above.
 - c. Upon the successful completion of the control testing of the enclosure assembly, all applicable documentation (i.e., finalized drawing set, signed control checklist cover page, device data sheets, etc.) shall be placed in the drawing pocket of the enclosure.
3. CONTROL ENCLOSURE
- a. The automatic controls shall be provided in a UL listed, NEMA Type 4X 304 stainless steel (12 gauge) floor mount enclosure that provides insulation and protection for electrical controls and components from highly corrosive environments indoors and outdoors. Enclosure shall include a seamless foam-in-place gasket to assure watertight and dust-tight seal. An internal 3-point latch and 316SS padlocking POWERGLIDE® handle shall be provided. Enclosures shall be unpainted, with a smooth #4 brushed finish. Enclosure shall include a painted white mild steel (12 gauge) sub-panel mounted with collar studs. Enclosure shall be manufactured by Hoffman or approved equal.
 - b. The control enclosure shall be mounted remotely.
 - c. Provide a stainless steel sun shield to overhang the front of the panel by at least 10 inches.
4. CORROSION INHIBITOR
- a. Each control enclosure assembly shall be provided with corrosion inhibitors to protect interior electrical components from damage caused by high

humidity. The corrosion inhibitors shall be installed prior to shipment to provide protection during shipment and storage of the enclosure.

- b. The corrosion inhibitor shall be Hoffman AHCI5E or approved equal.

5. AIR CONDITIONER

- a. A thermostat controlled air conditioner with noise suppression shall be supplied to protect control components mounted inside the enclosure from high temperatures, humidity and ambient air contaminants. The air conditioner shall be constructed of brushed finish stainless steel 304 material and provide NEMA 4X Type protection from outdoor and hose-down applications. The air conditioner unit shall use CFC-free or environmentally safe refrigerant that is universally accepted. The air conditioner shall be manufactured by Hoffman or approved equal.

6. ELECTRIC HEATER

- a. An electric heater shall be provided inside the control enclosure to protect sensitive mechanical and electrical components from the harmful effects of condensation, corrosion and low temperatures. The heater is a thermostatically controlled, fan-driven unit. The heater shall be manufactured by Hoffman or approved equal.

7. MAIN DISCONNECT CIRCUIT BREAKER

- a. A UL listed; automatic molded case 3-pole disconnect breaker shall be provided in the control enclosure(s). The primary function of the disconnect switch shall be to provide a means to manually open a circuit and automatically open a circuit under overload or short circuit conditions. The disconnect breaker shall have a door mounted operating mechanism with trip indication. Power distribution connectors shall be mounted integrally to the circuit breaker for multiple load connections. Integral connectors shall be provided. The disconnect circuit breaker shall be a Square D/HDL, JDL, LDL, MDL, PDL or approved equal.

8. MOTOR STARTER

- a. A full voltage non-reversing Integrated Motor Starter-Controller shall be provided for motor applications up to 15 kW. Each starter shall provide control, protection and monitoring functions for the motor. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a 42kA @ 480 VAC rated breaking capacity on short circuit. The starter shall have a mechanical durability of 15 million operations. The starter shall provide short circuit trip, thermal overload trip with selectable tripping class, under current trip and

phase imbalance trip.

- b. A full voltage non-reversing IEC Style motor starter shall be provided for motor applications over 15 kW. Each starter shall consist of a circuit breaker, contactor and overload relay. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a minimum 18 kA @ 480VAC and 25 kA @ 240 VAC interrupt rating on short circuit when used in combination with a PowerPact circuit breaker. The starter shall have a mechanical durability of 15 million operations. The solid state overload relay shall have class 10 tripping characteristics with trip current adjustment, phase loss and unbalance protection.

9. TRANSFORMER

- a. A step-down multi-tap transformer shall be supplied when there is a necessity to reduce incoming 3-phase power to 120 VAC single-phase. The transformer power wire connections (incoming and outgoing) shall be protected with a finger-safe cover to protect against accidental contact. Primary and secondary fuse protection shall be provided. Transformer shall be UL listed and of continuous wound construction with vacuum impregnated with non-hygroscopic thermosetting varnish. Transformer shall be Square D 9070T or approved equal.

10. TRANSFORMER PRIMARY AND SECONDARY FUSE

- a. Properly rated fuses and fuse blocks shall be provided for primary and secondary protection of the transformer. Each fuse shall be equipped with a thermoplastic cover to protect against accidental contact. Clip style fuse block shall be rated up to 600 VAC and 100 amps, dual element, time delay fuses shall be rated up to 600 VAC. Fuse blocks and fuses shall be UL listed. Fuses shall be Littelfuse Class CC or approved equal. Fuse blocks and fuse covers shall be manufactured by Marathon or approved equal.

11. CIRCUIT BREAKER

- a. All single phase branch or supplementary circuits shall be protected with a single-pole, C-Curve rated circuit breaker. Circuit breakers shall be rated for 240 VAC maximum, 50/60 Hz and UL 489 listed. Supplementary and branch protection circuit breakers shall be Merlin Gerin Multi 9 or approved equal.

12. FUSE

- a. Properly rated fuses and fuse holders shall be provided for protection of individual control devices (discrete and analog signals) mounted outside of

the enclosure. Each fuse shall be housed in a hinged type fuse block to protect against contact with the fuse. Fuses shall be rated up to 250 VAC and be Littelfuse or approved equal. Fuse holders for discrete devices shall be rated to 600 VAC and 30 Amps. Fuse holders for analog devices shall be rated to 300 VAC and 15 Amps. Fuse holders shall be Allen Bradley 1492 or approved equal.

13. OPERATOR DEVICE

- a. Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for all automatic controlled equipment. Transformer type push-to-test pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp. Color coding shall be applied as required and is as follows:
 - (1) Amber – Alarm active, caution.
 - (2) Green – Valve open, motor running.
 - (3) Red – Valve closed.
 - (4) White – Information.
- b. All operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and watertight with finger safeguards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Square D 9001 or approved equal.

14. HIGH FREQUENCY NOISE FILTER

- a. A UL listed active tracking filter shall be provided to protect the PLC and HMI power feeds from high-frequency noise and low-energy transients. It shall be designed for a single phase input voltage of 120VAC operating at 50/60 Hz. The unit shall provide surge capacity of 25,000 amps and provide transient protection in all modes (Line to neutral, line to ground and neutral to ground). The noise filter shall be a SolaHD STFV or approved equal.

15. GROUND FAULT DUPLEX RECEPTACLE

- a. A UL listed ground fault circuit interrupter (GFCI) duplex receptacle shall be provided within the panel for instrument (e.g., programming terminal, modem, etc.) use only. The receptacle shall be protected with a 5 Amp circuit breaker. The receptacle shall carry a 20A / 120VAC rating. The electro-mechanical circuit interrupter shall be double-pole and trip free (GFCI protection and shall not be overridden by holding reset button). Built-in transient suppression shall protect GFCI's internal circuitry from voltage transients. Receptacle shall be Hubbell DRUBGFI20 or approved equal.

16. 24 VOLT DC POWER SUPPLY

- a. A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with input voltage of 100 to 240 VAC (single-phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is “OK”. The power supply shall be an Allen Bradley 1606 or approved equal.

17. CONTROL RELAY

- a. UL listed control relays for general control purposes shall be supplied with a pilot light to indicate when the coil is in an energized state. The relay socket shall be panel or DIN rail mounted inside the enclosure. The relays shall provide the following ratings: 120VAC coil, 10A contact rating (thermal), 250 VAC insulation rating and 5 million mechanical life cycles. Relays shall be Allen Bradley 700-HK, Square D, or approved equal.

18. TERMINAL BLOCK

- a. Standard feed-through screw terminal blocks, DIN rail mounted, shall be supplied for all point to point wiring connections. All terminals shall be numbered per the wiring schematic with printed markers. Terminals shall carry a 600V AC/DC voltage rating. Terminal blocks shall be Allen-Bradley 1492-J4 (35A max) and 1492-J16 (85A max) or approved equal.

19. PROGRAMMABLE LOGIC CONTROLLER

- a. Automatic operation of the filters shall be controlled through a programmable logic controller (PLC) mounted inside the main control panel. The PLC components shall consist of a power supply, CPU, discrete input and output modules and analog input and output modules. The processor unit shall include built-in USB and two (2) Ethernet IP communication ports. All input and output points supplied (including unused) shall be wired to terminal blocks. Processor design characteristics shall include: 1.0MB user memory size, real-time clock and calendar, battery backed RAM and an operating temperature range between 32 °F and 140°F. The PLC processor shall be an Allen-Bradley CompactLogix 1769-L30ER or approved equal.
- b. Modular equipment shall be provided to complete the PLC system. These Allen-Bradley components include: 1769-PA4 – Power Supply, 1769-IA16 – Discrete input (16 point) modules, 1769-OW16 – Discrete output (16 point) modules and 1769-IF8 – Analog input (8 point) modules, 1769-OF4CI – Analog output (4 point) modules.

20. PLC POWER SUPPLY

- a. Input voltage range of 85-265 / 170-265 VAC, 47-63 Hz, maximum inrush current of 30 amps, backplane output current of 4 amps @ 5V or 2 amps @ 24V, internal fuse protection, ambient operating temperature of 32°F to 140°F, Class I, Division 2 hazardous location certified, UL Listed.

21. DISCRETE INPUT MODULE

- a. Operating voltage of 79 to 132 VAC at 47 to 63 Hz, backplane current draw at 5VDC = 115mA , off-state current 2.5mA maximum, maximum inrush current 250mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

22. DISCRETE OUTPUT MODULE

- a. Operating voltage of 5 to 265 VAC at 47 to 63 Hz / 5 to 125 VDC, backplane current draw at 5 VDC = 205mA , at 24VDC = 180mA, off-state current leakage is 1.0mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

23. ANALOG INPUT MODULE

- a. Backplane current draw at 5 VDC = 120mA, at 24VDC = 70mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

24. ETHERNET SWITCH

- a. An unmanaged Ethernet switch shall be provided inside the control enclosure to provide connectivity between the PLC, operator interface and plant networking. The switch shall support both 10 and 100 Mbit/s operation. The switch shall have five (5) 10/100Base-T ports with RJ-45 sockets and shall support auto-crossing, auto-negotiation and auto-polarity. Maximum distance between devices shall be 100m.
- b. The unit shall be DIN rail mounted and require 24VDC power. Diagnostic LEDs for power and connection status shall be included. The Ethernet switch shall be UL listed and manufactured by Allen-Bradley Stratix 2000 1783-US5T or approved equal.

25. HUMAN MACHINE INTERFACE OVERVIEW

- a. The control system shall be equipped with a UL listed operator interface that provides control display screens. These screens shall be used by the operator to monitor and control filter status, setpoint and alarm information.
- b. The Interface shall allow the Operator access to adjust the following operating parameters:

- (1) Backwash interval,
 - (2) Backwash duration,
 - (3) Sludge waste interval,
 - (4) Sludge waste duration,
 - (5) Number of backwashes between sludge wasting.
- c. The operator interface shall provide information to assist the Operator in assessing the status of the filter system. The interface screen shall display, at minimum, the following parameters:
- (1) Water level in the filter,
 - (2) Time since last Backwash,
 - (3) Time since last Sludge withdrawal,
 - (4) Elapsed time on the Drive Motor,
 - (5) Elapsed time on the Backwash Pump(s),
 - (6) Total backwash time and cycles,
 - (7) Total sludge withdrawal time and cycles.
- d. The OIT interface will allow the Operator to:
- (1) Initiate backwash
 - (2) Control all electric actuated valves
- e. The interface shall display the alarm history. The alarm history shall include the time and date of the most recent 25 alarms along with the description of the alarm.
- f. The interface shall also display current alarms, including the date, time and a description of the alarm.
- g. As a diagnostic aid to the Operator, the interface shall display the time between backwashes for the most recent 40 backwashes.

26. HUMAN MACHINE INTERFACE

- a. The operator interface shall be a NEMA 4X rated, 6.5” diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 640 x 480 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 7”.

27. HUMAN MACHINE INTERFACE SUN SHIELD

- a. A sun shield constructed of 304 stainless steel shall be mounted over the operator interface to provide protection and visibility of operator screens in outdoor applications.

PART 3 EXECUTION

3.1 PREPARATION

- A. The installing Contractor shall conduct a field inspection to verify the preparations are complete and that the site is ready for installation of the proposed equipment.
- B. All equipment shall be properly crated to protect any and all components from damage during shipment.
- C. The Contractor shall ensure that all parts are properly protected so that no damage or deterioration will occur during a prolonged delay from the time of delivery until installation is complete and the units and equipment are ready.

3.2 INSTALLATION

- A. Installation shall be in accordance with the recommendation of the equipment manufacturer to ensure that systems are professionally installed.
- B. All field wiring will be performed by the General Contractor.
- C. The existing filter system must remain in service during the construction of the proposed filter system. Modifications to the existing system are presented below in 3.4 of this section.

3.3 FIELD TESTS /START-UP SERVICES

- A. Furnish the services of a factory representative, having complete knowledge of the operational and maintenance requirements of the system to instruct the Owner's personnel in the proper operation of the equipment. Provide (8) hours of training. Training may be scheduled concurrent with trip to site required for purposes of start-up.
- B. After the equipment in this Section has been completely installed, under the direction of the manufacturer's factory representative, conduct in the presence of the Engineer preliminary and pre-final testing in accordance with 01 79 00 to ensure that all equipment conforms to this Section.
- C. If any part of the system does not meet the requirements specified, corrective measures shall be taken, and/or equipment shall be removed and replaced with equipment that satisfies the conditions specified. All expenses associated with field testing, including any corrective action, shall be borne by the Contractor.

END OF SECTION

APPENDIX A

Geotechnical Report

July 30, 2024

Mr. Andrew E. Lovejoy, P.E.
Civil Engineering Consultants, Inc.
4994 Lower Roswell Road, Suite 18
Marietta, Georgia 30068

Re: Subsurface Investigation Report
City of Jefferson, Georgia
Central City Water Reclamation Facility
Upgrade Phase 1
Jefferson, Jackson County, Georgia
GeoSystems Project No. 24-2942

Dear Mr. Lovejoy:

GeoSystems Engineering, Inc. (GeoSystems) has completed the authorized subsurface investigation for the proposed Phase 1 Upgrade to the City of Jefferson existing Central City Water Reclamation Facility (WRF). The purpose of the investigation was to determine subsurface conditions at the locations of new filter and screen additions and provide recommendations for foundation design and construction. The following report presents our investigation findings, evaluations, and conclusions.

PROJECT INFORMATION

Our understanding of this project is based on the information provided in emails from David Gauker of May 21, 2023. The information provided included “Not for Construction” plans, release date 08/22/2023, by Civil Engineering Consultants for the WRF additions. The plans contain an overall site plan and topographic site plans, structure layouts and sections for both additions. We have also reviewed historic Google Earth aerial photos online and developed a soil survey report of shallow subsurface conditions for the project area from the Natural Resource Conservation Service.

The new filter is located at the existing WRF at 774 Peachtree Road, 0.85-mile southeast of downtown Jefferson in Jackson County, Georgia. The proposed screen and flume structure is located at an existing land application site (LAS) off Curry Drive, about ½-mile northwest of the WRF. Curry Creek and wetlands lies northeast of both the LAS and WRF areas. The existing LAS was constructed prior to 1993 and the WRF in 2005-2006. The north and northeast sides of these sites is mostly forested. A mix of single-family residences, woodlands and Jackson County offices with a soccer field are located west and southwest of the sites. An Overall Boring Location Plan - Figure 1, is enclosed showing the WRF and LAS locations and existing conditions.

Topography at the new filter structure site is gently sloping down to the south between elevations 752 and 748 feet. The proposed screen is to be constructed on a moderately steep cut slope along the southwest side of a gravel access drive. Site elevations within the screen construction area vary from a low of 751 feet in the driveway to above 760 feet along the southwest side of the structure.

Cast-in-place concrete construction with slab on grade foundations are planned for both the filter and screen structures. Planned top of wall and top of foundation elevations are 750.0 and 738.25 feet for the filter and 760.5 and 750.5 feet for the screen. The existing topography indicates excavation depths of 12 to 14 feet for the filter and 6 to 11 feet for the screen will be required to achieve indicated foundation bearing elevations. Maximum foundation pressure is estimated at 1,500 to 2,000 psf.

INVESTIGATION METHODOLOGY

Subsurface conditions were investigated by drilling two soil test borings, B-1 and B-2, at the locations shown on the attached Filter Boring Location Plan – Figure 2 and Screen Boring Location Plan - Figure 3. The borings were field located by a GeoSystems engineer by taping distances and estimating right angles from existing structures. The screen boring B-2 could not be drilled within the structure footprint due to the relatively steep slope restricting drill rig set-up. Boring elevations were interpolated from the contours shown on the provided site plans. Since these measures are not precise, the boring locations and elevations should be considered approximate.

The soil test borings were advanced, utilizing hollow-stem auger drilling procedures, to auger refusal depth of 25 feet below the existing ground surface (bgs) in boring B-1, and boring termination at 25 feet bgs in boring B-2. All drilling and sampling operations were conducted in general accordance with ASTM standards. Standard penetration testing (SPT) and split-spoon sampling of the soils were conducted in each boring at regular intervals to evaluate relative density or consistency of the soils and obtain samples for classification. The split-spoon samples were obtained with a standard 1.4-inch I.D., 2-inch O.D. split-spoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the final foot was recorded and is designated the “standard penetration resistance” or “N” value. Penetration resistance, when properly evaluated, is an index of the soil’s consistency or relative density and bearing capacity.

The split-spoon samples from the borings were initially classified in the field and preliminary boring records were prepared by the driller. In the laboratory, each sample was examined by a geotechnical engineer and final detailed logs of the borings were prepared showing visual soil descriptions, unified soil classifications, groundwater conditions and graphical plots of the standard penetration resistances. The lines designating the interfaces between various strata on the boring logs represent approximate boundaries only, as transitions between materials may be gradual. The final soil test boring logs are included as attachments to this report.

AREA AND SITE GEOLOGY

Geologically, the site is located in the Winder Slope District of the Southern Piedmont Physiographic Province of Georgia. The Winder Slope District is an area characterized by a gently rolling topography that descends gradually from an elevation of 1000 feet in the north to 700 feet along the southern edge. Streams mainly flow in fairly deep and narrow valleys, 100 to 200 feet below narrow, rounded stream divides. A sharp break in the regional slope occurs along the southern boundary of this district, which approximates the 700 foot elevation. The district is dissected by headwater tributaries of major streams draining to the Atlantic Ocean and the drainage divide between streams that drain to the Atlantic Ocean and those draining to the Gulf of Mexico is generally along the western boundary. Numerous dome-shaped, granitic mountains are located on the upland areas between streams in the southern and western portion of the district.

The Piedmont Physiographic Province is an area bounded by the Ridge and Valley, and Blue Ridge provinces on the north and Coastal Plain on the south. The southern section consists of rocks southeast of the Brevard fault zone, which extends across Georgia from northeast of Montgomery, Alabama to near Mount Airy, North Carolina. The Piedmont Province is an area underlain by ancient igneous and metamorphic rocks of Paleozoic age (230 to 600 million years old). The origin of the rocks has been obscured, due to their age and repeated cycles of weathering, metamorphism, folding, faulting, and injection with younger Paleozoic granites and Triassic diabase dikes., such as granite, gneiss, and schist. The Geologic Map of Georgia, 1976, indicates the underlying rocks in the immediate vicinity of the site consist of biotitic gneiss/mica schist/amphibolite and hornblende gneiss/amphibolite units.

All these rocks have weathered in place and are covered by a mantle of residual soils of varying thickness. Residual soils are formed in-situ by chemical alteration of the underlying rocks. Normally, the weathering is most advanced near the ground surface and decreases with depth until unweathered parent rock is encountered. A transition from clay to silt to silty sand to partially weathered rock to hard rock is typical; however, this order of weathering is not always present. It is not uncommon to find layers or zones of partially weathered rock (PWR) or relatively unaltered rock within the deeper soil mantle or weathered rock layers within the underlying parent rock mass.

The deeper residual materials retain the relict structure of the original rock. Partially weathered rock materials have the appearance of sands in which the sand grains are individual mineral crystals that occupy the same positions as in the unaltered rock. Individual crystal breakdown occurs with further weathering and sandy silts or silty sands are formed. The original structure within the parent rock is preserved in these soils; however, the crystalline structure is altered or destroyed. Residual soils characterized by preservation of relict structures that were present in the unweathered rock are referred to as saprolites.

The naturally developed soil profile may also be changed by erosion, deposition, and/or human interference (ie: grading activities), so that the upper, more weathered zones may be completely stripped away or covered by washed-in alluvial soils or manmade fill, or both.

Groundwater in the Piedmont generally occurs under water table conditions because of infiltration of surface waters through the soil overburden or surface waters flowing directly into openings in exposed rock. Fractures and other discontinuities in the underlying rock can affect groundwater conditions. In this geologic setting, the configuration of the groundwater table is generally expected to be a slightly subdued replica of the ground surface.

SUBSURFACE CONDITIONS

Soil Survey Findings

The custom NRCS soil report shows the shallow soils at both proposed structure locations consist of Pacolet, 10 to 15 percent slopes, eroded (PuD2) soils. The native soils in this mapping unit are well drained soils located on side and back slopes of the Piedmont uplands and are formed in residuum weathered from granite and gneiss and/or residuum weathered from schist. The typical soil profile consists of 3 inches of clay loam overlying clay and sandy clay loam to a depth of 52 inches and then loam to 70 inches. Depth to a restrictive feature and depth to the water table is greater than 80 inches.

Soil Test Borings

Below a 6-inch-thick surficial layer of topsoil, subsurface conditions at both proposed structure locations consist mainly of residual soils. A relatively thin layer of partially weathered rock overlying auger refusal materials was also encountered in boring B-1. Groundwater was not encountered in the borings drilled during this investigation. The following further describes the residual soils, partially weathered rock, refusal materials and groundwater conditions indicated by our investigation.

Residual Soils/Partially Weathered Rock. Residual is a term used to describe soils formed in-place by the chemical weathering process of the underlying rocks. Partially weathered rock is similar to residual soils; however, the weathering is not as advanced as in the soil materials. Partially weathered rock can be penetrated by a power auger, but by definition standard penetration resistances in these materials must be a minimum of 100 bpf.

Residual soils were encountered below the topsoil layer to a depth of 22 feet in boring B-1 and boring termination at 25 feet in B-2. The residual soil conditions are generally typical of those described in the previous geology section and consist predominantly of loose to medium dense silty fine to medium or fine to coarse sand (SM) and firm to hard sandy silt (ML). Standard penetration resistances in the residual soils ranged from a minimum of 7 to a maximum of 49 blows per foot (bpf), but typically ranged between 7 and 15 bpf.

Below the residual soils, partially weathered rock was encountered in boring B-1 at a depth of 22 feet below the ground surface. The partially weathered rock is similar to residual soils and was described as very dense silty fine to coarse sand (SM) with large rock fragments. Standard penetration resistances in the PWR was in excess of 100 bpf.

Auger Refusal Material. Auger refusal material refers to any matter that cannot be penetrated by the soil drilling equipment and is normally indicative of a very hard or very dense obstructions, such as boulders, rock lenses, or the upper surface of bedrock. At this site, auger refusal material was encountered in boring B-1 at a depth 25 feet below the ground surface and appears to be at or very near the top of bedrock. Rock coring procedures, which were beyond the scope of this investigation, would be required to determine the actual character and continuity of the refusal material.

Groundwater

Groundwater was not observed in borings B-1 and B-2 at the time of this investigation. We note that groundwater is subject to subsurface conditions, runoff, climate, seasonal variations, and other factors; therefore, groundwater conditions at other locations or at other times may be different than that reported during this study.

EVALUATIONS AND CONCLUSIONS

This report has been prepared for the exclusive use of Civil Engineering Consultants, Inc. for design and construction of the new filter and screen structures. Evaluations, conclusions and recommendations in this report were based on our understanding of the project, the data gathered during this investigation, and our experience with similar site and subsurface conditions. We note that regardless of the thoroughness of a geotechnical investigation, there is always the possibility that conditions between test locations will differ from those at the actual test locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. If conditions differing from those anticipated are encountered during the course of construction, GeoSystems should review the changed conditions to develop any required revisions to our recommendations. Also, should the project plans change substantially from those outlined in this report, we request the opportunity to review our recommendations in light of the changes.

Our professional services were performed, our findings derived, and our conclusions prepared consistent with the professional skill and care ordinarily provided by geotechnical engineers practicing in the same locality under the same or similar circumstances for projects of this type. We make no warranties or guarantees, either expressed or implied. GeoSystems is not responsible for the conclusions, opinions or recommendations of others based on our findings and evaluations.

Seismic Site Classification

Site classification for seismic design of the treatment structures was determined in accordance with ASCE/SEI 7-22. Although subsurface conditions to a depth of 100 feet were not investigated at this site, the available boring data and our previous experience with similar subsurface conditions allow an estimation of the average shear wave velocity profile to a depth of 100 feet below the ground surface. The data indicates the shear wave velocity profile to a depth of 100 feet below the structures would be in the range of 1000 to 1450 ft/sec or greater. Therefore, we recommend Site Class CD (Dense sand or very stiff clay) for this site based on the ASTM definitions provided in Table 20.2-1.

Site Preparation/Excavation Conditions

Initially, all vegetation, root systems, topsoil, refuse, and other deleterious non-soil materials should be stripped from the proposed construction areas and wasted from the site. Clean topsoil may be stockpiled and reused at a later time in areas to be landscaped. On completion of the stripping, excavations to planned foundation bearing elevations can be performed. Excavations varying approximately from 12 to 14 feet for the filter and 6 to 11 feet for the screen are indicated to be required. Based on the boring data and our previous experience with similar conditions, difficult excavation conditions are not expected to be encountered during construction of the filter or the screen. Removal of the soils can be performed by conventional excavators of appropriate size and the excavated soils can be stockpiled for later use as backfill, as required.

We note that partially weathered rock and auger refusal material (apparent rock) were encountered below a depth of 22 feet in boring B-1 at the proposed filter location and some difficult excavation materials may be encountered in areas not investigated or at depths shallower than indicated at the location of B-1. In mass excavations for general site work, very hard or very dense soils and weathered rock can usually be removed by ripping with a single-tooth ripper attached to a large crawler tractor or by breaking the material out with a large front-end loader. In confined excavations, such as foundations and utility trenches, removal of weathered rock typically requires use of large backhoes, pneumatic spades, or light blasting. Refusal materials (apparent rock) usually requires blasting for removal in both mass and confined excavations. Any blasting within structure subgrade areas or in foundation excavations must be done in a controlled manner to prevent damage to the bearing materials and to existing structures.

Slope Stability

Our investigation did not include analysis of slope stability for any temporary or permanent condition. However, we recommend that excavations less than 20 feet in height not exceed 1.5(H):1.0(V) for temporary slopes and 2.0(H):1.0(V) for permanent slopes constructed in undisturbed residual soils or structural fill placed in accordance with our recommendations. A minimum setback from the top of all slopes of 10 feet is recommended for structures and 5 feet for pavements.

Foundation Support

Based on the planned top of foundation elevations, we expect the new filter and screen will be underlain by undisturbed firm sandy silt or medium dense silty sand residual soils. Subject to the inspection recommendations in this report, these conditions should provide adequate long-term shallow foundation support for the new structures. We recommend a maximum allowable soil bearing capacity of 3,000 psf for foundation design. The estimated foundation pressure for the new slab on grade foundations is on the order of 1,500 to 2,000 psf.

Earthwork

All fill required to achieve site grades, backfill excavations around structures or replace undercut areas should be clean soil, free of excessive organic matter and deleterious material. Material

containing rocks or stones greater than 3 inches in diameter should not be used. Fill soils should also have a plasticity index (PI) typically less than 30. We note that moisture control is important in order to achieve adequate compaction and stockpiled fill soils should be protected from the weather. Equipment should also be available on-site during construction for both wetting and drying the fill soils, if necessary.

General site structural fill should be placed in maximum 6 to 8-inch lifts, loose measure, and compacted to at least 95 percent of the maximum dry density as determined by the standard Proctor compaction test (ASTM D-698). Backfill around structures, in trenches or other confined spaces, where light portable compaction equipment is required, should be placed in maximum lift thicknesses of 3 to 4 inches, loose measure. All fill material should be placed in horizontal lifts and adequately keyed into the existing subgrade. In landscaped areas, where no structures are planned or anticipated in the future, the compaction criteria may be reduced to 90 percent of the standard Proctor maximum dry density.

Lateral Earth Pressures

Lateral earth pressures on shoring or retaining walls below grade are influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. The most common conditions assumed for earth-retention or retaining wall design are the active and at-rest conditions. Active conditions apply to relatively flexible earth retention structures, such as freestanding walls and temporary shoring walls, where some movement and rotation may occur to mobilize soil shear strength. Walls that are rigidly restrained, such as basement, pit and tunnel walls, should be designed for the at-rest condition. A third condition, the passive state, represents the maximum possible pressure when a structure is pushed against the soil. The passive state is used in retention/retaining wall foundation design to help resist active or at-rest pressures. Since significant wall movements are required to develop the passive pressure, the total calculated passive pressure should be reduced by one-half (factor of safety of 2) for design purposes.

Based on the boring information and our previous experience with similar soils, we recommend effective soil strength parameters of 0 psf for cohesion (c) and angles of internal friction (ϕ) of 25 and 28 degrees be used in determining lateral earth pressures for design of required temporary excavation shoring and permanent below grade structures. The angle of internal friction value of 25 degrees applies to structural fill compacted to 95 percent standard Proctor or undisturbed residual soils with standard penetration resistances generally less than 10 bpf. The 28-degree friction angle value may be used in undisturbed residual soils with penetration values greater than 10 bpf. An in-situ moist soil unit weight of 120 pcf is also recommended for shoring design calculations. Below the water table, lateral earth pressures should be determined using the buoyant weight of the soil. Hydrostatic pressures calculated with the unit weight of water (62.4 pcf) should be added to these earth pressures to obtain the total stresses for design.

Using ϕ -angles of 25 and 28 degrees results in the following earth pressure coefficients for design of the proposed filter and screen below grade structures and any temporary shoring that may be required for installation:

Earth Pressure Conditions	Coefficient	
	25°	28°
Active (K_A)	0.41	0.36
At-Rest (K_O)	0.58	0.53
Passive (K_P)	2.46	2.80

Inspection

We recommend the new filter and screen foundation excavations be evaluated by the project geotechnical engineer to confirm that conditions are similar to those encountered in the borings and that the bearing soils are capable of supporting the design foundation bearing pressure. We note that some stabilization and/or undercutting and replacement of weak or wet soils with crushed stone may be required in order to provide adequate foundation support. The extent of any stabilization measures or undercutting required should be determined at the time of construction by the inspecting geotechnical engineer.

Foundation excavations should be free of all soft or loose soil, mud, disturbed materials, and other deleterious materials prior to placement of concrete. In addition, foundation concrete should not be placed on a frozen subgrade. Any foundation bearing area that has been disturbed due to construction activities or exposure to precipitation or run-off must be repaired prior to construction of the foundation slab. We recommend the foundation excavations be concreted as soon as practical after they are prepared and inspected, and storm water or runoff should be prevented from ponding on or infiltrating the bearing surfaces. If it is necessary to leave the foundation excavations open for an extended period of time, we recommend that a thin mat of lean concrete be placed over the bottom for protection.

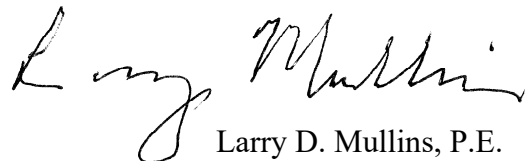
We appreciate the opportunity of working with you on this project and look forward to assisting during the construction phase. If you have any questions concerning this report or need anything further, please call us.

Sincerely,

GeoSystems Engineering, Inc.



Andy R Christian
Staff Engineer



Larry D. Mullins, P.E.
Principal Engineer

Enclosures: Boring Location Plan – Figure 1
Filter Boring Location Plan – Figure 2
Screen Boring Location Plan – Figure 3
Key to Symbols and Classifications
Soil Test Boring Logs





APPROXIMATE
NORTH




B-2

B-1

SOURCE:
Google Earth Aerial Photograph

LEGEND

 - SOIL TEST BORING

NOT TO SCALE

NO.	DATE	REVISION
PREPARED BY: GEI	DATE: 7/16/2024	
REVIEWED BY: LDM	DATE: 7/16/2024	

GEOSYSTEMS
ENGINEERING, INC.

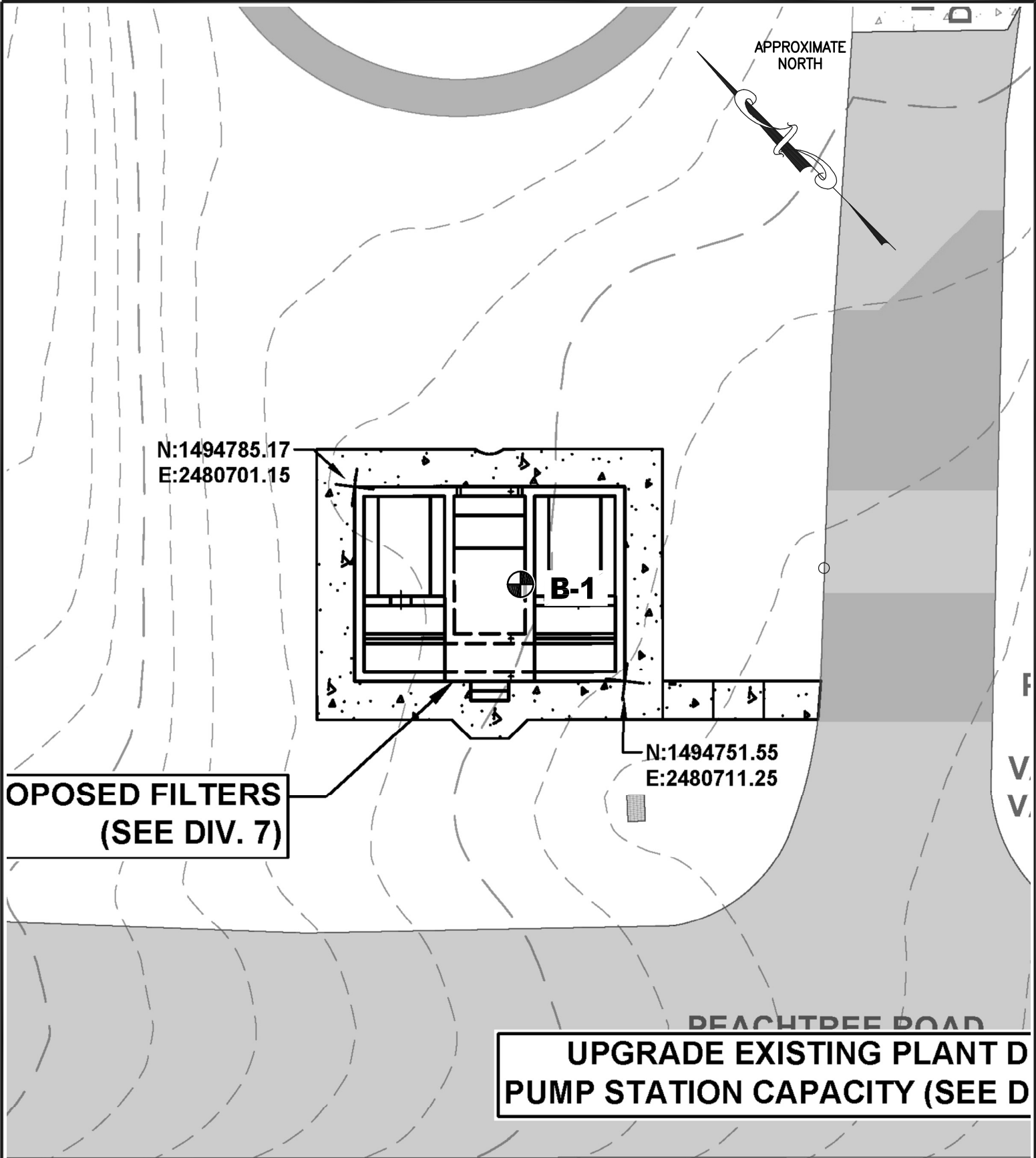
REFERENCE: Jefferson Central City WRF.dwg

BORING LOCATION PLAN

PROJECT: CITY OF JEFFERSON, GEORGIA
CENTRAL City WRF UPGRADE PHASE 1
Jackson County, Georgia
GeoSystems Project Number: 24-2942

FIGURE:

1



SOURCE:
 Jefferson Central City WRF Upgrade Phase 1, Proposed Plant Site Plan,
 Sheet 3-C-1 drawing prepared by Civil Engineering Consultants, Inc.

LEGEND	
	- SOIL TEST BORING
NOT TO SCALE	
PREPARED BY: GEI	DATE: 7/11/2024
REVIEWED BY: LDM	DATE: 7/11/2024

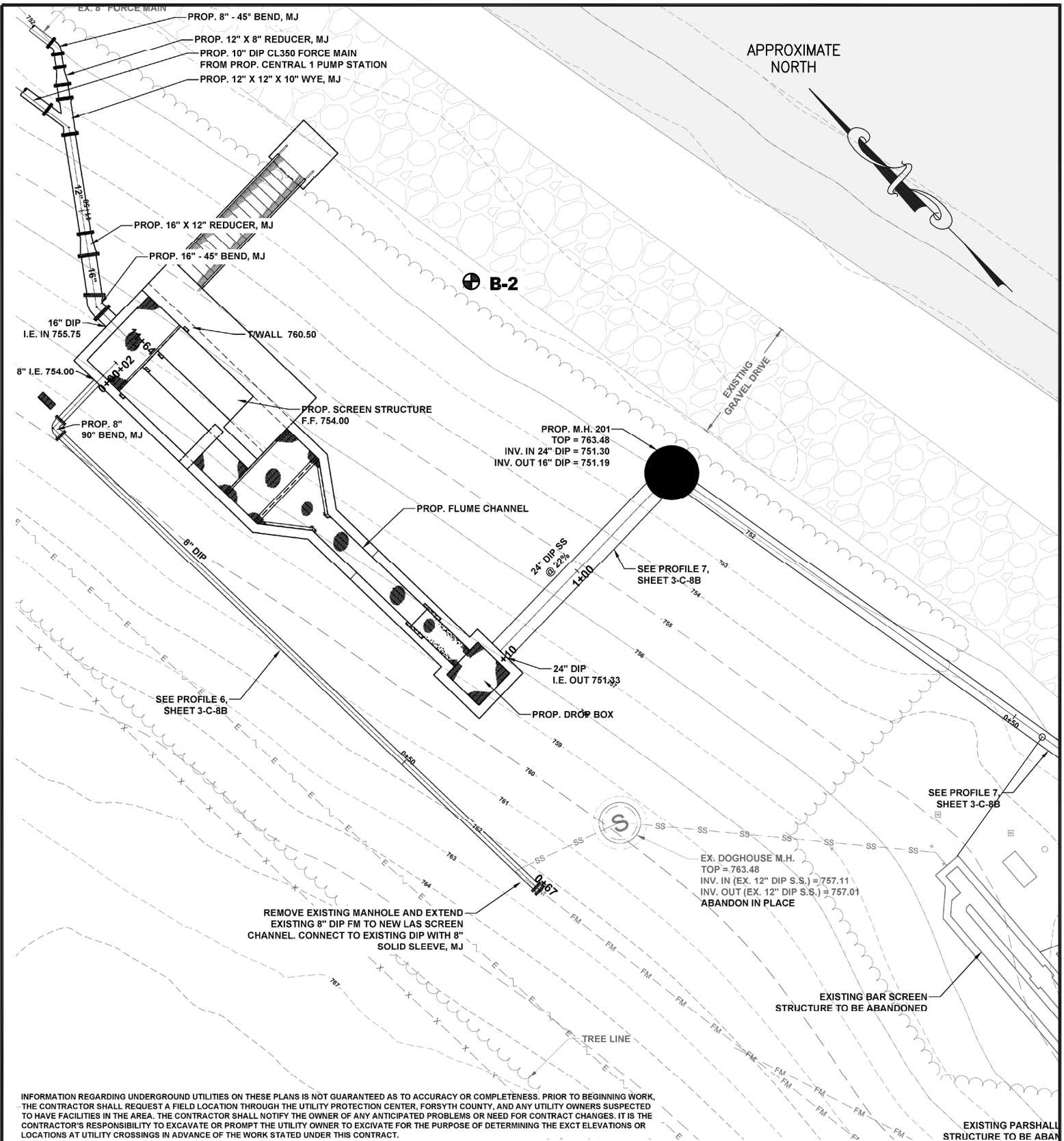


REFERENCE: Jefferson Central City WRF.dwg

FILTER BORING LOCATION PLAN

PROJECT: CITY OF JEFFERSON, GEORGIA
 CENTRAL City WRF UPGRADE PHASE 1
 Jackson County, Georgia
 GeoSystems Project Number: 24-2942

FIGURE:
2



INFORMATION REGARDING UNDERGROUND UTILITIES ON THESE PLANS IS NOT GUARANTEED AS TO ACCURACY OR COMPLETENESS. PRIOR TO BEGINNING WORK, THE CONTRACTOR SHALL REQUEST A FIELD LOCATION THROUGH THE UTILITY PROTECTION CENTER, FORSYTH COUNTY, AND ANY UTILITY OWNERS SUSPECTED TO HAVE FACILITIES IN THE AREA. THE CONTRACTOR SHALL NOTIFY THE OWNER OF ANY ANTICIPATED PROBLEMS OR NEED FOR CONTRACT CHANGES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO EXCAVATE OR PROMPT THE UTILITY OWNER TO EXCAVATE FOR THE PURPOSE OF DETERMINING THE EXCT ELEVATIONS OR LOCATIONS AT UTILITY CROSSINGS IN ADVANCE OF THE WORK STATED UNDER THIS CONTRACT.

SOURCE:
 Jefferson Central City WRF Upgrade Phase 1, Enlarged Proposed LAS & Pharshall Flume Site Plan, Sheet 3-C-7 drawing prepared by Civil Engineering Consultants, Inc.

LEGEND	
	- SOIL TEST BORING
NOT TO SCALE	
PREPARED BY: GEI	DATE: 7/11/2024
REVIEWED BY: LDM	DATE: 7/11/2024



REFERENCE: Jefferson Central City WRF.dwg

SCREEN BORING LOCATION PLAN

PROJECT:	CITY OF JEFFERSON, GEORGIA CENTRAL City WRF UPGRADE PHASE 1 Jackson County, Georgia GeoSystems Project Number: 24-2942	FIGURE:	3
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KEYS TO SYMBOLS AND CLASSIFICATIONS

SPECIAL STRATIGRAPHY IDENTIFIERS USED TO HIGHLIGHT SPECIFIC LAYERS	FILL TOPSOIL PAVEMENT	PARTIALLY WEATHERED ROCK ROCK (GENERAL) WATER ALLUVIUM
COARSE GRAINED SOIL - GRAVELS & SANDS (MORE THAN 50% OF MATERIAL IS RETAINED ON NO. 200 SIEVE)	CLEAN SANDS & GRAVELS (< 5% FINES CONTENT)	SP: Poorly graded sands SW: Well graded sands GP: Poorly graded gravels GW: Well graded gravels
FINE GRAINED SOIL - SILTS & CLAYS (MORE THAN 50% OF MATERIAL PASSES NO. 200 SEIVE)	SANDS & GRAVELS WITH HIGH FINES CONTENT (> 15% FINES CONTENT)	SM: Silty sands GM: Silty gravels SC: Clayey sands GC: Clayey gravels
SILTS	CLAYS	ML: Low plasticity inorganic silts MH: High plasticity inorganic silts CL: Low placticity inorganic clays CH: High plasticity inorganic clays
ORGANIC SILTS & CLAYS	ORGANIC SILTS & CLAYS	OL: Low plasticity organic silts and clays OH: High plasticity organic silts and clays

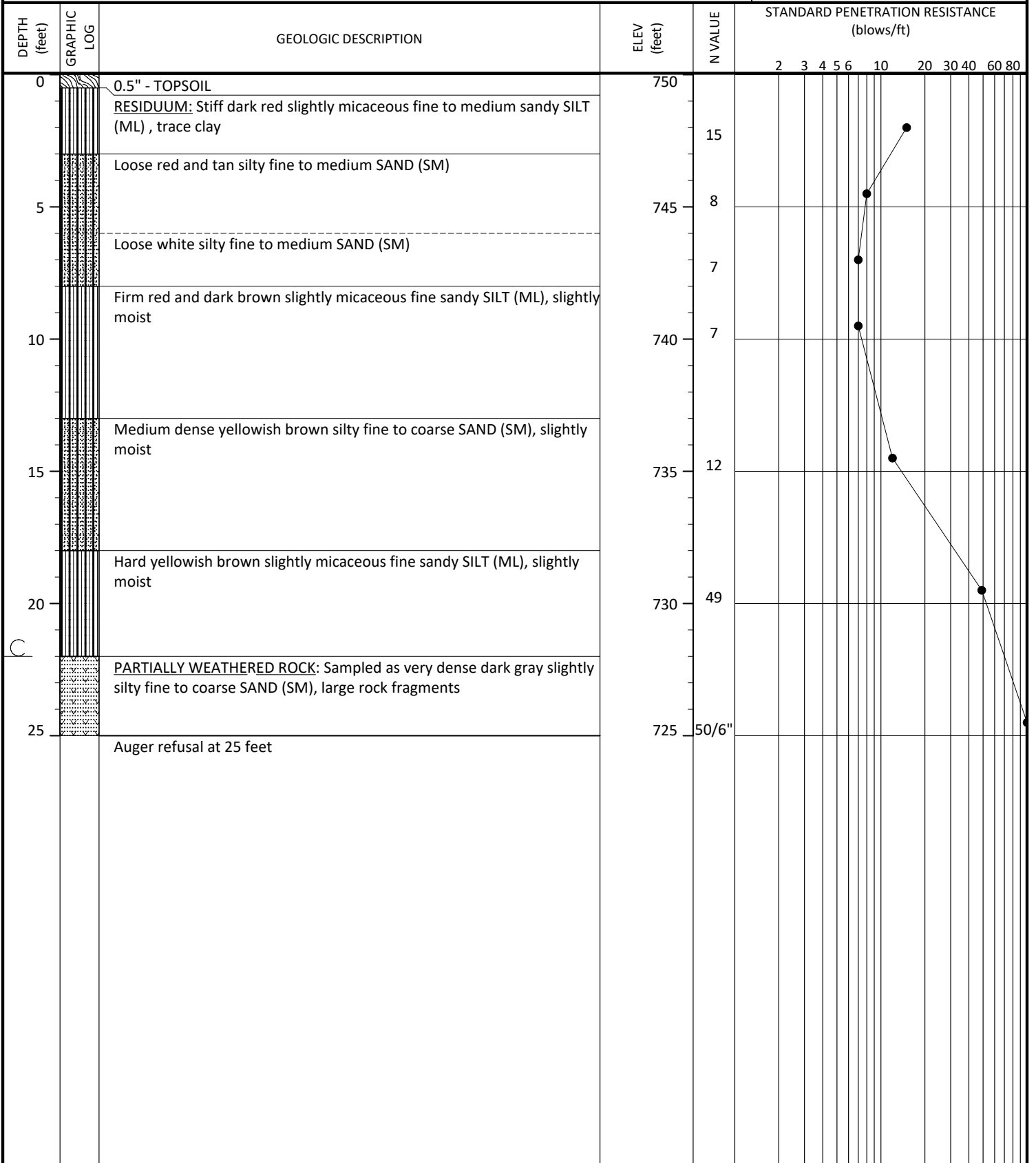
CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	NUMBER OF BLOWS, N	APPROXIMATE RELATIVE DENSITY
SANDS AND GRAVELS	0 - 4	Very Loose
	5 - 10	Loose
	11 - 30	Medium Dense
	31 - 50	Dense
	OVER 50	Very Dense
	SILTS AND CLAYS	NUMBER OF BLOWS, N
0 - 1		Very Soft
2 - 4		Soft
5 - 8		Firm
9 - 15		Stiff
16 - 30		Very Stiff
31 - 50		Hard
OVER 50		Very Hard

**CITY OF JEFFERSON, GEORGIA
CENTRAL CITY WRF - UPGRADE PHASE I
JACKSON COUNTY, GEORGIA**

LOG OF BORING B-1

GEOLOGIST: NA		ELEVATION (feet): 750		NOTES: 1. No groundwater encountered at the time of drilling (NGWE). 2. Measurement of stabilized groundwater level was not performed (NGWM). Borehole caved to a depth of 22 feet on removal of augers.
DATE DRILLED: 7/10/2024		BORING DEPTH (feet): 25		
DRILLER: HORIZON DRILLING LLC		WATER LEVEL ∇ TOB (feet): NGWE \blacktriangledown 24HR (feet): NGWM		
DRILLING METHOD: HOLLOW STEM AUGER WITH AUTOMATIC HAMMER				



**CITY OF JEFFERSON, GEORGIA
CENTRAL CITY WRF - UPGRADE PHASE I
JACKSON COUNTY, GEORGIA**

LOG OF BORING B-2

GEOLOGIST: NA	ELEVATION (feet): 751	NOTES: 1. No groundwater encountered at the time of drilling (NGWE). 2. Measurement of stabilized groundwater level was not performed (NGWM). Borehole caved to a depth of 23.5 feet on removal of augers.
DATE DRILLED: 7/10/2024	BORING DEPTH (feet): 25	
DRILLER: HORIZON DRILLING LLC	WATER LEVEL ∇ TOB (feet): NGWE \blacktriangledown 24HR (feet): NGWM	
DRILLING METHOD: HOLLOW STEM AUGER WITH AUTOMATIC HAMMER		

