



PROJECT MANUAL

Water & Wastewater Improvements Onondaga Cave State Park Leasburg, Missouri

Designed By: Archer - Elgin
310 E. 6th Street
Rolla, MO 65401

Date Issued: August 16, 2024

Project No.: X2306-02

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION
Facilities Management, Design & Construction

SECTION 00 01 07

PROFESSIONAL SEALS AND CERTIFICATIONS

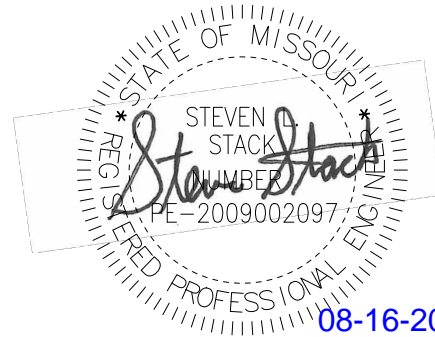
PROJECT NUMBER: (X2306-02 "Onondaga Cave State Park Water & Wastewater Improvements")

THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:

CIVIL, PROCESS KENNETH A. CAMPBELL, P.E. MO PE-2006002797	STRUCTURAL STEVEN L. STACK, P.E., S.E. MO PE-2009002097
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08-16-2024



08-16-2024

Steven L. Stack, P.E. 2009002097

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LIST OF DRAWINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.02 SUMMARY

- A. This Section provides a comprehensive list of the drawings that comprise the Bid Documents for this project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 LIST OF DRAWINGS

- A. The following list of drawings is a part of the Bid Documents:

	<u>TITLE</u>	<u>SHEET #</u>	<u>DATE</u>	<u>CAD #</u>
1.	Cover Sheet	Sheet G-001	08/16/24	G-001
2.	Overall Site Plan & Key Sheet	Sheet C-100	08/16/24	C-100
3.	Waterline Plan	Sheet C-101	08/16/24	C-101
4.	Waterline Plan	Sheet C-102	08/16/24	C-102
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8.	Well House Plan	Sheet C-106	08/16/24	C-106
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10.	Land Application Improvements	Sheet C-200	08/16/24	C-200
11.	Civil Details	Sheet C-501	08/16/24	C-501
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21.	Section & Details	Sheet S-301	08/16/24	S-301
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END OF SECTION

SECTION 001116 - INVITATION FOR BID

1.0 OWNER:

- A. The State of Missouri
Office of Administration,
Division of Facilities Management, Design and Construction
Jefferson City, Missouri

2.0 PROJECT TITLE AND NUMBER:

- A. Water & Wastewater Improvements
Onondaga Cave State Park
Leasburg, Missouri
Project No.: X2306-02

3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, October 17, 2024
- B. **Only electronic bids on MissouriBUYS shall be accepted: <https://missouribuys.mo.gov>. Bidder must be registered to bid.**

4.0 DESCRIPTION:

- A. Scope: The project consists of upgrades to the water supply, water distribution and wastewater treatment systems for the park.
- B. MBE/WBE/SDVE Goals: MBE 0%, WBE 0%, and SDVE 3%. **NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**
- C. ****NOTE:** Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.

5.0 PRE-BID MEETING:

- A. Place/Time: 10:00 AM, October 1, 2024, at 115 Meramec Park Drive, Sullivan, MO 63080.
- B. Access to State of Missouri property requires presentation of a photo ID by all persons.

6.0 HOW TO GET PLANS & SPECIFICATIONS:

- A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of \$100.00 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, <https://www.adsplanroom.net>. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. **Bidder must secure at least one bid set to become a planholder.**
- B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**
- C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

7.0 POINT OF CONTACT:

- A. Designer: Archer – Elgin, Ken Campbell, 573-364-6362, email: kcampbell@cmarcher.com
- B. Project Manager: Eric Hibdon, 573-508-3666, email: Eric.Hibdon@oa.mo.gov

8.0 GENERAL INFORMATION:

- A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.
- B. Bid results will be available at <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans> after it is verified that at least one bid is awardable and affordable.
- C. This is a federally funded/assisted construction project that requires compliance by the awarded Bidder with applicable federal laws and regulations. The Bidder should review Section 007333, Supplementary General Conditions for Federally Funded/Assisted Construction Projects and Section 007334, Terms and Conditions for Contractor Receipt of Federal ARPA SFRF Funds, which are made part of this Invitation to Bid and will be made part of the resulting contract by reference.

Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

- A. The bidder shall submit his or her bid and all supporting documentation on MissouriBUYS eProcurement System. No hard copy bids shall be accepted. Go to <https://missouribuys.mo.gov> and register. The bidder must register and complete a profile fully with all required documents submitted prior to submitting a bid.
- B. Once registered, log in.
1. Under "Solicitation" select "View Current Solicitations."
 2. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8", then click "Filter Solicitation" button.
 3. Select "Active Solicitations" tab.
 4. To see the Solicitation Summary, click on the Project Number and the summary will open. Click each heading to open detailed information.
- C. Here are simplified instructions for uploading the bid to MissouriBUYS:
1. Find the solicitation by completing Steps 1 through 4 above.
 2. Select the three dots under "Actions." Select "Add New Response."
 3. When the Quote box opens, give the response a title and select "OK."
 4. The detailed solicitation will open. Select "Check All" for the Original Solicitation Documents, open each document, and select "Accept." If this step is not completed, a bid cannot be uploaded. Scroll to the bottom of the page and select "Add Attachments." If you do not see this command, not all documents have been opened and accepted.
 5. The Supplier Attachments box will open. Select "Add Attachment" again.
 6. The Upload Documents box will open. Read the instructions for uploading. Disregard the "Confidential" check box.
 7. Browse and attach up to 5 files at a time. Scroll to bottom of box and select "Upload." The Supplier Attachments box will open. Repeat Steps 5 through 7 if more than 5 files are to be uploaded.
 8. When the Supplier Attachments box opens again and uploading is complete, select "Done." A message should appear that the upload is successful. If it does not, go to the Bidder Response tab and select "Submit."
 9. The detailed solicitation will open. At the bottom select "Close."
- D. Any time a bidder wants to modify the bid, he or she will have to submit a new one. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.
- E. If you want to verify that you are uploading documents correctly, please contact Paul Girouard: 573-751-4797, paul.girouard@oa.mo.gov ; April Howser: 573-751-0053, April.Howser@oa.mo.gov ; or Mandy Roberson: 573-522-0074, Mandy.Roberson@oa.mo.gov.
- F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Cathy Holliday at 573-751-3491 or by email: cathy.holliday@oa.mo.gov.

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

- A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project must adhere to requirements in Section 013513 – Site Security and Health Requirements as applicable per Agency.
- B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

2.0 - BID DOCUMENTS

- A. The number of sets obtainable by any one (1) party may be limited in accordance with available supply.
- B. For the convenience of contractors, sub-contractors and suppliers, copies of construction documents are on file at the office of the Director, Division of Facilities Management, Design and Construction and on the Division's web site - <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

3.0 - BIDDERS' OBLIGATIONS

- A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are also required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the contractor to fulfill in every detail all of the requirements of the contract, nor accepted as a basis for any claims for extra compensation.
- B. Under no circumstances will contractors give their plans and specifications to another contractor. Any bid received from a contractor whose name does not appear on the list of plan holders may be subject to rejection.

4.0 - INTERPRETATIONS

- A. No bidder shall be entitled to rely on oral interpretations as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than five (5) working days before opening of bids. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.
- B. Approval for an "acceptable substitution" issued in the form of an addendum as per Paragraph 4A above, and as per Article 3.1 of the General Conditions; ACCEPTABLE SUBSTITUTIONS shall constitute approval for use in the project of the product.
- C. An "acceptable substitution" requested after the award of bid shall be approved if proven to the satisfaction of the Owner and the Designer as per Article 3.1, that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner.
- D. A request for "Acceptable Substitutions" shall be made on the Section 006325 Substitution Request Form. The request shall be sent directly to the project Designer. A copy of said request should also be mailed to the Owner, Division of Facilities Management, Design and Construction, Post Office Box 809, Jefferson City, Missouri 65102.

5.0 - BIDS AND BIDDING PROCEDURE

- A. Bidders shall submit all submission forms and accompanying documents listed in SECTION 004113 – BID FORM, Article 5.0, ATTACHMENTS TO BID by the stated time or their bid will be rejected for being non-responsive.

Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals and times when they may be due. Please check for specific project requirements on the proposal form (Section 004113). ***Not all of the following bid forms may be required to be submitted.***

Bid Submittal – due before stated date and time of bid opening (see IFB):

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization
004545	Anti-Discrimination Against Israel Act Certification form

- B. All bids shall be submitted without additional terms and conditions, modification or reservation on the bid forms with each space properly filled. Bids not on these forms will be rejected.
- C. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated on the bid form, Section 004113. Failure of the contractor to submit the full amount required shall be sufficient cause to reject his bid. The bidder agrees that the proceeds of the check, draft or bond shall become the property of the State of Missouri, if for any reason the bidder withdraws his bid after closing, or if on notification of award refuses or is unable to execute tendered contract, provide an acceptable performance and payment bond, provide evidence of required insurance coverage and/or provide required copies of affirmative action plans within ten (10) working days after such tender.
- D. The check or draft submitted by the successful bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri. Bid bonds will only be returned upon request.

6.0 - SIGNING OF BIDS

- A. A bid from an individual shall be signed as noted on the Bid Form.
- B. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture or an attorney-in-fact. If the bid is signed by an officer of a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.
- C. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.
- D. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual. Corporate license number shall be provided and, if a corporation organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached. In addition, for corporate proposals, the President or Vice-President should sign as the bidder. If the signatory is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signatory has the legal authority to bind the corporation.

- E. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records.
- F. The Bidder should include its corporate license number on the Bid Form and, if the corporation is organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached to the bid form.

7.0 - RECEIVING BID SUBMITTALS

- A. It is the bidder's sole responsibility to assure receipt by Owner of bid submittals by the date and time specified in the Invitation for Bid. Bids received after the date and time specified shall not be considered by the Owner.
- B. Bids must be submitted through the MissouriBUYS statewide eProcurement system (<https://www.missouribuys.mo.gov/>) in accordance with the instructions for that system. The Owner shall only accept bids submitted through MissouriBUYS. Bids received by the Owner through any other means, including hard copies, shall not be considered and will be discarded by the Owner unopened.
- C. To respond to an Invitation for Bid, the Bidder must first register with MissouriBUYS by going through the MissouriBUYS Home Page (<https://www.missouribuys.mo.gov/>), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered, the Bidder accesses its account by clicking the "Login" button at the top of the MissouriBUYS Home Page. Enter your USERID and PASSWORD, which the Bidder will select. Under Solicitations, select "View Current Solicitations." A new screen will open. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8." Under "Filter by Opp. No." type in the State Project Number. Select "Submit." Above the dark blue bar, select "Other Active Opportunities." To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information. The Bidder must read and accept the Original Solicitation Documents and complete all identified requirements. The Bidder should download and save all of the Original Solicitation Documents on its computer so that the Bidder can prepare its response to these documents. The Bidder should upload its completed response to the downloaded documents as an attachment to the electronic solicitation response.
- D. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are provided in Section 001116 – Invitation For Bid.
- E. The Bidder shall submit its bid on the forms provided by the Owner on MissouriBUYS with each space fully and properly completed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner may reject bids that are not on the Owner's forms or that do not contain all requested information.
- F. No Contractor shall stipulate in his bid any conditions not contained in the specifications or standard bid form contained in the contract documents. To do so may subject the Contractor's bid to rejection.
- G. The completed forms shall be without interlineations, alterations or erasures.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

- A. Bidder may withdraw his bid at any time prior to scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.
- B. The Bidder shall modify his or her original bid by submitting a revised bid on MissouriBUYS.

9.0 - AWARD OF CONTRACT

- A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.
- B. The Owner reserves the right to let other contracts in connection with the work, including but not by way of limitation, contracts for the furnishing and installation of furniture, equipment, machines, appliances and other apparatus.

- C. The Owner shall award a contract to the lowest, responsive, responsible Bidder in accordance with Section 8.250, RSMo. No contract will be awarded to any Bidder who has had a contract with the Owner terminated within the preceding twelve months for material breach of contract or who has been suspended or debarred by the Owner.
- D. Award of alternates, if any, will be made in numerical order unless all bids received are such that the order of acceptance of alternates does not affect the determination of the lowest, responsive, responsible bidder.
- E. No bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.
- F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.
- G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.
- H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.
- I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.
- J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of \$5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding a E-Verify is located at <https://www.uscis.gov/e-verify/>. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

10.0 - CONTRACT SECURITY

- A. The successful bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 on a condition prior to the State executing the contract and issuing a notice to proceed.

11.0 - LIST OF SUBCONTRACTORS

- A. If required by “Section 004113 – Bid Form,” each bidder must submit as part of their bid a list of subcontractors to be used in performing the work (Section 004336). The list must specify the name of the single designated subcontractor, for each category of work listed in “Section 004336 - Proposed Subcontractors Form.” If work within a category will be performed by more than one subcontractor, the bidder must provide the name of each subcontractor and specify the exact portion of the work to be done by each. Failure to list the Bidder’s firm, or a subcontractor for each category of work identified on the Bid Form or the listing of more than one subcontractor for any category without designating the portion of work to be performed by each shall be cause for rejection of the bid. If the bidder intends to perform any of the designated subcontract work with the use of his own employees, the bidder shall make that fact clear, by listing his own firm for the subject category. **If any category of work is left vacant, the bid shall be rejected.**

12.0 - WORKING DAYS

- A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:
 - 1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

- A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.
- B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.
- C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the person's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

14.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

- A. Pursuant to section 34.600, RSMo, if the Bidder meets the section 34.600, RSMo, definition of a “company” and the Bidder has ten or more employees, the Bidder must certify in writing that the Bidder is not currently engaged in a boycott of goods or services from the State of Israel as defined in section 34.600, RSMo, and shall not engage in a boycott of goods or services from the State of Israel, if awarded a contract, for the duration of the contract. The Bidder is requested to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with their Bid Form. The applicable portion of the exhibit must be submitted prior to execution of a contract by the Owner and issuance of Notice to Proceed. If the exhibit is not submitted, the Owner shall rescind its Intent to Award and move to the next lowest, responsive, responsible bidder.

15.0 - MBE/WBE/SDVE INSTRUCTIONS

- A. Definitions:
 - 1. “**MBE**” means a Minority Business Enterprise.
 - 2. “**MINORITY**” has the same meaning as set forth in 1 C.S.R. 10-17.010.
 - 3. “**MINORITY BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
 - 4. “**WBE**” means a Women’s Business Enterprise.
 - 5. “**WOMEN’S BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
 - 6. “**SDVE**” means a Service-Disabled Veterans Enterprise.
 - 7. “**SERVICE-DISABLED VETERAN**” has the same meaning as set forth in section 34.074, RSMo.
 - 8. “**SERVICE-DISABLED VETERAN ENTERPRISE**” has the same meaning as “Service-Disabled Veteran Business” set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than \$100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be non-responsive, and its bid shall be rejected.
2. The Bidder should submit with its bid all of the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all appropriate MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.
3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder's proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) Working Days of receiving the request for clarification.
4. Pursuant to section 34.074, RSMo, a Bidder that is a SDVE doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business, shall receive a three-point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive bidder's bid. Based on this calculation, if the eligible SDVE's evaluation is less than the apparent low responsive bidder's bid, the eligible SDVE's bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only, and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service Disabled Veteran Business Form, and any information required by the form. The form is available on the MissouriBUYS solicitation for this project.

C. Computation of MBE/WBE/SDVE Goal Participation:

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: A MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) In order for the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.
2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.
3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.
4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.
5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.
6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.
2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory (<https://apps1.mo.gov/MWBCertifiedFirms/>). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management's online SDVE directory (<https://oao.mo.gov/sdve-certification-program/>) or the Department of Veterans Affairs' directory (<https://veterans.certify.sba.gov/#search>).
3. Additional information, clarifications, etc., regarding the listings in the directories may be obtained by calling the Division at (573)751-3339 and asking to speak to the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The GFE forms are located on the MissouriBUYS solicitation for this project. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be determined to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.
2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:
 - a. The amount of actual participation obtained;
 - b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;
 - c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;
 - d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;
 - e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;
 - f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;
 - g. The Bidder's stated reasons for rejecting any bids;
3. If no bidder has obtained any participation in a particular category (MBE/WBE/SDVE) or made a good faith effort to do so, the Director may waive that goal rather than rebid.

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount bid, unless the amount is modified in writing by the Owner.

2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:
 - a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or
 - b. Declaring the Contractor be non-responsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.
3. If the Contractor replaces an MBE, WBE, or SDVE during the course of this contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director.
4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.

**STATE OF MISSOURI
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION
*MBE/WBE/SDVE DIRECTORIES***

The MBE/WBE Directory for goods and services is maintained by the Office of Equal Opportunity (OEO) and is located at the following web address:

<https://apps1.mo.gov/MWBCertifiedFirms/>

The SERVICE DISABLED VETERAN ENTERPRISE (SDVE) Directories may be accessed at the following web addresses:

<https://oeo.mo.gov/sdve-certification-program/>

<https://veterans.certify.sba.gov/#search>



State of Missouri Construction Contract

THIS AGREEMENT is made (DATE) by and between:

Contractor Name and Address

hereinafter called the "Contractor,"

and the **State of Missouri**, hereinafter called the "**Owner**", represented by the Office of Administration, Division of Facilities Management, Design and Construction, on behalf of the Department of Natural Resources Division of State Parks.

WITNESSETH, that the Contractor and the Owner, for the consideration stated herein agree as follows:

ARTICLE 1. STATEMENT OF WORK

The Contractor shall furnish all labor and materials and perform all work required for furnishing and installing all labor, materials, equipment and transportation and everything necessarily inferred from the general nature and tendency of the plans and specifications for the proper execution of the work for:

Project Name: **Water & Wastewater Improvements
Onondaga Cave State Park
Leasburg, Missouri**

Project Number: **X2306-02**

in strict accordance with the Contract Documents as enumerated in Article 7, all of which are made a part hereof.

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **200 working days** from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of \$1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

ARTICLE 4. CONTRACT SUM

The Owner shall pay the Contractor for the prompt, faithful and efficient performance of the conditions and undertakings of this contract, subject to additions, and deductions as provided herein, in current funds the sum of:

Base Bid: \$

TOTAL CONTRACT AMOUNT: (\$CONTRACT AMOUNT)

ARTICLE 5. PREVAILING WAGE RATE

MISSOURI PREVAILING WAGE LAW (Sections 290.210 to 290.340, RSMo): The Contractor shall pay not less than the specified hourly rate of wages, as set out in the wage order attached to and made part of the specifications for work under this contract, to all workers performing work under the contract, in accordance with sections 290.210 to 290.340, RSMo. The Contractor shall forfeit a penalty to the Owner of one hundred dollars per day (or portion of a day) for each worker that is paid less than the specified rates for any work done under the contract by the Contractor or by any subcontractor, in accordance with section 290.250, RSMo.

DAVIS-BACON ACT: The requirements of the Davis-Bacon Act are not applicable to this project funded, which is funded solely by Coronavirus State and Local Fiscal Recover Funds (SLFRF) under the American Rescue Plan Act (ARPA).

ARTICLE 6. MINORITY/WOMEN/SERVICE DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION

The Contractor has been granted a waiver of the 0% MBE and 0% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

The Contractor has met the MBE/WBE/SDVE participation goals and agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows:

MBE/WBE/SDVE Firm: Subcontract Amt:\$
MBE/WBE/SDVE Firm: Subcontract Amt:\$
MBE/WBE/SDVE Firm: Subcontract Amt:\$

Total \$

MBE/WBE/SDVE assignments identified above shall not be changed without a contract change signed by the Owner.

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.

ARTICLE 7. CONTRACT DOCUMENTS

The following documents are hereby incorporated into this contract by reference (all division/section numbers and titles are as utilized in the Project Manual published by the Owner for this Project):

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
 - a. Invitation for Bid (Section 001116)
 - b. Instructions to Bidders (Section 002113)
 - c. Supplementary Instructions to Bidders (if applicable) (Section 002213)
 - d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:
 - i. Bid Form (Section 004113)
 - ii. Proposed Contractors Form (Section 004336)
 - iii. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
 - iv. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)

- v. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
- vi. Missouri Service Disabled Veteran Business Form (Section 004340)
- vii. Affidavit of Work Authorization (Section 004541)
- viii. Affidavit for Affirmative Action (Section 005414)
- e. Performance and Payment Bond, completed and executed by the Contractor and surety (Section 006113)
- f. General Conditions (Section 007213)
- g. Supplementary Conditions (Section 007300)
- h. Supplementary General Conditions for Federally Funded/Assisted Construction Projects (Section 007333)
- i. Wage Rate(s) (Section 007346)
- 2. Division 1 – General Requirements
- 3. All Drawings identified in the Project Manual
- 4. All Technical Specifications included in the Project Manual
- 5. Addenda, if applicable

ARTICLE 8 – CERTIFICATION

By signing this contract, the Contractor hereby re-certifies compliance with all legal requirements set forth in Section 6.0, Bidder’s Certifications of the Bid Form.

Further, if the Contractor provides any “personal information” as defined in §105.1500, RSMo concerning an entity exempt from federal income tax under Section 501(c) of the Internal Revenue Code of 1986, as amended, the Contractor understands and agrees that it is voluntarily choosing to enter into a state contract and providing such information for that purpose. The state will treat such personal information in accord with §105.1500, RSMo.

By signature below, the parties hereby execute this contract document.

APPROVED:

 Brian Yansen, Director
 Division of Facilities Management,
 Design and Construction

 Contractor’s Authorized Signature

I, Corporate Secretary, certify that I am Secretary of the corporation named above and that (CONTRACTOR NAME), who signed said contract on behalf of the corporation, was then (TITLE) of said corporation and that said contract was duly signed for and in behalf of the corporation by authority of its governing body, and is within the scope of its corporate powers.

Corporate Secretary



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT FOR AFFIRMATIVE ACTION

PROJECT NUMBER

NAME

First being duly sworn on oath states: that

he/she is the sole proprietor partner officer or manager or managing member of

NAME

a sole proprietorship partnership
 limited liability company (LLC)

or corporation, and as such, said proprietor, partner, or officer is duly authorized to make this

affidavit on behalf of said sole proprietorship, partnership, or corporation; that under the contract known as

PROJECT TITLE

Less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action requirements as set forth in Article 1.4 of the General Conditions of the State of Missouri have been met.

PRINT NAME & SIGNATURE

DATE

--

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER SEAL	STATE OF	COUNTY (OR CITY OF ST. LOUIS)	USE RUBBER STAMP IN CLEAR AREA BELOW
	SUBSCRIBED AND SWORN BEFORE ME, THIS		
	DAY OF	YEAR	
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
NOTARY PUBLIC NAME (TYPED OR PRINTED)			

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____

as principal, and _____

_____ as Surety, are held and firmly bound unto the

STATE OF MISSOURI. in the sum of _____ Dollars (\$ _____)

for payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

WHEREAS, the Principal has, by means of a written agreement dated the _____

day of _____, 20_____, enter into a contract with the State of Missouri for

(Insert Project Title and Number)

NOW, THEREFORE, if the Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the State of Missouri, with or without notice to the Surety and during the life of any guaranty required under the contract; and shall also faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made with or without notice to the Surety; and shall also promptly make payment for materials incorporated, consumed or used in connection with the work set forth in the contract referred to above, and all insurance premiums, both compensation and all other kinds of insurance, on said work, and for all labor performed on such work, whether by subcontractor or otherwise, at not less than the prevailing hourly rate of wages for work of a similar character (exclusive of maintenance work) in the locality in which the work is performed and not less than the prevailing hourly rate of wages for legal holiday and overtime work (exclusive of maintenance work) in the locality in which the work is performed both as determined by the Department of Labor and Industrial Relations or determined by the Court of Appeal, as provided for in said contract and in any and all duly authorized modifications of said contract that may be hereafter made, with or without notice to the Surety, then, this obligation shall be void and of no effect, but it is expressly understood that if the Principal should make default in or should fail to strictly, faithfully and efficiently do, perform and comply with any or more of the covenants, agreements, stipulations, conditions, requirements or undertakings, as specified in or by the terms of said contract, and with the time therein named, then this obligation shall be valid and binding upon each of the parties hereto and this bond shall remain in full force and effect; and the same may be sued on at the instance of any material man, laborer, mechanic, subcontractor, individual, or otherwise to whom such payment is due, in the name of the State of Missouri, to the use of any such person.

AND, IT IS FURTHER specifically provided that any modifications which may hereinafter be made in the terms of the contract or in the work to be done under it or the giving by the Owner of any extension of the time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal to the other, shall not in any way release the Principal and the Surety, or either or any of them, their heirs, executors, administrators and successors, from their liability hereunder, notice to the Surety of any such extension, modifications or forbearance being hereby waived.

IN WITNESS WHEREOF, the above bounden parties have executed the within instrument this _____ day of _____, 20 ____.

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
PRODUCT SUBSTITUTION REQUEST

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

SUBSTITUTION PRIOR TO BID OPENING
 (Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)

SUBSTITUTION FOLLOWING AWARD
 (Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

Bidder/Contractor hereby requests acceptance of the following product or systems as a substitution in accordance with provisions of Division One of the Bidding Documents:

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

Product data for proposed substitution is attached (include description of product, standards, performance, and test data)

Sample Sample will be sent, if requested

QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION REQUEST
NAME, BRAND		
CATALOG NO.		
MANUFACTURER		
VENDOR		

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER	DATE INSTALLED
LOCATION		

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION

DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?

YES NO

IF YES, EXPLAIN

SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK

YES NO

BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.

BIDDER/CONTRACTOR

DATE

REVIEW AND ACTION

Resubmit Substitution Request with the following additional information:

Substitution is accepted.

Substitution is accepted with the following comments:

Substitution is not accepted.

ARCHITECT/ENGINEER

DATE



PROJECT NUMBER

KNOW ALL MEN BY THESE PRESENT THAT: hereinafter called "Subcontractor" who heretofore entered into an agreement with hereinafter called "Contractor", for the performance of work and/or furnishing of material for the construction of the project entitled

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

 (ADDRESS OF PROJECT)

for the State of Missouri (Owner) which said subcontract is by this reference incorporated herein, in consideration of such final payment by Contractor.

DOES HEREBY:

1. ACKNOWLEDGE that they have been **PAID IN FULL** all sums due for work and materials contracted or done by their Subcontractors, Material Vendors, Equipment and Fixture Suppliers, Agents and Employees, or otherwise in the performance of the Work called for by the aforesaid Contract and all modifications or extras or additions thereto, for the construction of said project or otherwise.
2. RELEASE and fully, finally, and forever discharge the Owner from any and all suits, actions, claims, and demands for payment for work performed or materials supplied by Subcontractor in accordance with the requirements of the above referenced Contract.
1. REPRESENT that all of their Employees, Subcontractors, Material Vendors, Equipment and Fixture Suppliers, and everyone else has been **paid in full** all sums due them, or any of them, in connection with performance of said Work, or anything done or omitted by them, or any of them in connection with the construction of said improvements, or otherwise.

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT,
 DESIGN AND CONSTRUCTION

MBE/WBE/SDVE PROGRESS REPORT

Remit with ALL Progress and Final Payments

(Please check appropriate box) CONSULTANT CONSTRUCTION

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL <input checked="" type="checkbox"/> FINAL	DATE

PROJECT TITLE

PROJECT LOCATION

FIRM

ORIGINAL CONTRACT SUM (Same as Line Item 1. on Form A of Application for Payment) \$	TOTAL CONTRACT SUM TO DATE (Same as Line Item 3. on Form A of Application for Payment) \$
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THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: \$
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SELECT MBE, WBE, SDVE	TOTAL AMOUNT OF SUBCONTRACT	\$ AMOUNT PAID-TO-DATE	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
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<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	

Revised 05/21



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW

PROJECT NUMBER

Before me, the undersigned Notary Public, in and for the County of _____
 State of _____ personally came and appeared _____
 (NAME)
 _____ of the _____
 (POSITION) (NAME OF THE COMPANY)
 (a corporation) (a partnership) (a proprietorship) and after being duly sworn did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works project have been fully satisfied and there has been no exception to the full and completed compliance with said provisions and requirements and with Wage Determination No: _____ issued by the Department of Labor and Industrial Relations, State of Missouri on the _____ day of _____ 20 ____ in carrying out the contract and working in connection with _____
 (NAME OF PROJECT)
 Located at _____ in _____ County
 (NAME OF THE INSTITUTION)
 Missouri, and completed on the _____ day of _____ 20 ____

SIGNATURE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSEER OR BLACK INK RUBBER STAMP SEAL	STATE	COUNTY (OR CITY OF ST. LOUIS)
	SUBSCRIBED AND SWORN BEFORE ME, THIS	
	DAY OF	YEAR
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES
NOTARY PUBLIC NAME (TYPED OR PRINTED)		USE RUBBER STAMP IN CLEAR AREA BELOW

FILE: Closeout Documents

GENERAL CONDITIONS

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SECTION 007213 - GENERAL CONDITIONS

- A. These General Conditions apply to each section of these specifications. The Contractor is subject to the provisions contained herein.
- B. The General Conditions are intended to define the relationship of the Owner, the Designer and the Contractor thereby establishing certain rules and provisions governing the operation and performance of the work so that the work may be performed in a safe, orderly, expeditious and workmanlike manner.

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

As used in these contract documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

1. **"COMMISSIONER"**: The Commissioner of the Office of Administration.
2. **"CONSTRUCTION DOCUMENTS"**: The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
3. **"CONSTRUCTION REPRESENTATIVE"**: Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
7. **"DIVISION"**: Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.

8. **"INCIDENTAL JOB BURDENS"**: Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri, acting by and through the Office of Administration, Division of Facilities Management, Design and Construction.
11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
14. **"WORK"**: All supervision, labor, materials, tool, supplies, equipment, and any incidental operations and/or activities required by or reasonably inferable from the Contract Documents necessary to construct the Project and to produce the results intended by the Contract Documents in a safe, expeditious, orderly, and workmanlike manner, and in the best manner known to each respective trade.
15. **"WORKING DAYS"**: are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

- A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur, architectural drawings shall govern and, in case of conflict between structural and mechanical drawings, structural drawings shall govern.
- B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.
- C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.
- D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.
- E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action. If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.
- E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

ARTICLE 1.3 - COMPLIANCE WITH LAWS, PERMITS, REGULATIONS AND INSPECTIONS

- A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable laws, ordinances, rules and regulations that pertain to the work of this contract.
- B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.
- C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.
- D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.
- E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall

forfeit as a penalty to the public body on whose behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

A. The Contractor and his subcontractors will not discriminate against individuals based on race, color, religion, national origin, sex, disability, or age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

1. Against recipients of service on the basis of race, color, religion, national origin, sex, disability or age.
2. Against any employee or applicant, for employment on the basis of race, color, religion, national origin, sex or otherwise qualified disability status.
3. Against any applicant for employment or employee on the basis of age, where such applicant or employee is between ages 40 and 70 and where such Contractor employs at least 20 persons.
4. Against any applicant for employment or employee on the basis of that person's status as a disabled or Vietnam-era veteran.

The Contractor and his Subcontractors will take affirmative action to insure applicants for employment and employees are treated equally without regard to race, color, religion, national origin, sex, disability, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion and transfer; recruitment or recruitment advertising; and selection for training, including apprenticeship. The Contractor and his Subcontractors will give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements.

B. The Contractor and his subcontractors shall develop, implement, maintain and submit in writing to the Owner an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed Affidavit for Affirmative Action

in the form included in the contract specifications. For the purpose of this section, an "affirmative action program" means positive action to influence all employment practices (including, but not limited to, recruiting, hiring, promoting and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between age 40 and 70), disabled and Vietnam-era veteran status, and disability. Such "affirmative action program" shall include:

1. A written policy statement committing the total organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination;
2. The identification of a person designated to handle affirmative action;
3. The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion and discipline;
4. The exclusion of discrimination from all collective bargaining agreements; and
5. Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

In the enforcement of this non-discrimination clause, the Owner may use any reasonable procedures available, including, but not limited to: requests, reports, site visits and inspection of relevant documents of contractors and subcontractors.

C. In the event of the Contractor's or his subcontractor's noncompliance with any provisions of this Article of the Contract, the Owner may cancel this contract in whole or in part or require the Contractor to terminate his contract with the subcontractor.

ARTICLE 1.5 - ANTI-KICKBACK

No employee of the division, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract or in any part hereof. No officer, employee, designer, attorney, or administrator of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract, any material supply contract, subcontract,

insurance contract, or any other contract pertaining to the project.

ARTICLE 1.6 - PATENTS AND ROYALTIES

- A. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.
- B. If the Contractor uses any design, device or materials covered by letters, patent or copyright, the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

- A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.
- B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be

required for a Missouri bidder to successfully bid in the non-domiciliary state.

- C. In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

- A. All notices, requests, instructions, approvals and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.
- B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.
- C. The Contractor shall ensure that major subcontractors and suppliers shall attend monthly progress meetings as necessary to coordinate the work, and as specifically requested by the Construction Representative.

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

- A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.
- B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner's Representative before the work is performed. If the Contractor fails to do this, and constructs any

work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.

- C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.
- D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.
- E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.
- F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

- A. No assignment by Contractor of any amount or any part of this contract or of the funds to be received there under will be recognized unless such assignment has had the written approval of the Director and the surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in assignment contracts, the following language must be set forth: "It is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of this contract and to claims or liens for services rendered or materials supplied for the performance of the work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials."

ARTICLE 1.11 - INDEMNIFICATION

- A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.
- B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director's Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES

- A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.
- B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.
- C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice.

The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.

- D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.
- E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility for correcting such work without additional compensation.
- F. The Owner shall have the right to direct the Contractor to uncover any completed work.
 - 1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.
 - 2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.
- G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.
- H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.

- I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES

The Contractor shall register and utilize the Owner's eBuilder digital project management system for submission of documents described in the following sections. This includes but is not limited to submittals as required by designer, payment applications, Request for Information (RFI), construction change orders, Request for Proposals (RFP), Designer Supplemental Instructions (DSI), etc.

ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS

- A. The Contractor may request use of any article, device, product, material, fixture, form or type of construction which in the judgment of the Owner and Designer is equal in all respects to that named. Standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner and Designer that they are equal in design, strength, durability, usefulness and convenience for the purpose intended.
- B. Any changes required in the details and dimensions indicated on the drawings for the substitution of products other than those specified shall be properly made at the expense of the Contractor requesting the substitution or change.
- C. The Contractor shall submit a request for such substitutions in writing to the Owner and Designer within twenty (20) working days after the date of the "Notice to Proceed." Thereafter no consideration will be given to alternate forms of accomplishing the work. This Article does not preclude the Owner from exercising the provisions of Article 4 hereof.
- D. Any request for substitution by the Contractor shall be submitted in accordance with SECTION 002113 - INSTRUCTIONS TO BIDDERS.
- E. When a material has been approved, no change in brand or make will be permitted unless:
 - 1. Written verification is received from the manufacturer stating they cannot make delivery on the date previously agreed, or
 - 2. Material delivered fails to comply with contract requirements.

ARTICLE 3.2 -- SUBMITTALS

- A. The Contractor's submittals must be submitted with such promptness as to allow for review and approval so as not to cause delay in the work. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

Submit four (4) copies to the Designer and additional copies as required for the subcontractors and material suppliers. Also provide copies to meet the requirements for maintenance manuals.

- B. All subcontractors' shop drawings and schedules shall be submitted by the Contractor and shall bear evidence that Contractor has received, reviewed, and approved them. Any shop drawings and schedules submitted without this evidence will be returned to the Contractor for resubmission.
- C. The Contractor shall include with the shop drawing, a letter indicating any and all deviations from the drawings and/or specifications. Failure to notify the Designer of such deviations will be grounds for subsequent rejection of the related work or materials. If, in the opinion of the Designer, the deviations are not acceptable, the Contractor will be required to furnish the item as specified and indicated on the drawings.
- D. The Designer shall check shop drawings and schedules with reasonable promptness and approve them only if they conform to the design concept of the project and comply with the information given in the contract documents. The approval shall not relieve the Contractor from the responsibility to comply with the drawings and specifications, unless the Contractor has called the Designer's attention to the deviation, in writing, at the time of submission and the Designer has knowingly approved thereof. An approval of any such modification will be given only under the following conditions:
1. It is in the best interest of the Owner
 2. It does not increase the contract sum and/or completion time
 3. It does not deviate from the design intent
 4. It is without prejudice to any and all rights under the surety bond.
- E. No extension of time will be granted because of the Contractor's failure to submit shop drawings and schedules in ample time to allow for review,

possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction

- F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

ARTICLE 3.3 – AS-BUILT DRAWINGS

- A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

ARTICLE 3.4 – GUARANTY AND WARRANTIES

- A. General Guaranty
1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
 2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
 3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the

damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.

4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

B. Extended Warranty

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS

- A. Immediately after equipment submittals are approved and no later than ten (10) working days prior to the substantial completion inspection, the Contractor shall provide to the Designer three (3) copies of operating instructions and service manuals, containing the following:

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.
2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name place data, shop drawings and air and water balance reports.
4. Service Instructions: Provide the following information for all pieces of equipment.

- a. Recommended spare parts including catalog number and name of local supplier or factory representative.
- b. Belt sizes, types, and lengths.
- c. Wiring diagrams.

5. Manufacturer's Certificate of Warranty as described in Article 3.4.

6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

- B. Submission of operating instructions shall be done in the following manner.

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.
2. The manuals shall identify project name, project number, and include the name and address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.
3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.
4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.
- B. Contractor shall, at all times, enforce strict discipline and good order among his employees,

and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.

- C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and insure completion thereof within the time specified.
- D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.
- E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.
- F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.
- G. The Contractor must notify the Construction Representative at least one working day before placing concrete or burying underground utilities, pipelines, etc.
- H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.
- I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case,

unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

- J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.
- K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.
- L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.
- M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.
- N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.
- O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.

- P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.
- Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.
- R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.
- S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.
- T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.
- U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.
- V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.
- W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

- A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.
- B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.
- C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.
- D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

- A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.
- B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.
- C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon

before such changes become effective and shall be determined, through submission of a request for proposal, as follows:

1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.

D. Overhead and Profit on Contract Changes shall be applied as follows:

1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools, warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.
2. The percentages for overhead and profit charged on Contract Changes shall be subject to the following limits: (a) the percentage mark-up for the Contractor shall be limited to the Contractor's fee; (b) fifteen percent (15%) maximum for Work directly performed by employees of a subcontractor, or sub-subcontractor; (c) five percent (5%) maximum for the Work performed or passed through to the Owner by the Contractor; (d) five percent (5%) maximum subcontractor's mark-up for Work performed by a sub-subcontractor and

passed through to the Owner by the subcontractor and Contractor; and (e) in no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty-five percent (25%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.

3. The Contractor will be allowed to add the cost of Contractor's payment and performance bonding, builder's risk insurance, and general liability insurance to their cost of work. The above listed bonding and insurance cost shall not exceed 2% and shall be allowed on the total cost of the added work, including overhead and profit.
 4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.
 5. The percentage(s) for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be the same as those for additive Contract Changes provided above.
- E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.
- F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.
- G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for

compensation for such emergency work in writing to the Owner's Representative.

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

- A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:
 - 1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR
 - 2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR
 - 3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.
- B. Extension of the number of work days stipulated in the Contract for completion of the work without compensation may be made when:
 - 1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR
 - 2. Labor strikes or acts of God occur, OR
 - 3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.
- C. No time extension or compensation will be provided for delays caused by or within the control of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.
- D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by

the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

- A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:
 - 1. Contract;
 - 2. Performance/payment bond as described in Article 6.1;
 - 3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.
 - 4. Written Affirmative Action Plans as required in Article 1.4.
- Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.
- B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.
 - C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

- A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.
- B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

ARTICLE 5.3 -- PROJECT COMPLETION

- A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.
 1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
 - a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
 - b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
 - c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.
 2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the

Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.
- B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.
- C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the

approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

- D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.
- E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

- A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the

"Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

1. Updated construction schedule
 2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project
- B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.
- C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.
- D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:
1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
 2. Delivery is made in accordance with the time frame on the approved schedule.
 3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.
 4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.
- E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage,

of major equipment and material stored off the site if all of the following conditions are met:

1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
 2. Materials stored in one location off site are valued in excess of \$25,000.
 3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
 4. The materials are stored in a facility approved and inspected, by the Construction Representative.
 5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.
- F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.
- G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:
1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.
 2. A reasonable doubt that this contract can be completed for the unpaid balance.
3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
 4. Failure of the Contractor to update the construction schedule.
- When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.
- H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.
1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
 2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
 - a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.

- b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor
 - c) Certified copies of all payrolls
 - d) As-built drawings
3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.
 4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.
 5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

- A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.
- B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

ARTICLE 6.2 – INSURANCE

- A. The successful Contractor shall procure and maintain for the duration of the contract issued a policy or policies of insurance for the protection of both the Contractor and the Owner and their respective officers, officials, agents, consultants and employees. The Owner requires certification of insurance coverage from the Contractor prior to commencing work.
- B. Minimum Scope and Extent of Coverage
 1. General Liability

Commercial General Liability, ISO coverage form number or equivalent CG 00 01 ("occurrence" basis), or I-SO coverage form number CG 00 02, or ISO equivalent.

If ISO equivalent or manuscript general liability coverage forms are used, minimum coverage will be as follows: Premises/Operations; Independent Contractors; Products/Completed Operations; personal Injury; Broad Form Property Damage including Completed Operations; Broad Form Contractual Liability Coverage to include Contractor's obligations under Article 1.11 Indemnification and any other Special Hazards required by the work of the contract.
 2. Automobile Liability

Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".
 3. Workers' Compensation and Employer's Liability

Statutory Workers' Compensation Insurance for Missouri and standard Employer's Liability Insurance, or the authorization to self-insure for such liability from the Missouri Division of Workers' Compensation.
 4. Builder's Risk or Installation Floater Insurance

Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this contract price, whichever is greater, with loss payable

to Contractor and Owner as their respective interests may appear.

Contractor shall maintain sufficient insurance to cover the full value of the work and materials as the work progresses, and shall furnish Owner copies of all endorsements. If Builder's Risk Reporting- Form of Endorsement is used, Contractor shall make all reports as required therein so as to keep in force an amount of insurance which will equal the replacement cost of the work, materials, equipment, supplies, temporary structures, and other property covered thereby; and if, as a result of Contractor's failure to make any such report, the amount of insurance so recoverable shall be less than such replacement cost, Contractor's interest in the proceeds of such insurance, if any, shall be subordinated to Owner's interest to the end that Owner may receive full reimbursement for its loss.

C. Minimum Limits of Insurance

1. General Liability

Contractor

\$2,000,000 combined single limit per occurrence for bodily injury, personal injury, and property damage

\$2,000,000 annual aggregate

2. Automobile Liability

\$2,000,000 combined single limit per occurrence for bodily injury and property damage

3. Workers' Compensation and Employers Liability

Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of \$1,000,000 limit per accident for Employer's Liability.

General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions,

as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

The respective insurance policies and coverage, as specified below, must contain, or be endorsed to contain the following conditions or provisions:

1. General Liability

The Owner, and its respective commissioners, officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 Additional Insured - Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance of self-insurance programs maintained by the designated additional -insured's shall be excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's general liability insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner, or for any of their officers, officials, agents, consultants or employees.

2. Automobile Insurance

The Owner, and their respective officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 - Additional Insured Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the

performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's automobile insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner or for any of its officers, officials, agents, consultants or employees.

3. Workers' Compensation/Employer's Liability

Contractor's workers' compensation insurance shall be endorsed with NCCI form WC 00 03 01 A - Alternative Employer Endorsement. The Alternative Employer Endorsement shall designate the Owner as "alternate employers."

4. All Coverages

Each insurance policy required by this section of the Contract shall contain a stipulation, endorsed if necessary, that the Owner will receive a minimum of a thirty (30) calendar day advance notice of any policy cancellation. Ten (10) calendar days advance notice is required for policy cancellation due to non-payment of premium.

F. Insurer Qualifications and Acceptability

Insurance required hereunder shall be issued by an A.M. Best, "B+" rated, Class IX insurance company approved to conduct insurance business in the state of Missouri.

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its

behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract - the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.

2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.
- B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.
- C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.
- D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.
- E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.
- F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date

of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

- A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.
- B. Upon receipt of notification, the Contractor shall:
 1. Cease operations when directed.
 2. Take actions to protect the work and any stored materials.
 3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.
 4. Terminate all existing subcontracts, rentals, material, and equipment orders.
 5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.
 6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.
- C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

A. These Supplementary General Conditions clarify, add, delete, or otherwise modify standard terms and conditions of DIVISION 0, BIDDING AND CONTRACTING REQUIREMENTS.

2.0 CONTACTS:

Designer:

Ken Campbell
Archer – Elgin
310 East 6th Street
Rolla, MO 65401
Telephone: 573-364-6362
Email: kcambell@cmarcher.com

Construction Representative:

Kevin Hultberg
Division of Facilities Management, Design and Construction
10325 Business 21 North
Hillsboro, Missouri 63050
Telephone: 636-524-8528
Email: Kevin.Hultberg@oa.mo.gov

Project Manager:

Eric Hibdon
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: 573-508-3666
Email: Eric.Hibdon@oa.mo.gov

Contract Specialist:

April Howser
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: 573-751-0053
Email: April.Howser@oa.mo.gov

3.0 NOTICE: ALL BID MATERIALS ARE DUE AT THE TIME OF BID SUBMITTAL. THERE IS NO SECOND SUBMITTAL FOR THIS PROJECT.

4.0 FURNISHING CONSTRUCTION DOCUMENTS:

- A. The Owner will furnish the Contractor with approximately 3 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 3 sets of explanatory or change drawings at no charge.
- C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

5.0 SAFETY REQUIREMENTS

Contractor and subcontractors at any tier shall comply with RSMo 292.675 and Article 1.3, E, of Section 007213, General Conditions.

SUPPLEMENTARY GENERAL CONDITIONS
FOR FEDERALLY FUNDED/ASSISTED CONSTRUCTION PROJECTS

(American Rescue Plan Act (ARPA) Projects)

1.0 Notice of Federal Funding

This project is being performed in whole or in part using federal funds. Therefore, all work or services performed by the Contractor and its subcontractors shall be subject to the terms and conditions set forth below in addition to all terms and conditions in the Construction Contract, General Conditions, and other contract documents. The concepts, rules, and guidelines set forth in 2 C.F.R. 200 describing allowable costs and administrative requirements apply.

2.0 Definitions

As used herein, “Federal Government” means the government of the United States of America. “Federal Agency” means an agency, entity, department or division of the Federal Government that is providing funding for this project. All other terms shall have the meanings established in the Construction Contract, General Conditions, and/or Project Manual, unless such definitions conflict with a definition provided in an applicable statute or regulation.

3.0 Conflicting Terms or Conditions

To the extent that any terms or conditions set forth herein conflict with the Construction Contract or its General Conditions, the more stringent of the two terms and conditions shall govern.

4.0 No Obligation by Federal Government

The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the non-Federal entity, Contractor, or any other party pertaining to any matter resulting from the contract.

5.0 Compliance with Federal Laws, Regulations and Executive Orders

The Contractor and its subcontractors and suppliers are required to comply with all applicable Federal laws, regulations, and executive orders, regardless of whether set forth herein. The Contractor shall assist and enable the State of Missouri in complying with any requirements imposed by the Federal Agency as a condition of funding.

6.0 Compliance with Civil Rights Provisions

The Contractor shall comply with all Federal statutes, executive orders, and regulations relating to nondiscrimination. These include, but are not limited to the following:

Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin;

Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex;

Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps;

The Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age;

Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing;

Title VII of the Civil Rights Act of 1964 (42 U.S.C. part 2000(e)), which prohibits discrimination against employees on the basis of religion;

Any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and

The requirements of any other nondiscrimination statute(s) that may apply to the application.

7.0 Equal Employment Opportunity (41 C.F.R. 60-1.4(b)).

During the performance of this contract, the Contractor agrees as follows:

- (1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

- (2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- (3) The Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicants or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty to furnish information.
- (4) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

- (5) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- (6) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- (7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- (8) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: *Provided*, That if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and sub contractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and sub contractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any

further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

8.0 Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity
(Executive Order 11246, 41 C.F.R. 60-4.2)

(1) The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

(2) The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Time-tables	Goals for minority participation for each trade	Goals for female participation in each trade
107	11.4	6.9

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 C.F.R. pt. 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 C.F.R. 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 C.F.R. pt. 60-4. Compliance with the goals will be measured against the total work hours performed.

(3) The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

(4) As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

9.0 Standard Federal Equal Employment Opportunity Construction Contract Specifications
(Executive Order 11246 - 41 C.F.R. 60-4.3)

(1) As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

(3) If the Contractor is participating (pursuant to 41 C.F.R. 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

(4) The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement

contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

(5) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

(6) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(7) The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 C.F.R. pt. 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

(8) Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(9) A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

(10) The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, sexual orientation, gender identity, or national origin.

(11) The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

(12) The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

(13) The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 C.F.R. 60-4.8.

(14) The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily

understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

(15) Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

10.0 Prohibition of Segregated Facilities

- (1) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Employment Opportunity clause in this contract.
- (2) “Segregated facilities,” as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.
- (3) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Employment Opportunity clause of this contract.

11.0 Davis-Bacon Act (40 U.S.C. §§ 3141-3144, and §§ 3146-3148, and 29 C.F.R. pt. 5)

**The requirements of the Davis-Bacon Act and this section are not applicable to this project, which is funded solely by Coronavirus State and Local Fiscal Recover Funds (SLFRF) under the American Rescue Plan Act (ARPA).*

- (1) Minimum wages.
 - (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 C.F.R. pt. 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis–Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill,

except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis–Bacon poster (WH–1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

- (ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
 - (2) The classification is utilized in the area by the construction industry; and
 - (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
- (B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.
- (C) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.
- (D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.
- (iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.
- (iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has

found, upon the written request of the Contractor, that the applicable standards of the Davis–Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The (write in name of Federal Agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to Davis–Bacon prevailing wage requirements, which is held by the same prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis–Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 C.F.R. 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis–Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 C.F.R. 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime Contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered

worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime Contractor to require a subcontractor to provide addresses and social security numbers to the prime Contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 C.F.R. pt. 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 C.F.R. pt. 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 C.F.R. pt. 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the (write the name of the agency) or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal Agency may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 C.F.R. 5.12.

(4) Apprentices and trainees—

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary

employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (ii) Trainees. Except as provided in 29 C.F.R. 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
- (iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 C.F.R. pt. 30.

- (5) Compliance with Copeland Act requirements. The Contractor shall comply with the requirements of 29 C.F.R. pt. 3, which are incorporated by reference in this contract.
- (6) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 C.F.R. 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal Agency) may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 C.F.R. 5.5.
- (7) Contract termination: debarment. A breach of the contract clauses in 29 C.F.R. 5.5 may be grounds for termination of the contract, and for debarment as a Contractor and a subcontractor as provided in 29 C.F.R. 5.12.
- (8) Compliance with Davis–Bacon and Related Act requirements. All rulings and interpretations of the Davis–Bacon and Related Acts contained in 29 C.F.R. pts. 1, 3, and 5 are herein incorporated by reference in this contract.
- (9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 C.F.R. pt.s 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.
- (10) Certification of eligibility.
 - (i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis–Bacon Act or 29 C.F.R. 5.12(a)(1).
 - (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis–Bacon Act or 29 C.F.R. 5.12(a)(1).
 - (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

12.0 Copeland “Anti-Kickback” Act

- (1) The Contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract. The Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled.
- (2) The Contractor or subcontractor shall insert in any subcontracts the clause above, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
- (3) A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 C.F.R. 5.12.

13.0 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701 to 3708, 29 C.F.R. 5.5)

- (1) Overtime requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.
- (4) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.

14.0 Suspension and Debarment (Executive Orders 12549 and 12689, 2 C.F.R. pt. 180)

- (1) A contract award (see 2 C.F.R. 180.220) must not be made to parties listed on the government-wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. 180 that implement Executive Orders 12549 (3 C.F.R. pt. 1986 Comp., p. 189) and 12689 (3 C.F.R. pt. 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.
- (2) The contractor is required to verify that none of the contractor’s principals (defined at 2 C.F.R. 180.995) or its affiliates (defined at 2 C.F.R. 180.905) are excluded (defined at 2 C.F.R. 180.940) or disqualified (defined at 2 C.F.R. 180.935).
- (3) The contractor must comply with 2 C.F.R. pt. 180, subpart C and the regulations of the granting Federal Agency regarding suspension and debarment, and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.

- (4) This certification is a material representation of fact relied upon by the Owner. If it is later determined that the Contractor did not comply with 2 C.F.R. pt. 180, subpart C in addition to remedies available to the Owner, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.
- (5) By submitting a bid, the bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

15.0 Byrd Anti-Lobbying Amendment (31 U.S.C. § 1352)

- (1) Contractors that apply or bid for an award exceeding \$100,000 agree to file the required certification (set forth below), in compliance with 31 U.S.C. § 1352 (as amended).
- (2) Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352.
- (3) Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the awarding agency.

CERTIFICATION REGARDING LOBBYING

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form–LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required

certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

16.0 Procurement of Recovered Materials

The Contractor shall comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 U.S.C. § 6962). The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

Information about this requirement, along with the list of EPA designated items, is available at EPA's Comprehensive Procurement Guidelines web site, <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.

17.0 Fair Labor Standards Act

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 C.F.R. pt. 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers. The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

18.0 Access to Records and Reports

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Agency and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

19.0 Occupational Health and Safety Act

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 C.F.R. pt. 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (29 C.F.R. pt. 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

20.0 Rights to Inventions

Contracts or agreements that include the performance of experimental, developmental, or research work must provide for the rights of the Federal Government and the Owner in any resulting invention as established by 37 C.F.R. pt. 401, Rights to Inventions Made by Non-profit Organizations and Small

Business Firms under Government Grants, Contracts, and Cooperative Agreements. This contract incorporates by reference the patent and inventions rights as specified within 37 C.F.R. 401.14. Contractor must include this requirement in all sub-tier contracts involving experimental, developmental, or research work.

21.0 Energy Conservation

The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201 et seq.).

22.0 Clean Air Act and Federal Water Pollution Control Act

- (1) If the amount of the Contract exceeds \$150,000, the Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq. and the Federal Water Pollution Control Act, as amended, 33 U.S.C. § 1251 et seq.
- (2) The Contractor agrees to report each violation to the Owner, and understands and agrees that the Owner will, in turn, report each violation as required to assure notification to the Federal Agency and the appropriate Environmental Protection Agency Regional Office.
- (3) The Contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance.

23.0 Contractor Employee Whistleblower Rights and Requirement to Inform Employees of Whistleblower Rights

- (1) This contract and employees working on this contract will be subject to the whistleblower rights and remedies in the pilot program on contractor employee whistleblower protections established at 41 U.S.C. § 4712 by section 828 of the National Defense Authorization Act for Fiscal Year 2013 (Pub. L. 112-239) and FAR 3.908.
- (2) The Contractor shall inform its employees in writing, in the predominant language of the workforce, of employee whistleblower rights and protections under 41 U.S.C. § 4712, as described in section 3.908 of the Federal Acquisition Regulation.
- (3) The Contractor shall insert the substance of this clause, including this paragraph (c), in all subcontracts over the simplified acquisition threshold.

24.0 Veteran's Preference

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within Title 49 United States Code Section 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 U.S.C. § 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

25.0 Drug Free Workplace Act

The Contractor shall provide a drug free workplace in accordance with the Drug Free Workplace Act of 1988, 41 U.S.C. Chapter 81, and all applicable regulations. The Contractor shall report any conviction of the Contractor's personnel under a criminal drug statute for violations occurring on the Contractor's premises or off the Contractor's premises while conducting official business. A report of a conviction shall be made to the state agency within five (5) working days after the conviction.

26.0 Access Requirements for Persons with Disabilities

Contractor shall comply with 49 U.S.C. § 5301(d), stating Federal policy that the elderly and persons with disabilities have the same rights as other persons to use mass transportation services and facilities and that special efforts shall be made in planning and designing those services and facilities to implement that policy. Contractor shall also comply with all applicable requirements of Sec. 504 of the Rehabilitation Act (1973), as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of handicaps, and the Americans with Disabilities Act of 1990 (ADA), as amended, 42 U.S.C. § 12101 et seq., which requires that accessible facilities and services be made available to persons with disabilities, including any subsequent amendments thereto.

27.0 Seismic Safety

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction Guidelines for Contract Provisions for Obligated Sponsors and Airport Improvement Program Projects Issued on June 19, 2018 Page 61 Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

28.0 Required Use of American Iron, Steel, Manufactured Products, and Construction Materials – Build America, Buy America (Pub. L. No. 117-58, §§ 70901-52)

**The requirements of the Build America, Buy America Act and this section are not applicable to projects funded solely by Coronavirus State and Local Fiscal Recover Funds (SLFRF) under the American Rescue Plan Act (ARPA). The Contractor will be subject to the requirements of the Build America, Buy America Act only if SLFRF funds are used in conjunction with funds from another federal program that requires enforcement of the Build America, Buy America Act. Information about federal funding sources is provided in the Invitation for Bid.*

The Owner is the recipient of an award of Federal financial assistance from a program for infrastructure for this project. Pursuant to the Build America, Buy America Act of the Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. No. 117-58, none of the funds provided under the Federal award may be used unless the requirements of the domestic content procurement preference outlined below are met. Therefore, the Contractor shall ensure the following:

- (1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
- (2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another

standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and

(3) all construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

Waivers

When necessary, recipients of Federal financial assistance may apply for, and the awarding agency may grant, a waiver from the domestic content procurement preference.

When the Federal agency has made a determination that one of the following exceptions applies, the awarding official may waive the application of the domestic content procurement preference in any case in which the agency determines that:

(1) applying the domestic content procurement preference would be inconsistent with the public interest;

(2) the types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or

(3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent. A request to waive the application of the domestic content procurement preference must be in writing. The agency will provide instructions on the format, contents, and supporting materials required for any waiver request. Waiver requests are subject to public comment periods of no less than 15 days and must be reviewed by the Made in America Office.

There may be instances where an award qualifies, in whole or in part, for an existing waiver described on the awarding agency web site.

If the Contractor determines that an application for a waiver is necessary or an existing waiver is applicable to this project, the Contractor shall timely notify the Owner. The Owner will make a determination if a waiver is applicable or if a waiver application is necessary. The Contractor shall not submit any waiver application or information directly to the Federal agency without prior approval by the Owner.

Definitions

“Construction materials” includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is or consists primarily of: • non-ferrous metals; • plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); • glass (including optic glass); • lumber; or • drywall.

“Domestic content procurement preference” means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the United States; or the construction materials used in the project are produced in the United States.

“Infrastructure” includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

“Project” means the construction, alteration, maintenance, or repair of infrastructure in the United States.

29.0 Prohibition on Certain Telecommunication and Video Surveillances Services or Equipment (Pub. L. 115-232, Section 889)

Section 889(b) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, and 2 C.F.R. § 200.216 prohibit the head of a Federal executive agency and recipients or subrecipients of funds from such agencies from obligating or expending grant, cooperative agreement, loan, or loan guarantee funds on certain telecommunications products or from certain entities for national security reasons. Pursuant to such provisions, the Contractor understands and agrees that the Contractor and its subcontractors shall not obligate or expend loan or grant funds from the Federal Agency under this Contract to:

(1) Procure or obtain;

(2) Extend or renew a contract to procure or obtain; or

(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in [Public Law 115–232](#), section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

TERMS AND CONDITIONS FOR CONTRACTOR
RECEIPT OF FEDERAL ARPA SFRF FUNDS

I. Use of Funds: _____ (“Contractor”) understands and agrees that the State of Missouri has received funds for this project under section 602(c) of the Social Security Act (“Act”), as added by Section 9901 of the American Rescue Plan Act (“ARPA”), Pub. L. No. 117-2 (March 11, 2021), 135 Stat. 4, 223–26, and the funds disbursed under such grant may only be used in compliance with the ARPA and the U.S. Department of the Treasury (“Treasury”)’s regulations implementing that section and guidance, and in compliance with all other restrictions and specifications on use set forth in or applicable through this agreement.

Period of Performance: The period of performance for the award begins on the date hereof and ends no later than December 31, 2026. Contractor may use funds granted under this agreement to cover eligible costs incurred during the period of performance, but no later than December 31, 2024.

Reporting: Contractor agrees to comply with any reporting obligations established by Treasury or the State of Missouri (“State”), as it relates to this agreement.

Maintenance of and Access to Records: Contractor shall maintain records and financial documents sufficient to evidence compliance with section 602(c) of the Act and Treasury’s regulations implementing that section and guidance regarding the eligible uses of funds. Contractor shall also maintain records and financial documents: 1. sufficient for the State, with respect to Contractor’s participation in this grant agreement, to evidence compliance with section 602(c) of the Act and Treasury’s regulations implementing that section and guidance regarding the eligible uses of funds; and 2. necessary for the State, with respect to Contractor’s participation in this agreement, to comply with obligations under 2 C.F.R. Part 200 and any other applicable law. The Treasury Office of Inspector General, the Government Accountability Office, their authorized representatives, the State, or its authorized representatives, shall have the right of access to records and documents (electronic and otherwise) of Contractor in order to conduct audits or other investigations or reviews. Records shall be maintained by Contractor for a period of five (5) years after the end of the period of performance. Wherever practicable, records should be collected, transmitted, and stored in open and machine-readable formats. Contractor’s obligations under this section shall include, without limitation, maintenance of the following specified types of records and financial documents: contracts, invoices, receipts, payrolls, and financial statements.

Pre-award Costs: Pre-award costs, as defined at 2 C.F.R. § 200.458, may not be paid with funding from this agreement.

Compliance with Applicable Law and Regulations: Contractor agrees to comply with the requirements of section 602 of the Act, regulations adopted by Treasury pursuant to section 602(f) of the Act, guidance issued by Treasury regarding the foregoing, and all other restrictions and specifications set forth in or applicable through this agreement. Contractor also agrees to comply with all other applicable state and federal statutes, regulations, and executive orders, and

Contractor shall provide for such compliance by other parties in any agreements it enters into with other parties relating to this grant.

Federal regulations applicable to this agreement include, without limitation, the following:

i. If the amount of this agreement is expected to equal or exceed \$25,000, or if this agreement is for federally-required audit services, OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement), 2 C.F.R. Part 180, and Treasury's implementing regulation at 31 C.F.R. Part 19, including both the requirement to comply with that part's Subpart C as a condition of participation in this transaction, and the requirement to pass the requirement to comply with that subpart to each person with whom the participant enters into a covered transaction at the next lower tier;

ii. Recipient Integrity and Performance Matters, pursuant to which the award term set forth at 2 C.F.R. Part 200, Appendix XII, is hereby incorporated by reference;

iii. Uniform Relocation Assistance and Real Property Acquisitions Act of 1970 (42 U.S.C. §§ 4601–4655) and implementing regulations; and

iv. Generally applicable federal environmental laws and regulations.

Federal statutes and regulations prohibiting discrimination applicable to this agreement include, without limitation, the following:

i. Title VI of the Civil Rights Act of 1964 (42 U.S.C. §§ 2000d *et seq.*) and Treasury's implementing regulations at 31 C.F.R. Part 22, which prohibit discrimination on the basis of race, color, or national origin under programs or activities receiving federal financial assistance;

ii. the Fair Housing Act, Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§ 3601 *et seq.*) which prohibits discrimination in housing on the basis of race, color, religion, national origin, sex, familial status, or disability;

iii. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794), which prohibits discrimination on the basis of disability under any program or activity receiving federal financial assistance;

iv. the Age Discrimination Act of 1975, as amended (42 U.S.C. §§ 6101 *et seq.*) and Treasury's implementing regulations at 31 C.F.R. Part 23, which prohibit discrimination on the basis of age in programs or activities receiving federal financial assistance; and

v. For local governments only, Title II of the Americans with Disabilities Act of 1990, as amended (42 U.S.C. §§ 12101 *et seq.*), which prohibits discrimination on the basis of disability under programs, activities, and services provided or made available by state and local governments or instrumentalities or agencies thereto.

Remedial Actions: The State reserves the right to impose additional conditions or requirements on Contractor's receipt of this funds under this agreement, as the State deems necessary or advisable, in order to facilitate compliance with any existing or additional conditions or requirements imposed upon the State by Treasury for the State's receipt of ARPA funds. The State also reserves the right to seek recoupment or repayment of funds under this agreement in whole or in part, in the event that Treasury seeks recoupment or repayment of payments made to the State, for reasons relating to Contractor's acts or omissions respecting this agreement. These reservations are expressed without limitation to any other rights the State may hold, either to impose additional conditions or requirements on Contractor's receipt of funds under this agreement or to recoup such funds in whole or in part, under this agreement or other applicable law.

Hatch Act: Contractor agrees to comply, as applicable, with requirements of the Hatch Act (5 U.S.C. §§ 1501–1508 and 7324–7328), which limit certain political activities of State or local government employees whose principal employment is in connection with an activity financed in whole or in part by this federal assistance.

False Statements: Contractor understands that making false statements or claims in connection with this award is a violation of federal law and may result in criminal, civil, or administrative sanctions, including fines, imprisonment, civil damages and penalties, debarment from participating in federal awards or contracts, and/or any other remedy available by law.

Publications: Any publications produced with funds from this agreement must display the following language: "This product [is being] [was] supported, in whole or in part, by federal award number [enter project FAIN] awarded to State of Missouri by the U.S. Department of the Treasury."

Debts Owed State and Federal Government: Any funds paid to Contractor (1) in excess of the amount to which Contractor is finally determined to be authorized to retain under the terms of this agreement; (2) that are determined by the Treasury Office of Inspector General to have been misused; or (3) that are determined by Treasury to be subject to a repayment obligation pursuant to sections 602(e) and 603(b)(2)(D) of the Act and have not been repaid by Contractor shall constitute a debt owed by the State to the federal government. In such instance, the funds constituting the State's debt to the federal government shall also constitute Contractor's debt to the State. Debts owed by Contractor to the State must be paid promptly by Contractor. A debt owed the State by Contractor under this agreement is delinquent if it has not been paid by the date specified in the State's initial demand for payment, unless other satisfactory arrangements have been made or if Contractor knowingly or improperly retains funds that are a debt as defined in this paragraph. The State will take any actions available to it to collect such a debt, including but not limited to actions available to it under the "Remedial Actions" paragraph found in this same section (I) above. The rights of the State as expressed in this paragraph are in addition to, and do not imply the exclusion of, any other rights the State may have under applicable law to collect a debt or seek damages from Contractor.

Disclaimer: In its award of federal financial assistance to the State, Treasury provides that the United States expressly disclaims any and all responsibility or liability to the State or third

persons for the actions of the State or third persons resulting in death, bodily injury, property damages, or any other losses resulting in any way from the performance of this award or any other losses resulting in any way from the performance of this award or any contract or subcontract under this award. Furthermore, in its award of federal financial assistance to the State, Treasury also states that the acceptance of this award by the State does not in any way establish an agency relationship between the United States and the State. This disclaimer applies with equal force to this agreement.

Increasing Seat Belt Use in the United States: Pursuant to Executive Order 13043, 62 FR 19217 (Apr. 18, 1997), Contractor is hereby encouraged to adopt and enforce on-the-job seat belt policies and programs for its employees when operating company-owned, rented or personally owned vehicles, and to encourage any subcontractors to do the same.

Reducing Text Messaging While Driving: Pursuant to federal Executive Order 13513, 74 FR 51225 (Oct. 6, 2009), the State hereby encourages Contractor to adopt and enforce policies that ban text messaging while driving, and to encourage any subcontractors to do the same.¹

II. By entering into this agreement, Contractor ensures its current and future compliance with Title VI of the Civil Rights Act of 1964, as amended, which prohibits exclusion from participation, denial of the benefits of, or subjection to discrimination under programs and activities receiving federal funds, of any person in the United States on the ground of race, color, or national origin (42 U.S.C. § 2000d et seq.), as implemented by Treasury Title VI regulations at 31 C.F.R. Part 22 and other pertinent executive orders such as federal Executive Order 13166; directives; circulars; policies; memoranda and/or guidance documents.

Contractor acknowledges that federal Executive Order 13166, “Improving Access to Services for Persons with Limited English Proficiency,” seeks to improve access to federally assisted programs and activities for individuals who, because of national origin, have Limited English Proficiency (“LEP”). Contractor understands that denying a person access to its programs, services, and activities because of LEP is a form of national origin discrimination prohibited under Title VI of the Civil Rights Act of 1964 and Treasury’s implementing regulations. Accordingly, Contractor shall initiate reasonable steps, or comply with Treasury’s directives, to ensure that LEP persons have meaningful access to its programs, services, and activities. Contractor understands and agrees that meaningful access may entail providing language assistance services, including oral interpretation and written translation where necessary, to ensure effective communication in Contractor’s programs, services, and activities.

Contractor agrees to consider the need for language services for LEP persons during development of applicable budgets and when conducting programs, services, and activities. As a resource, Treasury has published its LEP guidance at 70 FR 6067. For more information on LEP, please visit <http://www.lep.gov>.

¹ Section I is based on requirements set forth in Treasury’s Coronavirus State Fiscal Recovery Fund Award Terms and Conditions document, executed by the State on July 26, 2021.

Contractor acknowledges and agrees that compliance with this assurance constitutes a condition of continued receipt of federal financial assistance and is binding upon Contractor and Contractor's successors, transferees, and assignees for the period in which such assistance is provided.

Contractor shall comply with Title VI of the Civil Rights Act of 1964, which prohibits recipients of federal financial assistance from excluding from a program or activity, denying benefits of, or otherwise discriminating against a person on the basis of race, color, or national origin (42 U.S.C. § 2000d et seq.), as implemented by the Department of the Treasury's Title VI regulations, 31 C.F.R. Part 22, which are herein incorporated by reference and made a part of this agreement. Title VI also includes protection to persons with "Limited English Proficiency" in any program or activity receiving federal financial assistance, 42 U.S.C. § 2000d et seq., as implemented by the Department of the Treasury's Title VI regulations 31 C.F.R. Part 22, and herein incorporated by reference and made a part of this agreement.

Contractor shall cooperate in any enforcement or compliance review activities by Treasury or the State of the aforementioned obligations. Enforcement may include investigation, arbitration, mediation, litigation, and monitoring of any settlement agreements that may result from these actions. That is, Contractor shall comply with information requests, on-site compliance review, and reporting requirements.

Contractor shall maintain and provide to applicants, beneficiaries, their representatives, or any other party requesting the same, information on how to file a Title VI complaint of discrimination with the State of Missouri.

Contractor shall provide to the State documentation of an administrative agency's or court's findings of non-compliance of Title VI and efforts to address the non-compliance, including any voluntary compliance or other agreements between Contractor and the administrative agency that makes any such finding. If Contractor settles a case or matter alleging such discrimination, Contractor must provide to the State documentation of the settlement. If Contractor has not been the subject of any court or administrative agency finding of discrimination, Contractor shall so state.

The United States of America has the right to seek judicial enforcement of the terms of this assurance section and nothing in this section alters or limits the federal enforcement measures that the United States may take in order to address violations of this section or applicable federal law.

Under penalty of perjury, the undersigned certifies that he/she has read and understood this section's obligations as herein described, that any information submitted in conjunction with this assurance document is accurate and complete, and that Contractor is in compliance with the aforementioned nondiscrimination requirements.

By signing this certification, the undersigned represents his or her intention, and legal authorization, to do so on behalf of Contractor.²

Signature of Contractor's Authorized Representative

Date: _____

Printed Name of Contractor's Authorized Representative

Contractor's Unique Entity Identifier: _____
(*Name associated with the Unique Entity Identifier must match the Contractor's name on contract documents)

III. This agreement shall be conducted in accordance with the standards set forth at 2 C.F.R. §§ 200.317 through 200.327, as applicable. Pursuant to 2 C.F.R. § 200.327 and Appendix II to Part 200 of Title 2 of the C.F.R.:

i. Contracts for more than \$250,000 must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

ii. All contracts in excess of \$10,000 must address termination for cause and for convenience by the State, including the manner by which it will be effected and the basis for settlement.

iii. Except as otherwise provided under 41 C.F.R. Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 C.F.R. Part 60-1.3 must include the equal opportunity clause provided under 41 C.F.R. 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p.339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 C.F.R. Part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

iv. When required by federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 C.F.R. Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute,

² Section II is based on requirements set forth in Treasury's Assurance of Compliance with Civil Rights Requirements document, executed by the State on July 26, 2021.

contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract must be conditioned upon the acceptance of the wage determination. The non-federal entity must report all suspected or reported violations to the federal awarding agency. The contracts must also include a provision for compliance with the Copeland “Anti-Kickback” Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 C.F.R. Part 3, “Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States”). The Act provides that each contractor must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-federal entity must report all suspected or reported violations to the federal awarding agency.

v. Where applicable, all contracts awarded by the non-federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Contract Work Hours and Safety Standards Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.³

vi. If the State or Contractor wishes to enter into a contract or subcontract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under the State’s award of ARPA funds or this agreement, the State and/or Contractor must comply with the requirements of 37 C.F.R. Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.

vii. Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the

³ Additionally, “in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in [29 C.F.R.] § 5.1,” 29 C.F.R. § 5.5(c) requires that another clause be included “in any such contract,” *id.* For language appropriate to construction of this additional clause, see 29 C.F.R. § 5.5(c).

Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA). [

viii. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. 180 that implement Executive Orders 12549 (3 C.F.R. Part 1986 Comp., p. 189) and 12689 (3 C.F.R. Part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. This requirement applies when the amount of the agreement is expected to equal or exceed \$25,000, or if the agreement is for federally-required audit services. 2 C.F.R. § 180.220.]

ix. Contractors that apply or bid for an award exceeding \$100,000 must file the certification required by 31 U.S.C. § 1352, the Byrd Anti-Lobbying Amendment. Under that law, each tier certifies to the tier above that it will not and has not used federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any federal contract, grant or any other award covered by 31 U.S.C. § 1352. Each tier must also disclose any lobbying with non-federal funds that takes place in connection with obtaining any federal award. Such disclosures are forwarded from tier to tier up to the non-federal award.

x. A non-federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines. In the performance of this agreement, Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired: 1. competitively within a timeframe providing for compliance with this agreement’s performance schedule; 2. meeting this agreement’s performance requirements; or 3. at a reasonable price. Information about this requirement, along with the list of EPA-designated items, is available at EPA’s Comprehensive Procurement Guidelines webpage: <http://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>. Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.

xi. Pursuant to Pub. L. No. 115-232, H.R. 5515 (115th Congress, 2018), and 2 C.F.R. § 200.216, funds provided by this agreement shall not be obligated or expended to: 1. Procure or obtain; 2. Extend or renew a contract to procure or obtain; or 3. Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered

telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. For purposes of this prohibition, “covered telecommunications equipment or services” has the meaning as set forth at Sec. 889(f)(3) of Pub. L. No. 115-232. *See also* 2 C.F.R. § 200.216.

xii. Pursuant to 2 C.F.R. § 200.322, as appropriate and to the extent consistent with law, Contractor should, to the greatest extent practicable under this agreement, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). For purposes of this provision: 1. “produced in the United States” means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States. 2. “manufactured products” means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

Annual Wage Order No. 31

Section 028
CRAWFORD COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by _____

Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 8, 2024**

Last Date Objections May Be Filed: **April 8, 2024**

Prepared by Missouri Department of Labor and Industrial Relations

Building Construction Rates for
CRAWFORD County

Section 028

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$26.65*
Boilermaker	\$26.65*
Bricklayer-Stone Mason	\$65.20
Carpenter	\$60.62
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$26.65*
Plasterer	
Communication Technician	\$26.65*
Electrician (Inside Wireman)	\$26.65*
Electrician Outside Lineman	\$26.65*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$26.65*
Glazier	\$26.65*
Ironworker	\$26.65*
Laborer	\$26.65*
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$26.65*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$26.65*
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$26.65*
Plumber	\$26.65*
Pipe Fitter	
Roofer	\$26.65*
Sheet Metal Worker	\$26.65*
Sprinkler Fitter	\$26.65*
Truck Driver	\$26.65*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

Heavy Construction Rates for
CRAWFORD County

Section 028

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$26.65*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$26.65*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$50.11
General Laborer	
Skilled Laborer	
Operating Engineer	\$65.97
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$26.65*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME and HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, "**overtime work**" shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

SECTION 01 10 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Onondaga Cave State Park Water & Wastewater Improvements (Project) shall involve upgrades to the water supply, water distribution and wastewater treatment systems for the state park.
 - 1. Project Location: 7556 Highway H, Leasburg, MO 65535-9136.
 - 2. Owner: State of Missouri, Department of Natural Resources, State Parks, PO Box 176, Jefferson City, Missouri 65102.
- B. Contract Documents, dated 08/16/2024 were prepared for the Project by C.M. Archer Group P.C. dba Archer-Elgin Engineering & Surveying, Located at 310 E. 6th St, Rolla, MO 65401.
- C. The Work consists of coordinating, scheduling, incorporating, and providing all equipment, materials and labor necessary to:
 - 1. Abandon existing pressure reducing valve assemblies and construct new assemblies within the distribution system;
 - 2. Construct a new water line loop from the day use area to the visitors center parking area;
 - 3. Construct a new well house around the existing wellhead;
 - 4. Rehabilitate and modify the existing ground storage tank;
 - 5. Replace existing land application spray irrigation equipment.

Work shall include, but not be limited to: unclassified excavation, shoring and bracing, dewatering, trenching, bedding, backfill, grading, erosion control, pavement, seeding and mulching; miscellaneous piping, fittings, valving, manholes, vaults, connections to new and existing structures; supply, installation and integration of equipment; temporary electric services, extension of new electric circuits, equipment racks, demolition of existing power circuits; start-up and acceptance testing; site cleanup and restoration; and any incidental items necessary for a complete and functional installation.

- D. The work will be constructed under a single prime contract.

1.03 DESIGNER'S ESTIMATE OF CONSTRUCTION COST RANGE

- A. The project designer has prepared this cost estimate range. The State of Missouri makes no guarantee regarding the accuracy of the estimate range nor does the State of Missouri intend to imply that the estimate range in any way reflects the actual cost required to perform the work represented by the specifications and drawings. The contractor should not rely on this estimate range in any way while preparing a bid for this project or otherwise.
- B. Estimate Range: N/A

1.04 WORK SEQUENCE

- A. General: Construction sequence shall be in accordance with requirements herein subject to Owner's need for continuous operation of existing facilities:
 - 1. Contractor(s) shall submit a proposed schedule and construction sequence in accordance with the general conditions relating to preliminary matters at the project preconstruction meeting, but shall generally follow this construction sequencing: Obtain all required permitting, mobilization, excavate and install water main, valves, and hydrants, make main to main connection to fill pipe and test main, connect service taps, cap existing main and make any remaining main to main connections, finish backfilling, pave road crossings, topsoil, seed, and mulch, reapply pavement markings.
- B. Continuous Service of Existing Facilities: Where the Work is on or adjacent to existing facilities, exercise caution and schedule operations to ensure that functioning of present facilities will not be endangered. Shutdown of Owner's operating facilities to perform the Work shall be held to a minimum length of time and shall be coordinated with Owner who shall have control over the timing and schedules of such shutdowns.
- C. Completed Areas: Owner intends to place in service, in accordance with the provisions for use of completed Work set forth in the General Conditions, the facilities as soon as they are sufficiently complete and ready for their intended use.
- D. Coordination: The Contractor shall be required to provide at least a seventy-two (72) hour notification of the shut down of any facilities necessary for him to perform his work. He shall also provide to the Owner, at least 2-3 weeks in advance, a written plan of work which identifies the stages, length of shutdown time, and other contingency plans for review and approval by the Engineer and Owner.

1.05 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.
- B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy and use by the public.
 - 2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.06 OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate owner usage. Perform the Work so as not to interfere with the Owner's operations.
- B. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. The Designer will prepare a Certificate of Partial Occupancy for each specific portion of the Work to be occupied prior to substantial completion.
2. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions for the building.
3. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions for the building.

1.07 OWNER-FURNISHED PRODUCTS

- A. N/A

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

1.01 WORK RESTRICTIONS

- A. General: The Contractor shall limit his use of the premises to the work indicated, so as to allow for Owner occupancy and use by the public.
- B. Use of the Site: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.
 1. Keep existing driveways and roadways open to traffic at all times. Coordinate open-cut crossings of roads to allow at least one lane of through traffic at all times.
 2. At all times fire lanes are to remain unblocked and accessible.
 3. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off-site.
 4. Excavation areas cannot be left open when not being worked and must be closed off at the close of business. In lieu of daily backfill, place adequate construction barriers and/or fencing conforming to federal Occupation Safety and Health Administration (OSHA) Regulation 29 CFR, Part 1910, Subpart D, Occupational Safety and Health Standards, General Industry Standards.) around the excavated area.
 5. Water service for the facility(ies) shall not be disturbed, and construction shall be staged to afford continuous water service for the facility(ies).
 6. Where disruption to water service must occur to make process/utility interconnection, submit a written plan a minimum of 72 hours prior to the commencement of construction documenting construction activities to be performed and the anticipated duration of the outage. Make every effort to minimize interruptions of service. Construction activities may proceed only after the owner's written approval of the proposed sequencing plan.
 7. Lock automotive-type vehicles, such as passenger cars and trucks and other mechanized or motorized equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

END OF SECTION

SECTION 012100 – ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Weather allowances.
- C. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
 - 2. Division 1 Section "Unit Prices" for procedures for using unit prices.

1.3 WEATHER ALLOWANCE

- A. Included within the completion period for this project are a specified number of “bad weather” days (see Schedule of Allowances).
- B. The Contractor’s progress schedule shall clearly indicate the bad weather day allowance as an “activity” or “activities”. In the event weather conditions preclude performance of critical work activities for 50% or more of the Contractor’s scheduled workday, that day shall be declared unavailable for work due to weather (a “bad weather” day) and charged against the above allowance. Critical work activities will be determined by review of the Contractor’s current progress schedule.
- C. The Contractor’s Representative and the Construction Representative shall agree monthly on the number of “bad weather” days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the “bad weather” days for a particular month, that disagreement shall be noted on this written document and signed by each party’s representative. Failure of the Contractor’s representative to sign the “bad weather” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “bad weather” day determination contained in that document.
- D. There will be no modification to the time of contract performance due solely to the failure to deplete the “bad weather” day allowance.

- E. Once this allowance is depleted, a no cost Change Order time extension will be executed for “bad weather” days, as defined above, encountered during the remainder of the Project.

1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, Designer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Designer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Designer from the designated supplier.

1.5 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Weather Allowance: Included within the completion period for this Project 10 “bad weather” days.

END OF SECTION 012100

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract Modifications.
- B. Related Sections include the following:
 - 1. Division 1, Section 013115 "Project Management Communications" for administrative requirements for communications.
 - 2. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
 - 3. Division 0, Section 007213, Article 4.0 "Changes in the Work" for Change Order requirements.

1.03 REQUESTS FOR INFORMATION

- A. In the event that the Contractor or Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation, the Contractor shall submit a "Request for Information" (RFI) in writing to the Designer. A RFI may only be submitted by the Contractor and shall only be submitted on the RFI forms provided by the Owner. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.
- B. Responses to RFI shall be issued within ten (10) working days of receipt of the Request from the Contractor unless the Designer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Designer, the Designer will, within five (5) working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a RFI on a time sensitive activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the ten (10) working days set forth above.
- C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a RFI will cause a change to the requirements of the Contract Document, the Contractor shall give written notice to the Designer requesting a Change Order for the work. Failure to give such written notice within ten (10) working days, shall waive the Contractor's right to seek additional time or cost under Article 4, "Changes in the Work" of the General Conditions.

1.04 MINOR CHANGES IN THE WORK

- A. Designer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Amount or the Contract Time, on "Designer's Supplemental Instructions" (DSI).

1.05 PROPOSAL REQUESTS

- A. The Designer or Owner Representative will issue a detailed description of proposed Changes in the Work that may require adjustment to the Contract Amount or the Contract Time. The proposed Change Description will be issued using the "Request for Proposal" (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 2. Within ten (10) working days after receipt of Proposal Request, submit a proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his proposal on the appropriate Change Order Detailed Breakdown form. Subcontractors may use the appropriate Change Order Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:
 - a. A detailed breakdown of costs per Article 4.1 of the General Conditions.
 - b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

1.06 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Change Order for signatures of Owner and Contractor on the "Change Order" form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00

COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Projects including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
- B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Contractor.
- C. Related Sections include the following:
 - 1. Division 1, Section 013200 "Schedules" for preparing and submitting Contractor's Construction Schedule.
 - 2. Articles 1.8.B and 1.8.C of Section 007213 "General Conditions" for coordinating meetings onsite.
 - 3. Article 5.4.H of Section 007213 "General Conditions" for coordinating Closeout of the Contract.

1.03 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections, which depend on each other for proper installation, connection, and operation.
- B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components including mechanical and electrical.
- C. Prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate Contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other Contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Startup and adjustment of systems.
 8. Project Closeout activities.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.04 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
- B. Key Personnel Names: Within fifteen (15) work days of starting construction operations, submit a list of key personnel assignments including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.05 PROJECT MEETINGS

- A. The Owner's Construction Representative will schedule a Pre-Construction Meeting prior to beginning of construction. The date, time, and exact place of this meeting will be determined after Contract Award and notification of all interested parties. The Contractor shall arrange to have the Job Superintendent and all prime Subcontractors present at the meeting. During the Pre-Construction Meeting, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed along with any other pertinent information.
1. Minutes: Designer will record and distribute meeting minutes.
- B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 007213 "General Conditions".

1. Minutes: Designer will record and distribute to Contractor the meeting minutes.
- C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of Manufacturers and Fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:
 - a. Contract Documents
 - b. Options
 - c. Related RFIs
 - d. Related Change Orders
 - e. Purchases
 - f. Deliveries
 - g. Submittals
 - h. Review of mockups
 - i. Possible conflicts
 - j. Compatibility problems
 - k. Time schedules
 - l. Weather limitations
 - m. Manufacturer's written recommendations
 - n. Warranty requirements
 - o. Compatibility of materials
 - p. Acceptability of substrates
 - q. Temporary facilities and controls
 - r. Space and access limitations
 - s. Regulations of authorities having jurisdiction
 - t. Testing and inspecting requirements
 - u. Installation procedures
 - v. Coordination with other Work
 - w. Required performance results
 - x. Protection of adjacent Work
 - y. Protection of construction and personnel
 3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

6. Revise paragraph below if Project requires holding progress meetings at different intervals. Insert special intervals such as "every third Tuesday" to suit special circumstances.
7. Project name
8. Name and address of Contractor
9. Name and address of Designer
10. RFI number including RFIs that were dropped and not submitted
11. RFI description
12. Date the RFI was submitted
13. Date Designer's response was received
14. Identification of related DSI or Proposal Request, as appropriate

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 15

PROJECT MANAGEMENT COMMUNICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 013300 - Submittals
- C. Division 1, Section 012600 – Contract Modification Procedures

1.02 SUMMARY

- A. Project Management Communications: The Contractor shall use the Internet web based project management communications tool, E-Builder® ASP software, and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
 - 1. Project management communications is available through E-Builder® as provided by "e-Builder®" in the form and manner required by the Owner.
 - 2. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited
- B. Support: E-Builder® will provide on-going support through on-line help files.
- C. Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.
- D. Purpose: The intent of using E-Builder® is to improve project work efforts by promoting timely initial communications and responses. Secondly, to reduce the number of paper documents while providing improved record keeping by creation of electronic document files
- E. Authorized Users: Access to the web site will be by individuals who are authorized users.
 - 1. Individuals shall complete the E-Builder New Company/User Request Form located at the following web site: <https://oa.mo.gov/facilities/vendor-links/contractor-forms>. Completed forms shall be emailed to the following email address: OA.FMDCE-BuilderSupport@oa.mo.gov.
 - 2. Authorized users will be contacted directly and assigned a temporary user password.
 - 3. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.
- F. Administrative Users: Administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will

result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).

- G. Communications: The use of fax, email and courier communication for this project is discouraged in favor of using E-Builder® to send messages. Communication functions are as follows:
1. Document Integrity and Revisions:
 - a. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
 - b. The system shall make it easy to identify revised or superseded documents and their predecessors.
 - c. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
 2. Document Security:
 - a. The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users. **DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!**
 3. Document Integration:
 - a. Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.
 4. Reporting:
 - a. The system shall be capable of generating reports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.
 5. Notifications and Distribution:
 - a. Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
 6. Required Document Types:
 - a. RFI, Request for Information.
 - b. Submittals, including record numbering by drawing and specification section.
 - c. Transmittals, including record of documents and materials delivered in hard copy.
 - d. Meeting Minutes.
 - e. Application for Payments (Draft or Pencil).
 - f. Review Comments.
 - g. Field Reports.
 - h. Construction Photographs.
 - i. Drawings.
 - j. Supplemental Sketches.

- k. Schedules.
 - l. Specifications.
 - m. Request for Proposals
 - n. Designer's Supplemental Instructions
 - o. Punch Lists
- H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the E-Builder® web site by licensed users.
1. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier shall respond to documents received in electronic form on the web site, and consider them as if received in paper document form.
 2. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.
 3. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.
- I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:
1. Providing suitable computer systems for each licensed user at the users normal work location¹ with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
 2. Each of the above referenced computer systems shall have the following minimum system² and software requirements:
 - a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
 - 1) Operating System: Windows XP or newer
 - 2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
 - 3) Minimum Recommend Connection Speed: 256K or above
 - 4) Processor Speed: 1 Gigahertz and above
 - 5) RAM: 512 mb
 - 6) Operating system and software shall be properly licensed.
 - 7) Internet Explorer version 7 (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
 - 8) Adobe Acrobat Reader (current version is a free distribution for download).
 - 9) Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

¹ The normal work location is the place where the user is assigned for more than one-half of his time working on this project.

² The minimum system herein will not be sufficient for many tasks and may not be able to process all documents and files stored in the E-Builder® Documents area.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION

SECTION 01 32 00

SCHEDULE – BAR CHART

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.02 SUMMARY

- A. This Section includes requirements for a Bar Chart Schedule for the project construction activities, schedule of submittals, and schedule for testing.

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.01 SUBMITTAL PROCEDURES

- A. The Contractor shall submit to the Designer, within ten (10) working days following the Notice to Proceed, a Progress Schedule including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.
 - 1. The Schedule of Values must have the following line items included with the value of the item as indicated below:
 - a. O&M's (Owner's Manual)
 - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
 - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - b. Close Out Documents
 - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
 - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - c. General Conditions
 - 1) No more than 10%
- B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.
- C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall coordinate preparation and processing of Schedules and reports with performance of other construction activities.

3.02 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

- A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general

construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 012100 – Allowances.

1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
 - a. If practical, use the same Schedule of Values breakdown for schedule time bars.
 2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar is to indicate start and completion dates for the activity. The Contractor is to place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.
 3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.
 6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.
- B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:
1. Requirement for Phased completion
 2. Work by separate Contractors
 3. Work by the Owner
 4. Pre-purchased materials
 5. Coordination with existing construction
 6. Limitations of continued occupancies
 7. Un-interruptible services
 8. Partial Occupancy prior to Substantial Completion
 9. Site restrictions
 10. Provisions for future construction
 11. Seasonal variations
 12. Environmental control
- C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:
1. Subcontract awards
 2. Submittals

3. Purchases
 4. Mockups
 5. Fabrication
 6. Sample testing
 7. Deliveries
 8. Installation
 9. Testing
 10. Adjusting
 11. Curing
 12. Startup and placement into final use and operation
- D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a “major area” is a story of construction, a separate building, or a similar significant construction element.
1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Revise list below to suit Project.
 - b. Structural completion.
 - c. Permanent space enclosure
 - d. Completion of mechanical installation
 - e. Completion of the electrical portion of the Work
 - f. Substantial Completion

3.03 SCHEDULE OF SUBMITTALS

- A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 013300 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.
- B. Prepare the schedule in chronological order. Provide the following information
1. Scheduled date for the first submittal
 2. Related Section number
 3. Submittal category
 4. Name of the Subcontractor
 5. Description of the part of the Work covered
 6. Scheduled date for resubmittal
 7. Scheduled date for the Designer’s final release or approval
- C. Distribution: Following the Designer’s response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.
1. Post copies in the Project meeting room and temporary field office.
 2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.

- D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

3.04 SCHEDULE OF INSPECTIONS AND TESTS

- A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor is to notify the testing agency at least (5) working days in advance of the required tests unless otherwise specified.
- B. Form: This schedule shall be in tabular form and shall include, but not be limited to, the following:
 - 1. Specification Section number
 - 2. Description of the test
 - 3. Identification of applicable standards
 - 4. Identification of test methods
 - 5. Number of tests required
 - 6. Time schedule or time span for tests
 - 7. Entity responsible for performing tests
 - 8. Requirements for taking samples
 - 9. Unique characteristics of each service
- C. Distribution: Distribute the schedule to the Owner, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION

SECTION 013300

SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 013115 "Project Management Communications" for administrative requirements for communications.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:
 - 1. Shop Drawings
 - 2. Product Data
 - 3. Samples
 - 4. Quality Assurance Submittals
 - 5. Construction Photographs
 - 6. Operating and Maintenance Manuals
 - 7. Warranties
- B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
 - 1. Construction Progress Schedule including Schedule of Values
 - 2. Performance and Payment Bonds
 - 3. Insurance Certificates
 - 4. Applications for Payment
 - 5. Certified Payroll Reports
 - 6. Partial and Final Receipt of Payment and Release Forms
 - 7. Affidavit – Compliance with Prevailing Wage Law
 - 8. Record Drawings
 - 9. Notifications, Permits, etc.
- C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with contract plans and specifications. The Contractor is responsible for the content of the shop drawings and coordination with other contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.
- D. The Contractor shall at all times make a copy, of all approved submittals, available on site to the Construction Representative.

1.03 SUBMITTAL PROCEDURES

- A. The Contractor shall comply with the General and Supplementary Conditions and other applicable sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction

activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- B. Each drawing and/or series of drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the drawings. Each series shall be numbered consecutively for ready reference and each drawing shall be marked with the following information:
1. Date of Submission
 2. Name of Project
 3. Location
 4. Section Number of Specification
 5. State Project Number
 6. Name of Submitting Contractor
 7. Name of Subcontractor
 8. Indicate if Item is submitted as specified or as a substitution

1.04 SHOP DRAWINGS

- A. Comply with the General Conditions, Article 3.2.
- B. The Contractor shall submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- C. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings including the following information:
1. Dimensions
 2. Identification of products and materials included by sheet and detail number
 3. Compliance with specified standards
 4. Notation of coordination requirements
 5. Notation of dimensions established by field measurement
 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8½"x11" but no larger than 36"x48".

1.05 PRODUCT DATA

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information including the following information:
 - a. Manufacturer's printed recommendations
 - b. Compliance with Trade Association standards
 - c. Compliance with recognized Testing Agency standards
 - d. Application of Testing Agency labels and seals
 - e. Notation of dimensions verified by field measurement
 - f. Notation of coordination requirements
2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.06 SAMPLES

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall submit full-size, fully fabricated samples, cured and finished as specified, and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 1. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Designer's sample including the following:
 - a. Specification Section number and reference
 - b. Generic description of the Sample
 - c. Sample source
 - d. Product name or name of the Manufacturer
 - e. Compliance with recognized standards
 - f. Availability and delivery time
 2. The Contractor shall submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for samples to be returned to the Contractor for incorporation in the Work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.
 - d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
 3. Field samples are full-size examples erected onsite to illustrate finishes, coatings, or finish materials and to establish the Project standard.
 - a. The Contractor shall comply with submittal requirements to the fullest extent possible. The Contractor shall process transmittal forms to provide a record of activity.

1.07 QUALITY ASSURANCE DOCUMENTS

- A. The Contractor shall comply with the General Conditions, Article 3.2
- B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- C. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the Manufacturer certifying compliance with specified requirements.
 - 1. Signature: Certification shall be signed by an officer of the Manufacturer or other individual authorized to contractually bind the Company.
- D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.
- E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.
 - 1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.
 - 2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.
 - 3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.
 - 4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

1.08 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

- A. The Contractor shall submit all required manufacturer's operating instructions, maintenance/service manuals, and warranties in accordance with the General Conditions, Article 3.5, and Supplementary Conditions along with this and other Sections of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 REQUIRED SUBMITTALS

- A. Contractor shall submit the following information for materials and equipment to be provided under this contract.

END OF SECTION

SPEC SECTION	TITLE	CATEGORY
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013200	Schedules	List of Subcontractors
013200	Schedules	Major Material Suppliers
030001	Concrete Mix Design	Product Data
030001	Concrete Reinforcement	Shop Drawings
042220	Masonry	Product Data
051000	Structural Steel	Product Data
055000	Metal Fabrications	Shop Drawings
071400	Fluid Applied Waterproofing	Product Data
071900	Water Repellents	Product Data
072110	Insulation	Product Data
074113	Roof Panels	Product Data
076000	Flashing	Product Data
079000	Joint Sealers	Product Data
081100	Metal Doors and Frames	Product Data
083114	Access Doors	Product Data
087100	Door Hardware	Product Data
099000	Paint	Product Data
312323	Flowable Fill	Product Data
312513	SWPP	Product Data
321123	Aggregate Base Course	Product Data
321216	Asphalt Mix	Product Data
323113	Chain Link Fence	Product Data
330509	Thrust Restraint	Product Data
330523	Frac-out Contingency Plan	Product Data
330561	Manholes	Shop Drawings
330597	Utility Signage	Product Data
331416	Piping	Product Data
331419	Valves	Product Data
409116	Flow instrumentation	Product Data
409119	Pressure instrumentation	Product Data
432516	Chemical Feed Equipment	Product Data
465113	Floating Aerators	Product Data

SECTION 01 35 13

SITE SECURITY AND HEALTH REQUIREMENTS (DNR)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUBMITTALS

- A. List of required submittals:
 - 1. Materials Safety Data Sheets for all hazardous materials to be brought onsite.
 - 2. Schedule of proposed shutdowns, if applicable.
 - 3. A list of the names of all employees who will submit fingerprints for a background check, and the signed privacy documents identified below for each employee.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ACCESS TO THE SITE

- A. The Contractor shall arrange with Facility Representatives to establish procedures for the controlled entry of workers and materials into the work areas at the Facility.
- B. The Contractor shall establish regular working hours with Facility Representatives. The Contractor must report changes in working hours or overtime to Facility Representatives and obtain approval twenty-four (24) hours ahead of time. The Contractor shall report emergency overtime to Facility Representatives as soon as it is evident that overtime is needed. The Contractor must obtain approval from Facility Representatives for all work performed after dark.
- C. The Contractor shall provide the name and phone number of the Contractor's employee or agent who is in charge onsite; this individual must be able to be contacted in case of emergency. The Contractor must be able to furnish names and address of all employees upon request.
- D. All construction personnel shall visibly display issued identification cards.

3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

- A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.

1. Onsite burning is prohibited.
 2. The Contractor shall store all flammable or hazardous materials in proper containers located outside the buildings or offsite, if possible.
 3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound dry chemical extinguishers shall be provided.
- B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.
 - C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.
 - D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers, and shall not dispose of volatile wastes or oils in storm or sanitary drains.
 - E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste, and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.
 - F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.
 - G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.
 - H. Alcoholic beverages or illegal substances shall not be brought upon the Facility premises. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.3 DISRUPTION OF UTILITIES

- A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.
- B. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and Facility Representative before closing any access drives, and shall make temporary access available, if possible. The Contractor shall not obstruct streets, walks, or parking.

3.4 PROTECTION OF PERSONS AND PROPERTY

- A. SAFETY PRECAUTIONS AND PROGRAMS

1. The Contractor shall at all times conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules, regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.
2. All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.
3. In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. "Rendered Harmless" shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

B. SAFETY OF PERSONS AND PROPERTY

1. The Contractor shall take reasonable precautions for safety of, and shall provide protection to prevent damage, injury, or loss to:
 - a. clients, staff, the public, construction personnel, and other persons who may be affected thereby;
 - b. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and
 - c. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
2. The Contractor shall give notices and comply with applicable laws, standards, codes, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.
3. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.
4. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall

exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.

5. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in this Section caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, and for which the Contractor is responsible under this Section, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's other obligations stated elsewhere in the Contract.
6. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment and enforce the use of such equipment by its employees and its subcontractors of any tier.
7. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
8. The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately.
9. The Contractor shall promptly notify in writing to the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.
10. The Owner assumes no responsibility or liability for the physical condition or safety of the Work site or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.
11. In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.
12. The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for clients, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

END OF SECTION 013513

SECTION 01 40 00

QUALITY REQUIREMENTS

Part 1 - GENERAL

1.01. SUMMARY:

- A. General: Required inspection and testing services are intended to assist in the determination of probable compliance of the work with requirements specified or indicated. These required services do not relieve the Contractor of responsibility for compliance with these requirements or for compliance with requirements of the contract documents.
- B. Definitions: The requirements of this section relate primarily to customized fabrication and installation procedures, not to the production of standard products. Quality control services include inspections and tests and related actions including reports, performed by independent agencies and governing authorities, as well as directly by the Contractor. These services do not include Contract enforcement activities performed directly by the Engineer.
 - 1. Specific quality control requirements for individual units of work are specified in the sections of these specifications that specify the individual element of the work. These requirements, including inspections and tests, cover both production of standard products and fabrication of customized work. These requirements also cover quality control of the installation procedures.
 - 2. Inspections, tests and related actions specified in this section and elsewhere in the Contract Documents are not intended to limit the Contractor's own quality control procedures which facilitate overall compliance with requirements of the Contract Documents.
 - 3. Requirements for the Contractor to provide quality control services as required by the Engineer, the Owner, governing authorities or other authorized entities are not limited by the provisions of this section.

1.02. RESPONSIBILITIES:

- A. Contractor Responsibilities: Except where they are to be provided by another identified entity, inspections, tests and similar quality control services are the Contractor's responsibility; these services also include those specified to be performed by an independent agency and not directly by the Contractor. Costs for these services shall be included in the Contract Price. The Contractor shall employ and pay an independent agency, testing laboratory, or other qualified firm to perform quality control services specified.
- B. Retest Responsibility: Where results of required inspections, tests of similar services prove unsatisfactory and do not indicate compliance of related work with the requirements of the Contract Documents, then retests are the responsibility of the Contractor, regardless of whether the original test was the Contractor's responsibility. Retesting of work revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on the original work.
- C. Responsibility for Associated Services. The Contractor is required to cooperate with the independent agencies performing required inspections, tests, and similar services. Provide

such auxiliary services as are reasonably requested. Notify the testing agency sufficiently in advance of operations to permit assignment of personnel. These auxiliary services include but are not necessarily limited to the following:

1. Providing access to the work.
 2. Taking samples or assistance with taking samples.
 3. Delivery of samples to test laboratories.
 4. Security and protection of samples and test equipment at the project site.
- D. Coordination: The Contractor and each independent agency engaged to perform inspections, tests and similar services for the project shall coordinate the sequence of their activities so as to accommodate required services with a minimum of delay in the progress of the work. In addition, the Contractor and each independent testing agency shall coordinate their work so as to avoid the necessity of removing and replacing work to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, taking of samples and similar activities.

1.03. QUALITY ASSURANCE:

- A. Qualifications for Service Agencies: Except as otherwise indicated, engage inspection and test service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories and which are recognized in the industry as specialized in the types of inspections and tests to be performed.

1.04. SUBMITTALS:

- A. General: Submit a certified written report of each inspection, test, or similar service, directly to the Engineer in triplicate. If Contractor is responsible for the service, submit a certified written report of each inspection, test, or similar service through the Contractor, in duplicate.

Qualifications statement for service agencies demonstration conformance to abovementioned requirements.

1. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to, the following:
 - a. Name of testing agency or test laboratory.
 - b. Dates and locations of samples and tests or inspections.
 - c. Names of individuals making the inspection or test.
 - d. Designation of the work and test method.
 - e. Complete inspection or test data.
 - f. Test results.
 - g. Interpretations of test results.
 - h. Notation of significant ambient conditions at the time of sample-taking and testing.
 - i. Comments or professional opinion as to whether inspected or tested work complies with requirements of the Contract Documents.

- j. Recommendations on retesting, if applicable.

1.05. SERVICES WITH EQUIPMENT AND MATERIALS FURNISHED UNDER THIS CONTRACT:

- A. Contractor shall furnish the services of qualified field personnel from the manufacturers and suppliers of equipment and materials furnished and installed under this Contract, as required to perform all manufacturer's field services called for in the Specifications.
- B. He shall perform no work related to the installation or operation of equipment or materials furnished and installed under this Contract without direct observation and guidance of the supplier's or manufacturer's field personnel (where such service is specified) unless Engineer concurs otherwise.
- C. The supplier's or manufacturer's field personnel shall perform the following:
 - 1. Observe the erection, installation, start-up, and testing of equipment.
 - 2. Instruct and guide Contractor in proper procedures.
 - 3. Supervise pre-operational testing, start-up, and final operational check, and any required adjustments of equipment.
 - 4. Instruct Owner's designated personnel in proper operation and maintenance of all equipment.
- D. All supplier's and manufacturer's field personnel are to advise Engineer of their arrival at the site and furnish to him a written report covering all Work done at least once each week and when completed.

1.06. PLACING EQUIPMENT IN OPERATION:

- A. Contractor shall place all equipment and materials installed under this Contract into successful operation according to instructions of the supplier or manufacturer, including making of all required adjustments, tests, operation checks, and the following:
 - 1. Cleaning, sounding, blowing-out, flushing of lubricating oil and water systems and other pipelines.
 - 2. Lubrication (lubricants supplied by Contractor unless specified to be furnished by Owner or others).
 - 3. Tests of lubrication system safety interlocks and system performance.
 - 4. Final alignment checks and measurements made under observation of Engineer and Owner. Alignment checks shall include opening connections if required to ensure there are no abnormal stresses on equipment from pipes, ducts, or other attachments. Alignment shall be within tolerances specified by the manufacturer, and measurements shall be recorded and furnished to Engineer.
 - 5. Motor rotation checks before connecting couplings.
 - 6. Inspection of sleeve bearings for adequate contact. Include scraping bearings for at least 80-percent contact and demonstrating contact area to Owner and Engineer before final assembly of bearing caps.

7. Checking of anchor-bolt tensions, grout, and shims. Anchor bolts shall be tightened with calibrated torque wrenches using care not to over-stress bolts.
- B. After run-in and acceptance of alignment, major equipment shall be affixed in place using standard tapered dowels with jack-out nuts at head end to facilitate removal.
- C. All above operations shall be recorded on forms furnished by Engineer.
- D.
- E. All necessary attendants and personnel shall be furnished as part of the work to accomplish the above operations until such time as individual items, systems, equipment, or sections of the plant are acceptable for operation by Owner.
- F. Contractor shall provide attendants on continuous basis as required to complete events.
- G. Contractor will provide fuel, electricity, water, and lubricants for placing equipment in operation.

1.07. PERFORMANCE TESTS:

- A. Equipment and Materials Furnished under this Contract:
 1. Refer to technical specification sections for acceptance testing requirements.
 2. No tests will be conducted on equipment or materials for which manufacturer's field service is specified unless manufacturer's Field Representative is present and declares in writing that the equipment and materials are ready for such test.
 3. Contractor will be notified so that he can have a representative, or manufacturer's representative, present during any tests of equipment or materials for which manufacturer's field service is not specified.
 4. The tests will be made as set forth in the Specifications unless the interested parties mutually agree upon some other manner of testing.

Part 2 - PRODUCTS (Not Applicable).

Part 3 - EXECUTION

1.08. REPAIR AND PROTECTION:

- A. General: Upon completion of inspection, testing, sample-taking, and similar services performed on the work, repair damaged work. Protect work exposed by or for quality control service activities, and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution
 - 2. Temporary electric power and light
 - 3. Temporary heat
 - 4. Ventilation
 - 5. Telephone service
 - 6. Sanitary facilities, including drinking water
 - 7. Storm and sanitary sewer
- C. Support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds
 - 2. Temporary roads and paving
 - 3. Dewatering facilities and drains
 - 4. Temporary enclosures
 - 5. Hoists and temporary elevator use
 - 6. Temporary project identification signs and bulletin boards
 - 7. Waste disposal services
 - 8. Rodent and pest control
 - 9. Construction aids and miscellaneous services and facilities
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection
 - 2. Barricades, warning signs, and lights
 - 3. Sidewalk bridge or enclosure fence for the site
 - 4. Environmental protection

1.3 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

- B. Implementation and Termination Schedule: Within (15) days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:
 - 1. Building code requirements
 - 2. Health and safety regulations
 - 3. Utility company regulations
 - 4. Police, fire department, and rescue squad rules
 - 5. Environmental protection regulations
- B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”. ANSI A10 Series standards for “Safety Requirements for Construction and Demolition”, and NECA Electrical Design Library “Temporary Electrical Facilities”.
 - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code”.
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry”.
 - 1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.

2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
 3. For fences and vision barriers, provide minimum 3/9" (9.5mm) thick exterior plywood.
 4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" (16mm) thick exterior plywood.
- C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.
- D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary office, shops, and shed.
- E. Paint: Comply with requirements of Division 9 Section "Painting".
1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
 2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
 3. For interior walls of temporary offices, provide two (2) quarts interior latex-flat wall paint.
- F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of (15) or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- G. Water: Provide potable water approved by local health authorities.
- H. Open-Mesh Fencing: Provide 0.120" (3mm) thick, galvanized 2" (50mm) chainlink fabric fencing 6' (2m) high with galvanized steel pipe posts, 1½" (38mm) ID for line posts and 2½" (64mm) ID for corner posts.

2.2 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide ¾" (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100' (30m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110 to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: 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 single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.

- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 - 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.

- B. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
 - 1. Install electric power service underground, except where overhead service must be used.
 - 2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125V, AC 20ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- D. Temporary Electric Power Service: The Owner will provide electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc.
- E. Temporary Heating and Cooling: The normal heating and/or cooling system of the building shall be maintained in operation during the construction. Should the Contractor find it necessary to interrupt the normal HVAC service to spaces, which have not been vacated for construction, such interruptions shall be pre-scheduled with the Construction Representative.
- F. Temporary Toilets: Install self-contained toilet units. Use of pit-type privies will not be permitted. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
 - 1. Shield toilets to ensure privacy.
 - 2. Provide separate facilities for male and female personnel.
 - 3. Provide toilet tissue materials for each facility.
- G. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a health and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
 - 1. Provide paper towels or similar disposable materials for each facility.
 - 2. Provide covered waste containers for used material.
 - 3. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- H. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
 - 1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:
 - 1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
 - 2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
- C. Storage Facilities: The Owner will provide storage onsite as designated by the Facility Representative or the Construction Representative. Areas for use by the Contractor for storage will be identified at the Pre-Bid Meeting.
- D. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.
 - 1. Paving: Comply with Division 2 Section “Hot-Mixed Asphalt Paving” for construction and maintenance of temporary paving.
 - 2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 - 3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
 - 4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 - 5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- E. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

- G. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
 - 1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
 - 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- H. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- I. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.
- J. Rodent Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures are regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.
- B. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
 - 1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.
- C. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
 - 1. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- D. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or

polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
 - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.
 - 3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housing.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 017400

CLEANING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for cleaning during the Project.
- B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
 - 1. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator for the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 PROGRESS CLEANING

- A. General
 - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
 - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
 - 3. At least once each week, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.
 - 4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.
- B. Site
 - 1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
 - 2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.
 - 3. Maintain the site in a neat and orderly condition at all times.
- C. Structures

1. Daily, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, sweep all interior spaces clean. "Clean" for the purposes of this paragraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.
3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily while work is being performed in the space in which finish materials have been installed. "Clean" for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish floor material.

3.02 FINAL CLEANING

- A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.
 1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities including landscape development areas, of rubbish, waste material, litter, and foreign substances.
 2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 3. Remove petrochemical spills, stains, and other foreign deposits.
 4. Remove tools, construction equipment, machinery, and surplus material from the site.
 5. Remove snow and ice to provide safe access to the building.
 6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 8. Broom clean concrete floors in unoccupied spaces.
 9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.
 10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 11. Remove labels that are not permanent labels.
 12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.
 15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 16. Clean ducts, blowers, and coils if units were operated without filters during construction
 17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.
 18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
 19. Leave the Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.
- D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.
- F. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner's property.

END OF SECTION

SECTION 03 00 01

CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Concrete and Materials.
 - 2. Reinforcing.
 - 3. Form Work.
 - 4. Grouts.
 - 5. Related Chemicals and Compounds.
 - 6. Moisture Barriers and Stops.
 - 7. Concrete Anchors.

1.02 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, curing compounds, grouts, sealants and finishing compounds.
- B. Test Report and Mill Certifications.
- C. Shop Drawings, Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bend bars, arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.
- D. Concrete mix design for each mix used with aggregate gradation information.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the latest editions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:
 - 1. American Society for Testing and Materials (ASTM):
 - C31 - Making and Curing Concrete Test Specimens in the Field
 - C33 - Concrete Aggregates
 - C39 - Compressive Strength of Cylindrical Concrete Specimens
 - C40 - Organic Impurities in Sands for Concrete
 - C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - C88 - Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
 - C94 - Ready-Mixed Concrete
 - C143 - Slump of Portland Cement Concrete

- C150 - Portland Cement
 - C172 - Sampling Fresh Concrete
 - C192 - Making and Curing Concrete Test Specimens in the Laboratory
 - C231 - Test for Air Content of Freshly Mixed Concrete by the Pressure Method
 - C233 - Testing Air-Entraining Admixtures for Concrete
 - C260 - Air-Entraining Admixtures for Concrete
 - C309 - Liquid Membrane-Forming Compounds for Curing Concrete
 - C311 - Sampling and Testing Fly Ash or Natural Pozzolans for Use as Mineral Admixtures in Portland Cement Concrete
 - C494 - Chemical Admixtures for Concrete
 - C595 - Blended Hydraulic Cements
 - C1240 - Silica Fume for Use in Hydraulic-Cement Concrete and Mortar
 - A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
 - D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
2. American Concrete Institute (ACI):
- 211.1 - Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete
 - 301 - Specifications for Structural Concrete Buildings
 - 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
 - 305 - Committee Report on Hot-Weather Concreting
 - 306 - Committee Report on Cold-Weather Concreting
 - 309 - Recommended Practice for Consolidation of Concrete
 - 318 - Building Code Requirements for Reinforced Concrete
3. Concrete Reinforcing Steel Institute:
- Manual of Standard Practice (CRSI).

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed faced plywood or other acceptable panel-type materials, to provide continuous straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

- C. Form Coatings: Provide commercial formulation form-coating compounds that will neither bond with, stain nor adversely affect (cause injury to) concrete surfaces, and will not impair subsequent treatments of concrete surfaces. Clean forms of sawdust, dust, dirt, and other foreign materials.
- D. Form Ties: Break-back, coil, or screw-type, except where otherwise specified. Water seal coil type in walls below grade and walls of water-bearing structures. Coil type shall leave conical depression in concrete. Space ties as required against pressure of fresh concrete.
- E. Chamfer Strips: 3/4" chamfer except where otherwise indicated. Place in all forms to provide chamfer where concrete will have exposed projecting corners or exposed projecting edges, or both.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed except as otherwise specified. Column ties and stirrups of any size shall conform to ASTM A 615, Grade 60, unless otherwise indicated.

Fabrication of Reinforcing Bars: Fabricate with cold bends conforming to the recommended dimensions shown in ACI 318. Field fabrication will be allowed only if the Contractor has equipment to properly fabricate steel. Attach metal or plastic tags with identifying mark corresponding to mark number on drawing.

- B. Steel Wire: ASTM A 82, plain, cold-drawn, steel.
- C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- D. Welded Deformed Steel Wire Fabric: ASTM A 497.
- E. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications, unless otherwise specified. Metal accessories shall be plastic coated (CRSI, Class 1) or stainless steel protected (CRSI, Class 2) where legs will be exposed in finished concrete surfaces. Do not use rocks, broken bricks, wood blocks, concrete fragments, or reinforcing bars driven into the ground for support of steel reinforcement.

For slabs on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Precast concrete block bar supports may be used. Blocks shall be made with a minimum of 9 sacks of cement per cubic yard and have a minimum compressive strength of 3000 psi in 7 days. Each block shall have a minimum of 9 square inches of bearing area. Space as required by the particular condition of weight, bearing surface and rigidity of the steel reinforcement.

2.03 CONCRETE MATERIALS

- A. General:
 - 1. Silica fume pozzolans will be allowed.
 - 2. Fly Ash:
 - a. Class "C" and "F" fly ashes shall conform to ASTM C618, Table 1 and 2.

- b. Fly ash, if used, shall be at least 15 percent and no more than 25 percent of the total cementitious material, cement plus fly ash.
 - 3. Ground granulated blast-furnace slag:
 - a. Slag conforming to ASTM C989 may be included in mix designs with all cement types. Slag, if used, shall be at least 25 percent and no more than 50 percent of the total cementitious material, cement plus slag.
 - b. Slag shall not be combined with fly ash in the same mix.
- B. Portland Cement:
 - 1. ASTM C150 Type I/II, IP, II, or IL cement shall be used on the following structures:
 - a. All concrete for this project
 - 2. The Portland Cement product of only one mill or any one brand shall be used on the project.
- C. Aggregates: Coarse and fine aggregates conforming to ASTM C 33 shall be separately furnished and stored. Pit run or naturally mixed aggregates will not be accepted, nor will mixing of aggregates from different sources or alternating batches of different aggregates in one stockpile be permitted.
- D. Fine Aggregate: Conform to ASTM C33 except deleterious substances shall not exceed (by weight) 0.25 percent for clay lumps, 2.0 percent for material finer than No. 200 sieve, 0.25 percent for coal and lignite, and 0.25 percent for all other deleterious materials. Maintain fine aggregate free of ice and frozen lumps.
- E. Coarse Aggregate: Conform to ASTM C33 except that deleterious substances shall not exceed the maximum allowed in ASTM C33 for Class 4S coarse aggregates.

Flat particles with maximum particle dimensions of 2-1/2 times the average thickness shall not exceed 5.0 percent. Blast furnace slag will not be permitted. Maintain coarse aggregate free of ice and frozen lumps. Grading requirements shall be ASTM C33 size Number 57 (1" to No. 4) for all concrete unless approved in writing by the Engineer.
- F. Mixing Water: Drinkable and free from foreign materials in amounts harmful to concrete and embedded steel, shall be acceptable without testing. Expense of testing water shall be paid by Contractor.
- G. Air-Entraining Admixtures: Conform to ASTM C260 and manufacturer's recommendations for use. Testing of air-entraining admixtures shall conform to ASTM C233. Obtain manufacturer's recommendations for coordinating dosage with superplasticizer.
- H. Water-Reducing Admixtures: Conform to ASTM C494, Type A; contain not more than 0.1 percent chloride ions and conform to manufacturer's recommendations for use. Technical assistance of the manufacturer's field representative shall be furnished upon request.
- I. High-Range Water-Reducing Admixtures (Super Plasticizer): ASTM C494, Type F or Type G, containing not more than 0.1 percent chloride ions. Super plasticizer used to raise slump above the initial slump shall be applied to the mix at the site.
- J. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C494, Type E, and containing not more than 0.1 percent chloride ions.

- K. Water-Reducing, Retarding Admixtures: ASTM C494, Type D, containing not more than 0.1 percent chloride ions.
- L. Certification: Provide admixture manufacturer's written certification that chloride ion content complies with specified requirements.

Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.

- M. Technical assistance of admixture manufacturer's field representative shall be furnished on request.

2.04 RELATED MATERIALS

- A. Waterstops: Provide centerbulb-type waterstops at all construction joints below grade and all construction joints in water retaining structures unless otherwise indicated. Unless the drawings show otherwise, use polyvinyl chloride water stop #705 or #724 as manufactured by Greenstreak Plastic Products, or approved equal. Waterstop shall conform to Corps of Engineers CRD-C 572.
- B. Moisture Barrier: Provide 6 mil polyethylene moisture barrier cover where indicated on drawings. Moisture barrier shall not be used in locations other than those indicated on the drawings.
- C. Smooth Dowel Bars and Caps: Smooth dowel bars shall be 3/4" Ø/ A36 smooth bars with no deformations at the ends. Dowel bars shall be fitted with caps at each end to provide for 1" minimum movement.
- D. Expansion Joint Material: Non-extruding (PVC) closed cell foam expansion joint filler conforming to ASTM D-1667, thickness as shown on the drawings. Use Sonneborn Vinylfoam, or approved equal.
- E. Plain Grout: One part portland cement to 2 parts sand by volume. Keep water to a minimum as required for placing by the dry packing method. Place after the mixed grout has been allowed to stand for 2 hours. The sand and cement shall be as specified for concrete.
- F. Nonshrink Grout: CRD-C 621, factory pre-mixed grout. Required for setting handrail posts, for setting equipment recommended by the manufacturer to be set with nonshrink grout, and in other places indicated. Grout shall be non-metallic, as manufactured by one of the following:
 - 1. Sika Grout, Sika Corporation
 - 2. Crystex, L and M Construction Chemicals, Inc.
 - 3. Five Star Grout, Five Star Products, Inc.
 - 4. Masterflow 713 Grout, Master Builder's Company.
 - 5. Saurereisen F-100, Saurereisen Cements Company.
 - 6. Supreme Grout, Gifford-Hill & Company.
 - 7. Or approved equal.

Prepare and place conforming to manufacturer's printed instructions.

- G. Grout for Bonding: One part cement to 1-1/2 parts sand by weight. Keep water to a minimum. Apply immediately prior to concrete placement.
- H. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 pounds of fluosilicates per gallon.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Surfhard; Euclid Chemical Co.
 - b. Lapidolith; Sonneborn-Contech.
 - c. Saniseal; Master Builders.
 - d. Burk-O-Lith; The Burke Co.
 - e. Or approved equal.
 - 2. Moisture-Retaining Cover: One of the following, complying with ASTM C171:
 - a. Waterproof paper.
 - b. Polyethylene film.
 - c. Polyethylene-coated burlap.
- I. Liquid Membrane Forming Curing Compound: Liquid membrane forming compound conforming to ASTM C309, Type 1. ASTM C309, Type 2, shall be used as specified for Hot Weather Concreting. Curing compound used on floors to be painted, tiled or covered with resilient floor covering shall be guaranteed not to interfere with application of paint, tile mortar, or tile adhesive after a 28-day curing period.
- J. Concrete Anchors:
 - 1. All anchors not cast in place shall be polyester resin or amine epoxy adhesive type.
 - 2. Bolts to conform to ASTM A167, type 304 stainless steel.
 - 3. Install in strict conformance with manufacturer's printed instructions. Furnish sizes and embedments indicated, or as directed by Engineer.
 - 4. Furnish anchors manufactured by one of the following:
 - a. Simpson Strong-Tie.
 - b. Hilti Inc.
 - c. ITW Redhead
 - 5. Concrete anchors shall not be substituted for indicated cast-in-place anchor bolts without prior written authorization by the Engineer for each specific anchor group or location.

2.05 LABORATORY TESTING OF MATERIALS FOR USE IN CONCRETE

- A. An approved independent testing laboratory shall be selected and paid by the Contractor to perform all required laboratory tests of materials proposed for use in the production of concrete and to determine mix proportions when laboratory trial batches are required. The laboratory shall report the results of the testing and mix designs as follows:
 - 1. Engineer, Home Office (1 copy).
 - 2. Resident Project Representative, Field Office (1 copy).

3. Contractor (copies as required).
4. Concrete supplier (copies as required).

All laboratory test results shall be submitted to the Engineer for approval no less than 30 days prior to the proposed date of construction.

- B. Contractor shall deliver representative samples of all proposed concrete materials to the laboratory for the following testing:
 1. Fine aggregate: to be tested according to ASTM C33, ASTM C40, and ASTM C88.
 2. Coarse aggregate: to be tested according to ASTM C33 and ASTM C88.
 3. Mixing water, if other than potable water is proposed for use and, in the opinion of the Engineer, there is reason to suspect its acceptability, then using the design mix, the laboratory shall make 2 concrete test cylinders using proposed water and 2 concrete test cylinders using potable water conforming to ASTM C192. All cylinders shall be tested conforming to ASTM C39. Age of cylinders at test shall be 28 days unless an earlier age is authorized.
 4. Air-entraining admixture shall be tested conforming to ASTM C233.

2.06 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for all concrete (unless otherwise specified) on the basis of field experience; but in the case where sufficient or suitable strength test data is not available, concrete shall be proportioned on the basis of laboratory trial mix design as specified in ACI 301.
- B. Concrete Qualities Required: Design mixes to provide normal weight concrete with the following properties:
 1. Minimum 28-day compressive strength = 4000 psi for all construction unless otherwise indicated.
 2. Initial slump of concrete shall be 3 inches plus or minus 1 inch. Higher final slumps are acceptable where an approved super plasticizer is used.
 3. Air content shall be between 5 to 7 percent.

Concrete shall be homogeneous, readily placeable and uniformly workable, proportioned to conform to ACI 211.1.

- C. Cement Content: Each cubic yard of concrete shall contain not less than the quantity of cement stated below:

ASTM C33 Coarse Aggregate Size Number	Minimum Cement Per Cubic Yard
#57 (1" to #4)	540 Lbs.
#67 (3/4" to #4)	560 Lbs.
#7 (1/2" to #4)	600 Lbs.

The water content of the concrete mix shall be calculated by the ratio (by weight) of water to cement("W/C Ratio"). The weight of water shall be the total water in the mix, including free

moisture in the aggregate. The W/C ratio shall not exceed 0.38 for concrete in all portions of any structure which contains or conveys water or sewage. The W/C ratio shall not exceed 0.45 for all other concrete.

If the W/C ratio specified herein along with the use of an ASTM C494 Type A water reducer does not supply the specified initial slump or sufficient workability, then an approved high-range water-reducing admixture may be used. Under no circumstances shall water be added which adjusts the slump beyond the specified initial slump, or which exceeds the specified W/C ratio.

For cast-in-place concrete only, a maximum of 25 percent by weight of Portland cement content per cubic yard may be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.

If fly ash is used, the water to fly ash plus cement ratio shall not exceed the maximum water cement ratio specified in this specification section.

- D. Super Plasticizer: An approved super plasticizer shall be incorporated in the 0.38 W/C ratio mix design for formed portions of structures, including walls and columns.
- E. Mix Design:
1. Field experience using test results within the preceding 90 days with the materials and plant to be employed may be the basis of mix proportions provided that not less than 30 consecutive satisfactory compressive strength tests on concrete using the proposed Portland cement and other materials with a similar mix are available. A compressive strength test is defined as the average 28-day compressive strength of 2 companion cylinders made conforming to ASTM C172 and ASTM C31 and tested conforming to ASTM C39. The standard deviation of such tests shall be computed as a basis for design of the mix. The design average strength shall exceed the specified strength in accordance with the following formulae:
 - a. When standard deviation is greater than 500 psi, Design Average Strength = Specified Minimum Strength - 500 + 2.326 x Standard Deviation.
 - b. When standard deviation is less than 500 psi, Design Average Strength = Specified Minimum Strength + 1.343 x Standard Deviation.
 - c. Submit previous test data, calculated standard deviation, and the proposed mix proportions to Engineer for approval prior to placing concrete.
 2. When laboratory trial batches are used as a basis for determining mix proportions, all such work shall be performed by the laboratory as specified in the part "Laboratory Testing of Materials for Use in Concrete."
 - a. Laboratory trial batches shall be used to establish a water-cement ratio compression strength curve with at least 3 points, each representing the strength of a separate trial batch. At least 1 point shall be above and 1 below the strength required. Each point on the curve shall represent the average of at least 3 specimens tested at 28 days or an earlier age when approved by Engineer. The slump and air content shall be the maximum limits specified in this part, "Concrete Qualities Required."
 - b. A point on the water-cement ratio compressive strength curve shall be selected that will provide an average strength at least 1200 psi greater than the specified minimum strength.
 - c. Laboratory reports establishing mix proportions shall be sent to Engineer, and his approval obtained prior to placing all concrete.

- F. Measurement of materials shall conform to ACI 304. Measure materials within 1 percent by weight for aggregates and cement, and within 1-1/2 percent by volume or by weight for water.
- G. Mixing and delivery shall conform to ACI 304. Cement temperature when added to mix shall not exceed 170°F. Batch Plant Mixer shall conform to Mixer Manufacturers Bureau Concrete Mixer Standards, AGC, adequate to handle 1 or more full-sack batches. Charge with 5 percent to 10 percent of the mixing water both in advance and after the addition of aggregates and cement. Charge with remaining water uniformly with the other materials. Avoid charging in excess of manufacturer's rating. Discharge mixed concrete completely prior to recharging. The mixing time shall start immediately when all ingredients except the last of the water are in the mixer. Minimum mixing time shall conform with mixer manufacturer's instructions, but not be less than the following:

Capacity of Mixer Cubic Yards	Minimum of Time of Mixing Minutes
1 or less	1 minute
2	1 minute, 15 seconds
3	1 minute, 30 seconds
4	1 minute, 45 seconds
5	2 minutes
6	2 minutes, 15 seconds

Add 15 seconds of mixing time for each additional cubic yard of concrete.

- H. Mixing of concrete at the plant off the jobsite requires a central mixer or truck mixer. Transport in a truck mixer turning at agitation speeds only. Water added to concrete having a slump below the specified minimum shall be at Contractor's risk. If the water added produces a slump greater than the specified maximum, the concrete will be rejected. If water is added, the concrete shall be remixed for a minimum of 25 revolutions. Truck mixer shall conform to "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau," of the National Ready-Mix Concrete Association. Ready-mixed concrete shall be produced and delivered conforming to ASTM C94 as applicable. Contractor shall furnish Owner with a concrete delivery ticket for each load of concrete. The ticket shall have the following information recorded:
 1. Batch plant name and ticket number.
 2. Mix number.
 3. Time batched.
 4. Time arrived on jobsite.
 5. Amount of concrete (by volume).
 6. Quantities of materials batched (by weight).
 7. Amount of water added at jobsite by Contractor.

PART 3 - EXECUTION

3.01 FORMS

- A. Design, erect, support, brace and maintain formwork to conform to ACI 318 and ACI 347. Adequately brace, stiffen and support forms to prevent perceptible deflection or settlement,

and to hold plumb or level and true to line. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Construct sufficiently tight to prevent mortar leakage. Avoid offsets between adjacent forms and construct so that shores, braces and stiffening members are in line with those below. Use wales, strongbacks, shores and bracing as required. Provide for openings, offsets, sinkages, keyways, recesses, moldings, restrictions, reglets, chamfers, blocking, screeds, buldheads, anchorages and inserts, and other features required for the work.

- B. Design, fabricate and construct formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.
- C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Locate temporary openings on forms at inconspicuous locations.
- D. Chamfer all exposed corners and edges of concrete structures, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- E. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retightening forms and bracing after concrete placement to eliminate mortar leaks and maintain proper alignment.

3.02 REMOVAL OF FORMS

- A. No shores, bracing, supports or other formwork shall be loosened or removed until the concrete members supported thereby have acquired sufficient strength to safely support their own weight and any other possible loads. The minimum time between concrete placement and form removal shall be determined either by field-cured test specimens or in accordance with the time specified for the member involved. If the Contractor elects to determine the required time by means of test specimens, all costs in connection therewith shall be his responsibility. Test specimens shall be made, field-cured, and tested as specified. No forms or supports shall be loosened or removed until tests indicate strength of members as follows:

Structural Member	Percent of design compressive or flexural strength
Unshored slab and beam forms for forms which can be removed without disturbing shores	70
Slab or beam shoring	85
Wall and beam side forms	40

- B. If field-cured test cylinders are not used as the basis for determination of time in place for formwork, the following criteria shall apply:
 - 1. Formwork not supporting weight of concrete, such as sides of beams, walls and similar parts of the work, may be removed after cumulatively curing at not less than

50°F (10°C) for 24 hours after placing concrete, provided concrete is sufficiently hard and will not be damaged by form removal operations, and provided curing and protection operations are maintained.

2. Formwork supporting weight of concrete, such as beam soffits, columns, joints, slabs and other structural elements, may not be removed in less than 14 days of cumulative curing at not less than 50°F (10°C), nor until the concrete has attained design minimum 28-day compressive strength.
- C. Remove forms in a manner to avoid damage to the structure, with particular care for corners and edges.

3.03 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.04 PLACING REINFORCEMENT

- A. Place in accordance with the contract drawings, Chapters 7 and 12 of ACI 318 and the Manual of Standard Practice of the Concrete Reinforcing Steel Institute.
- B. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Tie securely with 16-gage or larger annealed iron wire. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- C. Place reinforcement to obtain at least minimum coverages for concrete protection. Minimum coverage shall conform to Chapter 7 of ACI 318 unless otherwise indicated.
- D. Install welded wire fabric in the longest practical lengths. Lap adjoining pieces at least one full mesh plus 2 inches and lace splices with wire, unless otherwise indicated. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.05 JOINTS

- A. Construction Joints: Locate and install joints which are not indicated or specified in conformance with ACI 318. Obtain Engineer's approval of joints located by Contractor prior to preparation of reinforcing steel drawings.

Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints. Clean and break laitance or other foreign material from bonding surfaces. Tighten forms remaining in place (where applicable) to prevent seepage between forms and hardened concrete.

- B. Waterstops: Provide water stops and shear keys specified in any new construction joints requested by Contractor. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions. Lapping of waterstops will not be allowed.
- C. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs on-grade at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, equipment foundations and elsewhere as indicated.
- D. Contraction (Control) Joints: Maintain true alignment with straightedge and locate as indicated. Joints shall be grooved except where sawed joints are indicated.

Install grooved joints during finishing process. Width of groove shall not exceed 1/4" and depth shall be at least 1/4 of slab thickness. Sawed joints shall be installed as soon as the concrete surface is firm enough to resist tearing or damage by the power blade and before random shrinkage cracks can occur. Make joints approximately 1/8" wide with depth as indicated. Seal joint with the same type sealant specified for expansion joint sealant.

3.06 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Provide for accurate installation of embedded items. Securely fix floor drains and pressure relief valves in place to prevent flotation while placing concrete. Uniformly and accurately slope floor slab toward the drains. Protect pipe sleeves from moisture during cold weather. Protect anchor bolt threads from concrete splatter.

3.07 CONCRETE PLACEMENT

- A. Placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in-place. Notify other crafts to permit installation of their work. Moisten wood forms immediately before placing concrete where form coatings are not used. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
 - 1. Notify Engineer at least 24 hours prior to each placement of concrete.
- B. General: Conform to ACI 304. Bonding surfaces shall be clean, free of laitance and foreign materials. Face horizontal bonding surfaces with 1" thick coat of fresh "grout for bonding." Wet all other surfaces. Place concrete on properly prepared and unfrozen subgrade and only in dewatered excavation and forms. Use forms for all concrete except where otherwise indicated or specified. Do not place concrete that has partially hardened or has been contaminated by foreign materials. Prevent mud or foreign materials from entering the concrete or forms during placement operations.
- C. Conveying: Convey concrete from the mixer and deposit in place by methods which will prevent the desegregation or loss of materials. Equipment for chuting, pumping, and pneumatically conveying concrete shall be of such size and design as to provide a practically continuous flow of concrete at the delivery end. Aluminum conveying equipment shall not be used.
- D. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams

or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Place concrete in continuous horizontal lifts not to exceed 2 feet, and place concrete against bulkheads and keyways at vertical joints. Maximum free drop of concrete shall be 5 feet in walls 10 inches or less in thickness with 1-foot additional drop allowed for each inch of wall thickness over 10 inches, with a maximum drop of 10 feet.

- E. **Placing Concrete Slabs:** Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed. When moisture barrier is used, keep lapped joints closed and take precautions to avoid puncturing the barrier. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- F. **Consolidation:** Consolidate concrete in conformance with ACI 309. Characteristics and application of concrete vibrators shall be as set forth in Table 5.1.4. Provide an adequate number of vibrators of sufficient capacity to keep up with the maximum rate of concrete placement. Vibrate concrete only until the concrete is thoroughly consolidated and the voids filled as evidenced by the leveled appearance of the concrete at the exposed surface and the embedment of the surface aggregate. Insert vibrators vertically to the full depth of the layer being placed and into the previous layer a minimum of 6 inches. Do not insert vibrators into lower layers of concrete that have begun to set. Do not drag vibrators through concrete. Insert and withdraw vibrators slowly with the vibrator running continuously so that no hole will be left in the concrete. Do not flow concrete from one location to another by the use of a vibrator. Use form vibrators only where sections are too thin or where sections are inaccessible for internal vibrators.
- G. **Time Requirements:** Place concrete at a sufficient rate to assure that lift below is still plastic and that no cold joints will be formed. Place concrete within 45 minutes after mixing. This period may be extended to 1 hour and 30 minutes provided that the combined air temperature, relative humidity, and wind velocity are such that the plasticity of the fresh concrete is satisfactory for placement and consolidation and that the specified mixing water is not exceeded. Concrete which has partially set shall not be retempered but shall be discarded.
- H. **Placing Concrete at Joints:** Bed horizontal joints with 1 inch of grout for bonding. Take precautions to ensure tight, well-bonded construction joints with no air pockets or voids, and to avoid bending or displacing waterstops while placing fresh concrete. Delay construction at a joint a minimum of 24 hours where placement is continued past the joint except where otherwise indicated.
- I. **Hot-Weather Placing of Concrete:** When the temperature is 90°F or above, or is likely to rise above 90°F within a 24-hour period after the concrete placement or when there is any combination of high air temperature, low relative humidity and wind velocity which would impair concrete strength or quality, follow the recommendations of ACI 305. Concrete shall have a maximum temperature of 85°F during placement. Dampen subgrade and forms with cool water immediately prior to placement of concrete. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature. Protect freshly placed concrete immediately after placement so that the rate of evaporation as determined by ACI 305 does not exceed 0.2 pound per square foot per hour. Protect concrete with suitable insulation, if rapidly decreasing nighttime temperatures occur, which would cause thermal shock to concrete placed during warm daytime temperatures. Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.

- J. Cold Weather Placement of Concrete: When the temperature is 40°F or is likely to fall below 40°F during a 24-hour period after concrete placement, follow the recommendations of ACI 306 to prevent loss of concrete strength or quality. Minimum temperature for concrete as mixed shall be indicated on lines 2, 3 and 4 of Table 1.4.1 of ACI 306. Maximum temperature for concrete as mixed shall be 10°F greater than the corresponding minimum temperature. Place and maintain concrete so that its temperature is never less than the temperature indicated on line 1 of Table 1.4.1 of ACI 306. Maintain the required temperature for the time duration indicated on Table 1.4.2 of ACI 306. Monitor temperatures of concrete at corners or edges of formwork as applicable. Do not expose concrete to carbon monoxide or carbon dioxide fumes from heaters or engines. Oil or coke burning salamanders will not be permitted. Personnel shall be present at all times to maintain safe, continuous operation of heating system. Control temperature and humidity of protected concrete so that excessive drying of concrete surfaces does not occur. Calcium chloride will not be permitted as a concrete accelerator or to thaw frozen subgrade prior to concrete placement.

3.08 FINISHING - UNFORMED SURFACES

- A. Screed Finish: Use as first stage for all concrete finishes. Use as final finish on surfaces that will be covered by additional concrete, grout placement, mortar setting bed (except as otherwise specified) or earth backfill. Immediately after screeding, use a wood float, darby or bullfloat to eliminate high and low spots and to embed large aggregate. This shall be done in a manner to produce even, uniform surfaces so that surface irregularities do not exceed 3/8" in 10' when used as final finish.
- B. Floated Finish: Use as second stage of broomed or troweled finish. Use as final finish on surfaces to receive ceramic tile or quarry tile, and on surfaces which are to be covered with membrane of elastic waterproofing. Float with mechanical or hand float. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats. On surfaces not to receive troweled finish, finish with wood or cork float after mechanical floating to a true uniform surface so that surface irregularities do not exceed 1/8" in 10', except at floor drains.
- C. Broomed Finish: Use as final finish on all outdoor slabs including pavements and sidewalks. After floated finish, draw a stiff bristle broom across the surface making uniform corrugations, perpendicular to the direction of traffic, not more than 1/16" deep.
- D. Troweled Finish: Use as final finish on inside floors and on all other unformed surface not otherwise indicated or specified. Trowel with steel trowel, mechanical or hand, to obtain a smooth, dense finish. The final troweling shall be done after the concrete has become hard enough so that no mortar adheres to the edge of trowel and a ringing sound is produced as the trowel passes over the surface. Do not trowel before surface water has evaporated or been removed with a squeegee. Finish to a true uniform surface so that surface irregularities do not exceed 1/8" in 10', except at floor drains. Do not add sand or cement to the floor surface.
- E. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete floor and in strict compliance with manufacturer's printed instructions.
- F. Repair finished unformed surfaces that contain defects which affect durability or appearance of concrete. Surface defects include crazing, cracks in excess of 0.01 inch wide, or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets and other objectionable conditions. Repair surface defects as specified in the Part I.2, 'Repair of Defective Surfaces.'

- G. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days and before application of any surface preparation including, but not limited to, chemical-hardeners.

3.09 FINISHING - FORMED SURFACES

- A. Surface finish for exterior above-grade areas and any surface receiving coatings shall be required as follows. Surface defects shall be repaired as outlined in I.2 through I.4. Remove or grind down all form marks, fins or irregularities which project more than 1/8" from the surface. Surface shall be finished to a smooth uniform texture by using a carborundum brick or other methods as approved by Engineer.
- B. Repair of Defective Surfaces: Defined as any concrete surface showing misalignment, rock pockets, poor joints, holes from ties, voids, honeycomb, or any other defective area. Repair as soon as the forms have been removed. Chip surface back to a minimum depth of 1/2", chip edges perpendicular to surface, prewet depression, and brush with cement immediately before patching. Patch surfaces using stiff mortar with same sand-cement ratio as original concrete and with minimum water for placing. Blend with white cement to match existing concrete color. Compact mortar into depressions so that after curing, hole is filled and mortar is flush with surface. Use hammer and ramming rod for compacting the holes. Moist cure for three days or use curing compound. Engineer shall be notified of areas containing defects or where reinforcing steel is exposed prior to determination of repair method.

3.010 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid drying at end of final curing period.

- B. Curing Methods: Cure all concrete by one of the following methods unless specified otherwise:
 1. Leave in forms for a minimum of 7 days. Keep formwork wet to prevent drying of concrete surfaces.
 2. Use saturated bats, soaker hoses, or sprinkler for a minimum of 7 days. Keep concrete continuously wet.
 3. Using 1 coat of a liquid membrane-forming compound conforming to ASTM C309, Type 1. Apply immediately after removal of forms (which have been continuously wet); or in case of a slab, after the concrete has been finished and is hardened sufficiently to walk on.
 4. Using polyethylene sheets applied in full contact with surfaces.
 5. Hot weather curing of unformed surfaces shall commence immediately after finishing and continue for 24 hours. Curing shall consist of application and maintenance of water-saturated material to all exposed surfaces: horizontal, vertical, and otherwise. After the 24-hour interval, continue curing using either a moist cure for 6 days, application of 1 coat of curing compound conforming to ASTM C309, Type 2, or

application and maintenance of curing paper or heat-reflecting plastic sheets for 6 more days.

Begin curing formed concrete immediately after placing. Curing shall consist of keeping forms continuously wet for 24 hours. After the 24-hour period, continue curing by loosening forms and applying soaker hoses so that water runs down along concrete surfaces for a minimum of 6 additional days, or, strip forms and apply a curing compound conforming to ASTM C309, Type 2.

6. Cold weather curing of concrete shall conform to the section on Cold Weather Placement of Concrete.

Cure floor surfaces where concrete hardener is indicated with "Curing- Hardening Compound" as specified in this section.

3.011 LOW-STRENGTH CONCRETE

- A. Low-strength concrete is defined as concrete whose 28-day test (average of 2 cylinder breaks) is less than the minimum 28-day strength required. Remove and replace with acceptable concrete when the quality and the location of the low-strength is such that Engineer considers the strength or durability of the structure is impaired and so orders. Low-strength concrete shall be considered defective work as defined in GENERAL CONDITIONS.
- B. Potentially Low-Strength Concrete: Defined as concrete whose 7-day test is less than 70 percent of the specified minimum 28-day compressive strength.

Construction delays caused by low-strength or potentially low-strength concrete shall not relieve Contractor from responsibility for late completion even though extensions of time may be granted.

3.012 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work by other trades is in place. Mix, place and cure concrete as herein specified to blend with in-place construction.
- B. Equipment Bases and Foundations: Construct equipment bases, pads, and foundations as indicated or, when not indicated, conforming to equipment manufacturer's requirements. Reinforce conforming to typical detail unless otherwise indicated. Equipment bases shall include concrete, reinforcing steel, form work (as required) and anchor bolts. Place grout for equipment installed under this contract. Finish top area of bases between anchor bolts and forms with a troweled finish.

3.013 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Field Testing of Concrete and Making of Concrete Test Cylinders: Contractor shall furnish test equipment, test cylinder molds, and ACI Certified Grade I Field Testing personnel to perform all required field tests, make the required concrete test cylinders, and deliver test cylinders to the laboratory. The prescribed test shall be made in the presence of or with the concurrence of the Owner/Engineer.

Concrete sampling for tests and cylinder making shall be done conforming to ASTM C172. Prepare test cylinders conforming to ASTM C31, with not less than one set of cylinders (4

cylinders) for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yard of concrete. Slump Test conforming to ASTM C143 and Air Content Test conforming to ASTM C231. Discard concrete used for slump and air tests. Slump and Air Test results shall be furnished to the Testing Laboratory for inclusion in the Cylinder Test Reports.

A slump and air test shall be taken from the first batch of concrete delivered to the site for each days' pour, for each class of concrete, to check the consistency of the concrete. Compressive strength cylinders, slump, air, and temperature tests shall be taken from a random sample taken at a random point during any given concrete pour as determined by the Resident Project Representative and/or the Engineer.

- B. Additional Testing Due to Variances in Concrete: Should the consistency of the concrete visually appear to vary from what is specified, the Resident Project Representative and/or Engineer can require one additional test (slump, cylinders, air and temperature) to determine that the concrete meets the specified criteria. All costs for additional testing shall be paid for by the Contractor.
- C. Laboratory Testing of Concrete During Construction:
 - 1. An independent testing laboratory will be selected and paid by the Contractor to perform the required laboratory tests and statistical evaluations of concrete being used in the work. The laboratory will cure and test concrete cylinders conforming to ASTM C192 and C39, testing 2 cylinders at 7 days of age, and 2 at 28 days of age.
 - 2. The Engineer shall have the right to observe all phases of concrete cylinder curing and testing. Should the Engineer observe any deviations from the prescribed testing procedures that he considers detrimental to concrete strength test results, he shall immediately notify the Owner in writing. The Contractor shall make arrangements with the testing laboratory to receive copies of test reports. The costs of providing a maximum of 2 copies of each report will be paid by the Contractor.
 - 3. Should the statistical data indicate an unacceptable combination of average strength and standard deviation, Contractor shall take immediate corrective action. Should the statistical data indicate an excessive margin of safety, the concrete mix may be modified subject to Engineer's approval.

END OF SECTION

SECTION 04 22 20

WATER REPELLENT UNIT MASONRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Concrete masonry units with integral water repellent admixture.
- B. Mortar for concrete masonry units with integral water repellent admixture.

1.02 REFERENCES

- A. American Society for Testing Materials (ASTM):
 - A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
 - C33 - Concrete Aggregates.
 - C90 - Hollow Load Bearing Concrete Masonry Units.
 - C331 - Lightweight Aggregates for Concrete Masonry Units.
- B. American Concrete Institute (ACI):
 - 531.1 - Concrete Masonry Unit Construction.

1.03 SUBMITTALS

- A. Submit block manufacturer's description of masonry units, including surface preparation and dimensions of special units. Include location of manufacturer and name of distributor or wholesale dealer, if any.
- B. Submit color samples of units.
- C. Submit certificate or test reports certifying that masonry units furnished meet or exceed the requirements of this specification.
- D. Submit mix proportions and material data for mortar. Identify sources of materials and products to be used.
- E. Submit manufacturer's specifications and instructions for water repellent admixtures.

1.04 QUALITY ASSURANCE

- A. Contractor shall construct one 4-foot high by 6-foot long sample panel of block with the exterior surface as indicated. The panel shall be constructed on a 4" concrete leveling bed, and located on site. Protect from damage during the execution of the work. The panel shall be used by the Engineer and the Owner to judge workmanship of erected masonry units for the project.
- B. Use water repellent admixture supplied by the same manufacturer for masonry units and mortar.

PART 2 - MATERIALS

2.01 HOLLOW LOAD-BEARING UNITS

- A. Conform to ASTM C90, Grade N with normal weight aggregate for exterior walls and backing

of exterior slotted concrete masonry units, Grade S for interior walls. Lightweight concrete masonry units WILL NOT be permitted on exterior walls.

- B. Nominal dimensions of 16" length x 8" height width indicated.
- C. Units shall be integrally colored. Samples of the manufacturer's standard colors shall be submitted before procurement for color selection.
- D. Units shall be fabricated with integral water repellent.

2.02 SPECIAL SHAPES

- A. Construct where indicated and where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
- B. Provide square corner units at all window, door and louver jambs, outside corners, and in other locations indicated.

2.03 REINFORCING

- A. Vertical and horizontal reinforcing as indicated and as specified in Division 3 - Concrete, wire reinforcing to be hot dipped truss or ladder type to width required by wall type, minimum 9 gauge.

2.04 MORTAR AND GROUT

- A. All walls, Type N mortar mixed with integral water repellent.
- B. Concrete grout for vertical reinforcing and horizontal bond beams shall conform to ASTM C-476.

2.05 INTEGRAL WATER REPELLENTS

- A. Integral water repellents shall be equal to:
 - 1. Rheomix 235, Master Builders
 - 2. Dry Block, W.R. Grace

PART 3 - EXECUTION

3.01 GENERAL

- A. Build masonry construction to the full thickness indicated, except build single-unit walls to actual thickness of the masonry unit.
- B. Cut units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to fit pattern indicated and to fit adjoining work neatly. Use full units without cutting wherever possible.
- C. As the work progresses, build in all items, openings and recesses as required for the work of other trades. Where built-in items are embedded in masonry cells, place layer of metal lath in the joint below and rod mortar or grout into core.
- D. Lay up walls plumb and true, with courses level, accurately spaced and coordinated with other work.
- E. When stopping and resuming work, step back ½ masonry unit length in each course. Do not tooth. Clean exposed surfaces of set masonry. Remove loose masonry units and mortar prior to laying fresh masonry.
- F. Temporarily brace masonry walls that may be exposed to wind loads or other conditions that

could affect stability. Determine necessary bracing placement and capacity.

3.02 JOB CONDITIONS

- A. Cold weather precautions shall be taken when temperature is expected to be below 40°F. Do not lay masonry units when temperature is below 40°F, except under the following conditions:
 - 1. Heat all materials and maintain air temperature at minimum of 40°F on both sides of wall for period of 72 hours after laying.
- B. Do not use frozen materials or materials coated with ice or frost. Remove and replace masonry work damaged by frost or freezing.
- C. Do not wet concrete masonry units.
- D. Protect partially completed walls against weather, when work is not in progress, by covering top of walls with strong, waterproof, nonstaining membrane. Extend membrane at least 2 feet down both sides of wall and anchor securely in place.

3.03 INSTALLATION

- A. Bonding and Coursing:
 - 1. Lay exterior concrete masonry units in running bond.
 - 2. Bond and interlock each course at corners unless otherwise indicated. Do not use units with less than 4 inches horizontal face dimension at corners or jambs.
 - 3. Bond intersecting walls with continuous wire reinforcement.
 - 4. Install lintels with minimum bearing of 8 inches at each jamb unless otherwise indicated.
- B. Joints:
 - 1. Lay walls with 3/8" joint and to maintain coursing.
 - 2. Tool exposed joints concave, including joints in finished and unfinished areas.
 - 3. Cut joints flush where concealed or covered with other materials, including joints in chases and above suspended ceilings.
 - 4. Rake out mortar in preparation for application of caulking or sealants where indicated.
 - 5. Mortar Beds for Hollow Units:
 - a. Lay with full mortar coverage on horizontal and vertical face shells.
 - b. Lay with full mortar coverage on horizontal and vertical face shells and webs in all courses of the following:
 - 1) Starting course on footings or solid foundation walls.
 - 2) Where adjacent to cells or cavities to be filled with grout.
 - 6. Mortar Beds for Solid Units: Lay with full mortar coverage on horizontal and vertical joints.
- C. Masonry Accessories and Built-in Work:
 - 1. Install the following items as masonry work progresses as indicated and as specified in their applicable Sections.
 - a. Reinforcing, ties, anchors, and other accessories.
 - b. Through-wall flashing and built-in sheet metal work.

- c. Steel, precast, and bond-beam lintels.
 - d. Frames, inserts, piping, conduits.
 - e. Anchor bolts.
2. Where built-in items, excluding bar reinforcement, are embedded in cores of hollow masonry units, install metal lath in joint below and rod mortar or grout and point to match adjacent work.

3.04 REPAIR AND POINTING

- A. Remove and replace loose, chipped, broken, stained, or otherwise damaged masonry units. Replace with new units to match. Install in fresh mortar or grout and point to match adjacent work.
- B. During tooling of joints, enlarge any voids or holes as necessary, except weep holes, and completely fill with fresh mortar.

3.05 CLEANING

- A. Clean exposed concrete masonry units by dry brushing at the end of the day's work and after final pointing to remove mortar spots and droppings.

END OF SECTION

SECTION 051000
STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel Materials.
- B. Connections:
 - 1. Bolted.
 - 2. Welded
- C. Anchor bolts and concrete anchors.
- D. Fabrication.
- E. Erection.

1.02 RELATED SECTIONS

- A. Section 099000 - Painting.

1.03 REFERENCES

- A. American Institute of Steel Construction (AISC):
Manual of Steel Construction, 8th Edition.
Quality Criteria and Inspection Standards.
- B. American Welding Society (AWS):
D1.1 - Structural Welding Code.
- C. American Society for Testing and Materials (ASTM):
 - A36 - Structural Steel.
 - A167 - Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip.
 - A307 - Low-Carbon Steel Externally Threaded Standard Fasteners.
 - A325 - High-Strength Bolts for Structural Steel Joints.
 - A563 - Specifications for Carbon and Alloy Steel Nuts.
- D. Research Council on Riveted and Bolted Structural Steel Joints of the Engineering Foundation
"Specification for Structural Joints Using ASTM A325 Bolts or A490 Bolts" as approved by AISC.

1.04 SUBMITTALS

- A. Fabrication and erection drawings for all work.
- B. All necessary information for the fabrication, including filler metal for welds, of the component parts of the structure, presented on drawings to conform to recognized standard practice, AISC Manual, Part 5, and AWS Code.

- C. Drawings showing each piece including anchor bolts marked for identification to correspond to erection drawings. Include details of cuts, connections, camber, holes and other pertinent data. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
- D. Mill Tests:
 - 1. Perform for each melt of material used in the fabrication.
 - 2. Furnish two copies of each certified mill test to Engineer upon request.

1.05 QUALITY ASSURANCE

- A. Welder Qualifications:
 - 1. Welders shall be previously qualified (within the past twelve months) by passing the tests prescribed in the AWS Qualification Section, or by passing such other test as the Engineer may accept.
 - 2. Submit two certified copies of the qualifications records to Engineer as evidence of qualification to the above-mentioned code.
- B. Inspection: Material or workmanship will be subject to inspection in the shop and field.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel: Conform to ASTM A36, as designated in the AISC Manual, Part 1, unless otherwise indicated or specified.
- B. Connection Bolts, Nuts, and Washers: Conform to ASTM A325, unless otherwise indicated or specified.
- C. Anchor Bolts: Conform to ASTM A307 using A36 steel, unless otherwise indicated to be stainless steel or high strength steel. Machine Bolts shall conform to ASTM A307.
- D. Stainless Steel: Conform to ASTM A167, Type 304.
- E. Welding: For ASTM A36 steel, use E70 electrodes for shielded metal arc welding, F7 series electrodes for submerged arc welding. Select "matching" filler metal in accordance with Table 4.1.1, AWS D1.1.

2.02 FABRICATION

- A. Fabricate all steel to conform to AISC Specifications, codes and standards. For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes. Properly mark and match-mark materials for field assembly.
- B. Permissible variations for sweep, camber, length and cross-section of all steel members shall conform to ASTM A6, AISC "Manual of Steel Construction, Part 1" and AISC "Quality Criteria and Inspection Standards" unless indicated otherwise.

- C. Completely assemble, including welding of units, before start of finishing operations.
- D. Shop Milling:
1. Perform at the base of columns and at the top of column base-plates, except that rolled-steel bearing plates 4 inches thickness or less may be straightened by pressing.
 2. Perform at ends of columns or beams which butt against a plate.
- E. Welding: All welding shall be shielded metal arc or submerged arc conforming to AWS Code, AISC Manual Part 4 and the AISC Quality Criteria and Inspection Standards. The Contractor shall perform fabrication inspection of welds in accordance with the AWS Code to determine the acceptability of welds. The inspector shall be an AWS Certified Welding Inspector. Correct defective welds.
- F. Shop Connections:
1. Weld, or bolt at Contractor's option except when otherwise indicated or specified.
 2. Shop portions of connections may be welded equivalent to any bolted connection specified if Engineer concurs.
 3. Welded connections shall be as indicated or in accordance with acceptable alternative designs.
 - a. Welds of connection angles to beam webs shall conform with AISC Manual Part 4, Tables III and IV with particular regard for minimum web thickness. Provide longer connection angles or reinforce web as required.
 - b. All butt joint groove welds shall be complete penetration welds unless otherwise indicated and shall conform to the applicable standards in AISC Manual Part 4 with special emphasis on maintaining root opening. Accomplish this for single-bevel butt joint welds by using backup plates or by chipping out and welding on the opposite side.
 - c. Prepare weld bevels with a mechanically guided cutting torch or by grinding.
 - d. Removal all run-out tabs.
 4. Bolted connections shall conform with AISC Manual Part 4.
 - a. All bolted connections shall be made with ¾-inch bolts, nuts and washers unless otherwise indicated or specified.
 - b. Capacity of beam connections shall have a minimum capacity of that specified in AISC Manual Part 4, Tables II-B for "Oversize and Short-Slotted Holes" in friction-type connections with the number of bolt rows indicated.
 - c. Use the minimum number of rows of bolts for beam connections so that bottom row is at or below the centerline of the beam.

G. Field Connections:

1. Provide with bolted connections unless otherwise indicated or specified.
2. Provide for field welding only when so indicated or when detail clearances make bolting impractical.
3. Provide all members to be field welded with bolted erection connections adequate to resist erection stresses prior to field welding.

H. Holes For Other Work: Provide holes required for securing other work to structural steel framing. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning.

2.03 EQUIPMENT ANCHOR BOLTS

A. Furnish for all equipment furnished and installed under this contract, (and as required to install all equipment furnished by others for installation under this contract unless otherwise indicated).

2.04 CONCRETE ANCHORS

- A. All anchors to be polyester resin or amine epoxy adhesive type, or approved equal.
- B. Conform to ASTM A167, Type 304, stainless steel.

2.05 SHOP PROTECTIVE COATING: Prepare surface and apply primer as specified in Division 9.

PART 3 EXECUTION

3.01 PREPARATION

- A. Field-check location and elevation of anchor bolts and footings before erecting structural steel.
- B. Contractor shall be responsible for an acceptable method and sequence of erection.

3.02 STEEL ERECTION

- A. Erect all steel to conform to AISC specifications, codes and standards, AISC Quality Criteria and Inspection Standard or any local, State or Federal Codes which may exceed such requirements.
- B. Protect steel from entrapped water that can cause damage from freezing or corrosion.
- C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
- D. Base Plates: Prior to setting base plates, clean out sleeves and concrete surface of all foreign material and liquid. Grout under base plate with a flowable nonshrink grout, taking special care not to disturb their grade or alignment. See DIVISION 3 for nonshrink grout. Cut off exposed edges of the grout at 45 degrees along the edges of the base plates after grout has acquired its initial set.

- E. Erection Bracing: Provide all necessary temporary struts, ties, cables, temporary flooring, planking and scaffolding in connection with the erection of the structural steel or support of erection machinery. Place as required to maintain proper position against loads from erection equipment, construction material and wind. Leave bracing in place until sufficient steel connections, concrete slabs, exterior walls, and roof members are in place to ensure stability of the structure.
- F. Steel Erection: Unless otherwise noted in the contract documents, all bolted joints shall be bearing type connections using A325 high strength bolts.
- G. Bolted Connections: As indicated in the contract documents, connections shall be bolted-friction type. Tighten high-strength bolts to correct bolt tension using load indicators in accordance with AISC, "Specifications for Structural Joints Using ASTM A325 or A490 Bolts," dated 1985.
 - 1. Load Indicators: Use Coronet load indicators as manufactured by Cooper and Turner, Inc., Pittsburg, Pennsylvania; Bethlehem load indicator washers as manufactured by Bethlehem Steel Corporation, Bethlehem, Pennsylvania; or approved equal. Store and install in accordance with manufacturer's written instructions. Contractor shall furnish one unused metal feeler gauge of thickness specified by load indicator manufacturer for purpose of inspection.
- H. Welded Connections: Make welded connections as indicated and leave all erection bolts in place after completion of welding unless otherwise indicated. Reinforce connections when members requiring filler welds are not in contact. Use backup bars as spacer bars on all butt welds where root opening exceeds 3/16-inch. Remove all run-out tabs.
- I. Welding and Welders: The requirements for erection welding and welders shall be the same as specified for steel fabrication. All welds shall be stamped with a mark identifying the welder. Remove welders from work after two defective welds. The Contractor shall perform erection inspection of welds in accordance with the AWS Code to determine the acceptability of welds. The inspector shall be an AWS Certified Welding Inspector. Correct defective welds.
- J. Field Protective Coating: Surface preparation, priming, and finish coating are specified in Division 9.

3.03 INSPECTION

- A. Contractor shall engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
 - 1. Bolts in connections not identified as slip critical shall be tightened snug tight using the turn of the nut method. Inspection should insure that the bolts are properly aligned and placed in accordance with the contract drawings and the accepted submittal drawings. The bolts need not be inspected for bolt tension nor does a qualified inspector need to be present during the tightening operation as long as the tightening operation can be verified.
 - 2. Bolts in connections identified as slip critical shall be installed and tightened in the presence of a qualified inspector. The inspector shall monitor the prequalification, installation and tightening of the bolts. A tension calibrator shall be used to verify the fastener assemblies, train installation crews, and calibrate wrenches if calibrated wrenches are to be used. Load indication washers are acceptable in verifying the bolt tension.

3. Welded connections shall be inspected to insure that the weld size and quality are in conformance with the contract documents and AWS requirements. Prior to the work, welding qualifications of all welders shall be verified.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Definition: Metal fabrications include items made from iron, steel, or aluminum shapes, plates, bars, strips, tubes, pipes and castings which are not part of structural steel or other metal systems specified elsewhere.
- B. Extent of metal fabrications is indicated on drawings and schedules.
- C. Types of work in this section include but is not limited to metal fabrications for:
 - 1. Ladders.
 - 2. Stairs,
 - 3. Loose bearing and leveling plates.
 - 4. Miscellaneous steel or aluminum trim.
 - 5. Shelf and ledge angles.
 - 6. Metal bar grating.
 - 7. Floor plate.
- D. Related work specified elsewhere:
 - 1. Concrete anchors specified in Division 3.
 - 2. 083114, Access Doors with Safety Grating and Frames.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.
- B. Shop Drawings:
 - 1. See Specification Section 013300 for requirements for details of the submittal process.
 - 2. Fabrication and/or layout drawings and details:
 - a. Submit drawings for all fabrications and assemblies. Include erection drawings, plans, sections, details and connection details.
 - b. Identify materials of construction, shop coatings and third party accessories.
 - 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.

- c. Provide manufacturer's standard allowable load tables for the following:
 - 1) Grating and checkered plate.
 - 2) Expansion anchor bolts.
 - 3) Adhesive anchor bolts.
 - 4) Castings, trench covers and accessories.
 - 5) Metal (Modular) framing systems.
 - 6) Alternating tread stairs.
 - 4. Contractor designed systems and components, including but not limited to, stairs, landings and ladders:
 - a. Certification that manufactured units meet all design loads specified.
 - b. Shop Drawings and engineering design calculations:
 - 1) Indicate design live loads.
 - 2) Sealed by a professional structural engineer.
 - 3) Engineer will review for general compliance with Contract Documents.
- C. Miscellaneous Submittals:
- a. See Specification Section 013300 for requirements for details of the submittal process.
 - b. Certification of welders and welding processes. Indicated compliance with AWS

1.03 QUALITY ASSURANCE

- A. Referenced Standards:
- 1. Aluminum Association (AA):
 - ADM-1, Aluminum Design Manual.
 - 45, Designation System for Aluminum Finishes.
 - 2. American Institute of Steel Construction (AISC):
 - Manual of Steel Construction - Allowable Stress Design (ASD).
 - 360, Specifications for Structural Steel Buildings (referred to herein as AISC Specification).
 - 3. American National Standards Institute (ANSI):
 - A14.3, Ladders - Fixed - Safety Requirements.
 - 4. ASTM International (ASTM):
 - A6, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - A36, Standard Specification for Carbon Structural Steel.
 - A48, Standard Specification for Gray Iron Castings.
 - A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - A108, Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished.
 - A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
A992, Standard Specification for Steel for 1 Structural Shapes.
B26, Standard Specification for Aluminum-Alloy Sand Castings.
B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
B632, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
F467, Standard Specification for Nonferrous Nuts for General Use.
F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
F594, Standard Specification for Stainless Steel Nuts.
F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

5. American Welding Society (AWS):

A5.1, Standard Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
D1.1, Structural Welding Code Steel.
D1.2, Structural Welding Code Aluminum.

6. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 510, Metal Stairs Manual.
MBG 531, Metal Bar Grating Manual.

7. Occupational Safety and Health Administration (OSHA):

29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

8. Building code:

a. International Code Council (ICC):

International Building Code and associated standards, 2003 Edition including all amendments, referred to herein as Building Code.

- B. Qualifications:
 - 1. Qualify welding procedures and welding operators in accordance with AWS. Fabricator shall have minimum of 10 years experience in fabrication of metal items specified.
 - 2. Engineer for contractor-designed systems and components: Professional structural engineer licensed in the State of Missouri.
- C. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinate installation.
- D. Definitions
 - 1. Installer or Applicator
 - a. Installer or applicator is the person actually installing or applying the product in the field at the project site. The terms installer and applicator are synonymous.
 - 2. Hardware: As defined in ASTM A153.
 - 3. Galvanizing: Hot-dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 Oz. of zinc primer per square foot of metal (average of specimens) unless otherwise noted or dictated by applicable referenced standards.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Epoxy adhesive anchor bolts:
 - a. Hilti Inc.
 - b. ITW Ramset/Red Head.
 - c. Simpson Strongtie.
 - 2. Metal (Modular) framing system:
 - a. Unistrut Building Systems.
 - b. B-Line Systems.
 - c. Kindorf.
 - d. Metal Products Div., USG Industries, Inc.
 - e. Mono-Systems, Inc.
 - f. Superstrut.

B. Submit request for substitution in accordance with Specification Section 01640.

2.02 MATERIALS

A. Stainless Steel

1. Minimum Yield strength of 30,000-psi and minimum tensile strength of 70,000-psi.
 - a. Bolts and nuts: ASTM Type 316.
2. Minimum yield strength of 25,000-psi and minimum tensile strength of 70,000-psi
 - a. Strip, plate and flat bar for welded connections, ASTM A666, Type 304L or 316L
3. Welding electrodes: In accordance with AWS for metal alloy being welded.

B. Aluminum:

1. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
 - a. ASTM B221 and ASTM B308 for shapes including beams, channels, angles, tees and zees.
 - b. Weir plates, baffles and deflector plates, ASTM B209.
2. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
 - a. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
3. ASTM B26 for castings.
4. ASTM F468, alloy 2024 T4 for bolts.
5. ASTM F467, alloy 2024 T4 for nuts.
6. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.

C. Washers: Same material and alloy as found in accompanying bolts and nuts.

D. Embedded Anchor Bolts:

1. Building Anchor Bolts:
 - a. ASTM F1554, Grade 55 with weldability supplement S1 or ASTM A36 threaded galvanized rods.
 - b. ASTM A307, Grade A for headed bolts, galvanized.
2. All other anchor bolts: Type 304, 314 or 316.

E. Adhesive Anchor Bolts:

1. Stainless steel, ASTM Type316.
2. Provide minimum edge distance cover and spacing as recommended by manufacturer, or as indicated on Drawings whichever is larger.
 - a. Minimum embedment as recommended by manufacturer or 8 DIA of bolt, whichever is larger.
 - b. Notify Engineer if required depth of embedment cannot be achieved at a particular anchor bolt location.
 - c. Follow manufacturer's recommendations for installation and torque.
3. Submit manufacturer's load test data to verify at least the anchor bolt capacities at the

following embedment depths:

- a. Data must be based on actual tests performed in unreinforced mass of concrete of not more than 4,000 psi compressive strength.
- b. Capacity must be at a concrete temperature of at least 130 Deg F.

Anchor Diameter (in)	Bolt Embedment (in)	Minimum Tension (Kip)(*)(**)	Ultimate capacity
3/8	3	4.8	
1/2	4	8.1	
5/8	5	11.4	
3/4	6	15.4	
7/8	7	20.0	
1	8	24.7	
1-1/4	10	34.3	

(*) Data must be based on actual tests performed in unreinforced mass concrete not more than 4,000-psi compressive strength.

(**) Capacity must be at a concrete temperature of at least 130 Deg F.

- 4. Adhesive anchor bolts:
 - a. HVA Adhesive Anchor System by Hilti.
 - b. HIT HY 150 Adhesive Anchor by Hilti.
 - c. HSE 2411 Epoxy Adhesive Anchor by Hilti.
 - d. EPCON Ceramic 6 Epoxy by ITW Ramset/Red Head.
 - e. Acrylic-Tie by Simpson Strong-Tie.

F. Iron and Steel Hardware: Galvanized in accordance with ASTM A153 when required to be galvanized.

G. Finishes

- 1. Shop Painting: Prepare ferrous surfaces and apply primer as specified in Division 9.
- 2. Shop Coating for Aluminum: All aluminum surfaces and edges in contact with other metals and concrete shall be protected by a heavy brush coat of alkali resistant bituminous coating, or a nonporous tape or gasket. Coating is not required for aluminum in contact with stainless-steel bolts. Apply one of the following bituminous coatings at 15 mils minimum dry film thickness.
 - a. Glidden 61778.
 - b. Koppers - Bitumastic No. 50.
 - c. Porter 7100.
 - d. Tnemec - Heavy Duty 46-449.
 - e. Or approved equal.

2.03 FABRICATION, GENERAL

A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions

indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

- B. Verify field conditions and dimensions prior to fabrication.
- C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a nominal radius of approximately 1/32-inch to 1/16-inch unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Provide drilled or punched holes with smooth edges. Punch or drill field connections for and for attachment of work by other trades.
- E. Weld Permanent Shop Connections:
 - 1. Welds to be continuous fillet type unless indicated otherwise
 - 2. Full penetration but welds at bends in stair stringers and ladder side rails.
 - 3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1.
 - 4. Weld aluminum in accordance with AWS D1.2.
 - 5. All headed studs to be welded using automatically timed stud welding equipment.
 - 6. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.
- G. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.
- H. Provide for anchorage of type indicated, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- I. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.
- J. Tolerances
 - 1. Rolling:
 - a. ASTM A6.
 - b. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC Specifications.
 - 2. Fabrication tolerance:
 - a. Member length:
 - 1) Both ends finished for contact bearing: 1/32 IN.
 - 2) Framed members:

- a) 30 FT or less: 1/16 IN.
 - b) Over 30 FT: 1/8 IN.
 - b. Member straightness:
 - 1) Compression members: 1/1,000 of axial length between points laterally supported.
 - 2) Non-compression members: ASTM A6 tolerance for wide flange shapes.
 - c. Specified member camber (except compression members):
 - 1) 50 FT or less: Minus 0/plus 1/2 IN.
 - 2) Over 50 FT: Minus 0/plus 1/2 IN (plus 1/8 IN per 10 FT over 50 FT).
 - 3) Members received from mill with 75 percent of specified camber require no further cambering.
 - 4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
 - 5) Camber shall be measured in fabrication shop in unstressed condition.
 - d. At bolted splices, depth deviation shall be taken up by filler plates.
 - 1) At welded joints, adjust weld profile to conform to variation in depth.
 - 2) Slope weld surface per AWS requirements.
 - e. Finished members shall be free from twists, bends and open joints.
 - 1) Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.
 - 3. Maximum tolerance for difference in depth between checkered plat or grating depth and seat or support angle depth: 1/8-inch
 - 4. Distance between edge of grating or checkered plat and face of embedded seat angle or face of wall or other structural member shall be 1/4-inch.
 - 5. Bar grating tolerances shall be in accordance with NAAMM MBG 531.
- K. Fabricate grating, checkered plate, stairs, ladders and accessories using aluminum unless shown otherwise on the Drawings.
- 1. Finish:
 - a. Aluminum: Mill finished unless scheduled or otherwise specified, or if approved by the Engineer, finished in manufacturer's standard coating.
 - b. Coat surfaces in contact with dissimilar materials. See Specification Section 099000.
 - c. Galvanize items where specified or indicated on Drawings.

2. See Specifications Section 099000 for preparation and painting of ferrous metals and other surfaces.

2.04 Aluminum Checkered Plate:

- A. Conform to ASTM B632.
 1. Diamond pattern: Use one (1) pattern throughout Project.
 2. Material: Type 6061-T6.
- B. Design live load:
 1. 100 psf, uniform load.
 2. 300 LBS concentrated load on 4 IN square area.
 3. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
 4. Maximum deflection: 1/300 of span under a superimposed live load of 50 psf.
- C. Reinforce as necessary with aluminum angles.
- D. Plate sections:
 1. Maximum 3 FT wide.
 2. Minimum 1/4 IN thick.
 3. Maximum 100 LBS per section if required to be removable.
- E. Provide joints at center of all openings unless shown otherwise.
 1. Reinforce joints and openings with additional angles to provide required load carrying capacity.
- F. Unless shown otherwise, frame for openings with aluminum checkered plate cover:
 1. Aluminum support angles:
 - a. 3 x 2 x 1/4 IN minimum size with long leg vertical.
 - b. 5/8 IN DIA adhesive anchor bolts spaced at maximum of 24 IN OC along each side with not less than two (2) anchor bolts per side.
 2. Aluminum concrete insert seats:
 - a. 2 x 2 x 1/4 IN minimum size.
 - b. Auto-welded studs or strap anchors at 18 IN OC with not less than two (2) studs or anchored per side.

3. Drill and tap frame to receive 3/8 IN DIA aluminum cap screws at not more than 24 IN OC with not less than two (2) screws per side.

2.05 Aluminum Grating:

- A. NAAMM MBG 531.
- B. Bearing bars: Rectangular, 1-1/2 x 3/16 IN at 1-3/16 IN OC spacing OR I-bar, 1-1/2 IN deep with minimum 1/16 IN thick bar and minimum 1/4 IN flange width at 1-3/16 IN OC spacing.
- C. Cross bars:
 1. Welded, swaged or pressure locked to bearing bars:
 2. Maximum 4 IN/OC spacing.
- D. Top edges of bars: Grooved or serrated.
- E. Removable grating sections: Not wider than 3 FT and not more than 100 LBS.
- F. Standard mill finish.
- G. Ends and perimeter edges: Banded.
- H. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
- I. Provide joints at openings between individual grating sections.
- J. Clips and bolts: Stainless steel.
- K. Seat angles: Aluminum.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.
- B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site to allow their installation in other construction. If such items are not provided in time for installation, cut in and install.
- C. Prior to installation, inspect and verify condition of substrate. Installation of product constitutes installer's acceptance of substrate condition for product compatibility.
- D. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.02 INSTALLATION

A. General:

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in- place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required. Provide steel templates for all column anchor bolts.
2. Cutting, Fitting and Placement:
 - a. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Field cutting grating or checkered plate to correct fabrication errors is not acceptable; replace entire section.
 - b. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing systems, etc.
 - c. Set work accurately in location, alignment and elevation. Shim and grout as necessary.
 - d. Fit exposed connections accurately together to form tight hairline joints.
 - e. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing. Provide full penetration welded splices where continuity is required.
 - f. Provide each fabricated item complete with attachment devices as indicated or required to install.
 - g. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.
 - h. Tie anchor bolts into position to embedded reinforcing steel using wire. Tack welding of anchors is prohibited. Coat anchor threads and nuts with heavy coat of clean grease prior to concrete/grout/mortar placement.
3. Connections: Unless otherwise noted or specified.
 - a. Connect steel members to steel members with 3/4-inch diameter ASTM A325 high strength bolts
 - b. Connect aluminum to aluminum with 3/4-inch diameter aluminum bolts
 - c. connect aluminum to structural steel using 3/4-inch diameter stainless steel bolts
 - d. Connect aluminum and steel members to concrete and masonry using stainless steel expansion anchor bolts or adhesive anchor bolts unless shown otherwise.
 - e. Provide washers for all bolted connections.
 - f. Where exposed, bolts shall extend a maximum of 3/4-inch and a minimum of 1/2-inch above the top of the nut. If bolts are cut off to require maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.
 - g. Provide appropriate protection between connections of dissimilar metals/materials.
4. Field welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work. Grind welds smooth where field welding is required. Field welding aluminum is not permitted unless approved in writing by Engineer.
5. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surface. Clean bottom surface of

bearing plates.

6. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with the edge of the bearing plate before packing with grout. Use non-metallic non-shrink grout in all locations.
7. Install Bollards in concrete as detailed. Fill pipe with concrete and round off top.
8. Provide abrasive stair nosings in each tread and landing of all concrete stairs and at each concrete stair landing having metal stair structure attaching to the concrete landing. Center stair nosings in stair width. Coordinate nosings with railing vertical posts. Maintain 2-inch clearance between the end of the nosing and the edge of the railing base plate.
9. Attach grating to end and intermediate supports with grating saddle clips and bolts.
 - a. maximum spacing: 2-ft O.C. with minimum of two (2) per side.
 - b. Attach individual units of aluminum grating together with clips at 2-ft O.C. maximum with a minimum of two (2) clips per side.
 - c. Attach each aluminum plate to support per manufacturer's recommendations using stainless steel clips and bolts.

3.03 ADJUST AND CLEAN

- A. After erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter. Provide surface acceptable to receive field applied paint coatings in conformance to Specification Section 099000.
- B. Touch-up painting: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint of miscellaneous metal is specified in Division 9 of these specifications.
- C. Repair damaged galvanized surfaces in accordance with ASTM A780. Prepare damaged surfaces by abrasive blasting or power sanding. Apply galvanizing repair paint to minimum 6-mils DFT in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 14 00

FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. Extent of each type of dampproofing work is indicated on drawings and as follows.
 - 1. Manholes, all types and locations.
 - 2. Concrete valve vaults
 - 3. Concrete pump station wetwells
 - 4. Similar work used as exposed finish is excluded by definition and, if required, is specified as waterproofing, vapor barrier, roofing, flooring, special coating or other appropriate category. Dampproofing shall be applied below elevation of finish grade only.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and recommendations for each dampproofing material required. Include data substantiating that materials comply with requirements.
- B. Certifications: Submit manufacturer's certification in writing that the product is suitable for the application specified. Certification letter shall state the required application rate to dampproof the indicated structures.

1.03 QUALITY ASSURANCE

- A. General: For each type of work, obtain primary materials from single manufacturer, to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Installer Qualifications: A firm which has specialized for not less than three years in installation of types of dampproofing required for the project and which is acceptable to manufacturer of primary materials.

1.04 PROJECT/SITE CONDITIONS

- A. Substrate: Proceed with dampproofing work only after substrate construction and penetrating work have been completed.
- B. Weather: Proceed with dampproofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 COLD LIQUID-APPLIED ELASTOMERIC WATERPROOFING MATERIALS

- A. Primer: Manufacturer's recommended primer appropriate to substrate
- B. Waterproofing system:

1. One (1) or two (2) component, moisture curing polyurethane elastomer meeting the requirements of ASTM C836.
 2. Flowing type for surfaces up to five (5) percent slope.
 3. Non-flow type for surfaces exceeding 5-percent
 4. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - a. Carlisle – Liquiseal CCW-703
 - b. Tremco – TREMproof 201/60
 - c. Or approved equal.
- C. Adhesive: Manufacturer's standard
- D. Flashing Reinforcement: Woven uncoated fiberglass mesh.
- E. Sealant: Manufacturer's recommended sealant.
- F. Protection board: Manufacturer approved fiberboard or expanded polystyrene, 1-inch thickness (min.).
- G. Backer Rod: Closed cell polyurethane foam rod.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine Substrate and conditions under which dampproofing work is to be performed and notify Contractor in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION OF SUBSTRATE

- A. Cure concrete and masonry in accordance with manufacturer's recommendations. Verify moisture content does not exceed manufacturer's maximum allowable. Ensure that curing agents used are compatible with the coating system.
- B. Remove surface contamination by high pressure water cleaning per ASTM D4258.
- C. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.
- D. Install can't strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.
- E. Fill voids, seal joints, and apply bond breakers (if any) as recommended by prime materials manufacturer, with particular attention at construction joints.
- F. Install separate flashings and corner protection stripping as recommended by prime materials manufacturer, where indicated, to precede application of dampproofing. Comply with details shown and manufacturer's recommendations. Give particular attention to requirements at building expansion joints, if any.
- G. Prime substrate as recommended by prime materials manufacturer.
- H. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.03 INSTALLATION

- A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of work.
- B. Apply waterproofing to the exterior side of vertical concrete and masonry wall surface and structure surfaces located below grade. Below grade structure requiring waterproofing membranes include:
 - 1. Precast and Cast-in-place Backflow Preventer Vault
 - 2. Precast and Cast-in-place Concrete Manholes
 - 3. Similar work used as exposed finish is excluded by definition and, if required, is specified as waterproofing, vapor barrier, roofing, flooring, special coating or other appropriate category. Dampproofing shall be applied below elevation of finish grade only.
- C. Provide a minimum 60-mil dry film thickness.
- D. Protection Board: Protection board is to be installed prior to any rigid perimeter insulation specified. Secure protection board as required to prevent displacement during backfilling. All mechanical fasteners used for securing protection board that penetrate the membrane must be re-sealed prior to backfilling.

END OF SECTION

SECTION 07 19 00
WATER REPELLENTS

PART 1 GENERAL

1.01 SUMMARY

- A. The submitted and approved products shall be applied in strict accordance with the manufacturer's recommendations and instructions on the following surfaces:

Exterior concrete masonry unit surfaces.
Exterior brick surfaces.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, installation instructions, and general recommendations for water repellents and sealers.
- B. Include data substantiating that water repellents and sealers are recommended by manufacturer for applications on indicated surfaces.

1.03 WARRANTY

1. Provide a manufacturer's warranty for the specified applications for a period of 5 years covering the material.
2. Provide Contractor's written and certified warranty covering labor to reapply product determined to be defective for a period of 2 years. Warranty from Contractor covering labor shall cover cases of defective product and/or improper product application.

PART 2 MATERIALS

2.01 PRODUCTS

- A. Provide material for the application listed above in accordance with the recommendations of the following manufacturers:

Hydrozo Incorporated	Lincoln, NE
ProSo Co., Incorporated	Kansas City, KS
Or approved equal.	

- B. All products shall comply with applicable regulations governing volatile organic content (VOC).

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean substrate of substances which might interfere with penetration/ adhesion of water repellents and test for moisture content in accordance with manufacturer's instructions.

- B. Coordinate with Sealants: Delay application of water repellents and sealers until installation of sealants, caulk, etc., has been completed and cured in joints and adjoining surfaces to be coated with repellents.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent and sealers. Cover adjoining and nearby surfaces of aluminum, glass, etc., where there is possibility of water repellent and sealers being deposited on surfaces. Cover vegetation with drop cloths. Clean water repellent from adjoining surfaces immediately after spillage. Comply with manufacturer's recommendations for cleaning and disposal of excess material.

3.02 APPLICATION

- A. Apply water repellents and sealers in strict accordance with the manufacturer's recommendations. Comply with manufacturer's recommendations regarding weather and substrate conditions.
- B. Workers applying the material shall have prior training by a manufacturer's representative prior to working on the surfaces specified above.

END OF SECTION

SECTION 07 21 10
FIBROUS BATT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Extent of insulation work is shown on drawings and indicated by provisions of this section.
- B. Applications of insulation specified in this section include the following:
 - 1. Batt insulation and vapor barrier in exterior wall construction.
 - 2. Batt insulation for installation above ceilings.
 - 3. Batt insulation and vapor barrier in designated interior partitions.

1.02 REFERENCES

- A. FS HH-I-1252B - Insulation Thermal, Reflective Aluminum Foil.
- B. ASTM C655 - Preformed Glass Fiber Batt.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications and installation instructions for each type of insulation and vapor barrier material required.

1.04 QUALITY ASSURANCE

- A. Fire and Insurance Ratings: Comply with fire-resistance, flammability, and insurance ratings indicated, and comply with regulations as interpreted by governing authorities.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mineral/Glass Fiber Blanket/Batt Insulation (M/GFB-Ins): Inorganic (nonasbestos) fibers formed with binders into resilient flexible blankets or semi-rigid batts; FS HH-I-521, type as indicated, densities of not less than 0.5 lb. per cu. ft. for glass fiber units and not less than 2.5 lb. per cu. ft. for mineral wool units, k-value of 0.27; manufacturer's standard lengths and widths as required to coordinate with spaces to be insulated; types as follows:

Provide Type I unfaced units where indicated, semi-rigid in vertical spaces and where self-support is required.

Provide Type II nonreflective vapor barrier faced units where indicated, with integral nailing flanges; barrier rating of 0.5 perms, other face (if any) with rating greater than 5.0 perms.

Provide Type III reflective vapor barrier faced units where indicated, with integral nailing flanges; aluminum foil barrier with rating of 0.5 perms, other face (if any) with rating greater than 5.0 perms.

Flame-Spread Rating: Provide units with rating of 25, ASTM E 84.

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Certain-Teed Products Corp.; Valley Forge, PA
Clecon Inc.; Cleveland, OH
Manville Bldg Materials Corp.; Denver, CO
Owens-Corning Fiberglas Corp.; Toledo, OH
Or approved equal.

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Installer must examine substrates and conditions under which insulation work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- B. Clean substrates of substances harmful to insulations or vapor barriers, including removal of projections which might puncture vapor barriers.

3.02 INSTALLATION

- A. General:

Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

- B. Fit insulation tight within spaces and tight to and behind mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

3.03 PROTECTION

- A. General: Protect installed insulation from harmful weather exposures and from possible physical abuses, where possible by nondelayed installation of concealing work or, where that is not possible, by temporary covering or enclosure. Installer shall advise Contractor of exposure hazards, including possible sources of deterioration and fire hazards.

END OF SECTION

SECTION 07 41 13
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concealed-fastener, lap-seam, metal roof panels.
- B. Exposed-fastener, lap-seam, metal roof panels.
- C. Roofing accessories.

1.02 RELATED SECTIONS

1.03 REFERENCES

- A. ASTM International (ASTM):
 - ASTM A792 / A792M - Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's specifications and installation instructions for roofing components and accessories.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
- B. Sustainable Design Submittals:
 - 1. Product test reports indicating Solar Reflectance Index (SRI).
 - 2. Manufacturer's product data and costs for metals having recycled content.
- C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures.
- D. Verification Samples:
 - 1. Sheet Metal Roofing: Minimum 12 inches (305 mm) long by full width including finished seams, fasteners, cleats, closures, and other accessories.
 - 2. Finishes: minimum size 6 by 6 inches (152 by 152 mm) for each finish specified.
 - 3. Accessories: Full-size sample.
- E. Qualifications: For installer and manufacturer.
- F. Close Out Submittals:
 - 1. Maintenance Data.
 - 2. Warranty.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.
- B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Manufacturer Qualifications: Minimum 5 years experience manufacturing similar products.
- D. Installer Qualifications: Minimum 2 years experience installing similar products.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation. Follow manufacturer's recommended storage procedures. Do not allow steel roofing to contact the ground.
- B. Unload, store, and handle to prevent twisting, bending, abrasion, scratching and denting. Do not allow standing moisture on panels, elevate one side for moisture to drain off.

1.07 PROJECT CONDITIONS

- A. Anticipate environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
- B. Do not proceed with installation of sealants unless sealant manufacturer's requirements can be met including extreme temperature conditions that would cause joint openings to be minimum or maximum widths, or if heavy wind loads are forecast.

1.08 WARRANTY

- A. Roofing System Warranty: Provide manufacturer's standard limited paint warranty 40 years for film integrity, 30 years for chalk and fade. Refer to warranty document for complete details.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Lester Building Systems, which is located at: 1111 2nd Ave. S.; Lester Prairie, MN 55354; Toll Free Tel: 800-826-4439; Tel: 320-395-2531; Fax: 320-395-2969; Email: [request info \(sbeste@lesterbuildings.com\)](mailto:sbeste@lesterbuildings.com); Web: www.lesterbuildings.com
- B. Substitutions: Approved Equal.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.02 CONCEALED FASTENER, LAP-SEAM, METAL ROOF PANELS

- A. Basis of Design: Eclipse panel as manufactured by Lester Building Systems. Metal roof panels with side edges lapping adjacent panels. Secured to supports using fasteners through the major ribs. Fasteners concealed with snap-on batten. Include accessories required for weathertight installation.
 - 1. Configuration
 - a. Roll-formed; 36 inch (915 mm) coverage width. Provide panels covering up to 35 foot (10.5 m) lengths in single pieces.

- b. Rib profile, 1 inch (25 mm) inch high trapezoidal major ribs 18 inches on center. Reversed minor ribs 3 inch (75 mm) wide on centers spaced symmetrically.
 - c. One outboard corrugation as overlapping.
 - d. Opposite outboard corrugation as underneath corrugation with full return leg to support side lap.
 - e. Outboard side Lap Height with Batten (H by W): 1.5 by 1 inches (38 by 25 mm).
 - f. Factory cut to required length.
 - g. Eave: Hemmed.
 - h. Eave: No extension.
 - i. Eave: 4 inch (102 mm).
2. Material and Finish: 28 gauge steel, ASTM A 792 ClassAZ50 Galvalume, coated both sides, 0.0157 inches (.398 mm) thick.
- a. Exterior Surface Finish: Bonderize and provide baked-on primer and Valspar Weather-XL (silicone modified polyester) finish coat, 0.7 - 0.8 mil minimum dry film thickness.
 - 1) Color: Lester Antique Brown.
 - 2) Color: Lester Barn Red. *
 - 3) Color: Lester Black.
 - 4) Color: Lester Bone White. *
 - 5) Color: Lester Burgundy.
 - 6) Color: Lester Clay. *
 - 7) Color: Lester Colony Green.
 - 8) Color: Lester Dark Blue.
 - 9) Color: Lester Earth Brown. *
 - 10) Color: Lester Evergreen. *
 - 11) Color: Lester Pewter Gray. *
 - 12) Color: Lester Quaker Gray.
 - 13) Color: Lester Rawhide. *
 - 14) Color: Lester Sandstone. *
 - 15) Color: Lester Slate Blue. *
 - 16) Color: Lester Snow White. *
 - 17) Color: Lester White Sand. *
 - 18) Color: As selected by Architect.
 - 19) * Meets Energy Star reflectivity standards.
3. Material and Finish: 26 gauge steel, ASTM A 792 Class AZ50 Galvalume, coated both sides, 0.0187 inches (.474 mm) thick.
- a. Exterior Surface Finish: Bonderize and provide baked-on primer and Valspar Weather-XL (silicone modified polyester) finish coat, 0.7 - 0.8 mil minimum dry film thickness.

- b. Exterior Surface Finish: Bonderize and provide baked-on primer and factory applied baked-on 70 percent Kynar 500 or Hylar 5000 PVDF fluoropolymer resin based paint coating manufactured by Valspar, with a minimum dry film thickness of 0.7 - 0.8 mil.
 - 1) Color: Lester Antique Brown.
 - 2) Color: Lester Barn Red. *
 - 3) Color: Lester Black.
 - 4) Color: Lester Bone White. *
 - 5) Color: Lester Burgundy.
 - 6) Color: Lester Clay. *
 - 7) Color: Lester Colony Green.
 - 8) Color: Lester Dark Blue.
 - 9) Color: Lester Earth Brown. *
 - 10) Color: Lester Evergreen. *
 - 11) Color: Lester Metallic Champagne (only available in PVDF paint). *
 - 12) Color: Lester Metallic Copper (only available in PVDF paint). *
 - 13) Color: Lester Pewter Gray. *
 - 14) Color: Lester Quaker Gray.
 - 15) Color: Lester Rawhide. *
 - 16) Color: Lester Regal Red (only available in PVDF paint). *
 - 17) Color: Lester Sandstone. *
 - 18) Color: Lester Slate Blue. *
 - 19) Color: Lester Snow White. *
 - 20) Color: Lester White Sand. *
 - 21) Color: As selected by Architect.
 - 22) * Meets Energy Star reflectivity standards.

- B. Fasteners: DS2000coated No. 14piercing screws with 3/8inch (9.5mm) hex head pre-assembled to 1/2 inch (13 mm) O.D. dome seal or bond seal galvanized steel ASTM A153, and EPDM washers.

2.03 EXPOSED FASTENER, LAP-SEAM, METAL ROOF PANELS

- A. Basis of Design: Imperial Rib panel as manufactured by American Building Components (ABC). Metal roof panels with side edges lapping adjacent panels. Secured to supports using fasteners through the major ribs.
 - 1. Configuration:
 - a. Roll-formed; 36 inch (915 mm) coverage width. Provide panels covering up to 35 foot (10.5 m) lengths in single pieces.
 - b. Five major corrugations, 3/4 inch (25 mm) high, spaced 9 inches (457 mm) on center with 8 minor corrugations,
 - c. Form one outboard corrugation as overlapping corrugation.

- d. Form opposite outboard corrugation as underneath corrugation with full return leg to support side lap and a continuous anti-siphon drain channel.
 - e. Factory cut to required length.
2. Material and Finish: 29 gauge steel, ASTM A 792 Class AZ50 Galvalume, coated both sides, 0.0157 inches (.398 mm) thick.
- a. Exterior Surface Finish: Smooth (Standard).
 - 1) Color: Shall be selected from Manufacturer's Standard colors.
3. Material and Finish: 26 gauge steel, ASTM A 792 Class AZ50 Galvalume, coated both sides, 0.0187 inches (.474 mm) thick.
- a. Exterior Surface Finish: Bonderize and provide baked-on primer and Valspar Weather-XL (silicone modified polyester) finish coat, 0.7 - 0.8 mil minimum dry film thickness,
 - b. Exterior Surface Finish: Bonderize and provide baked-on primer and factory applied baked-on 70 percent Kynar 500 or Hylar 5000 PVDF fluopolymer resin based paint coating manufactured by Valspar, with a minimum dry film thickness of 0.7 - 0.8 mil..
 - 1) Color: Shall be selected from Manufacturer's Standard colors.
- B. Fasteners: DS2000coated No. 14piercing screws with 3/8 inch (9.5 mm) hex head pre-assembled to 1/2 inch (13 mm) O.D. dome seal or bond seal galvanized steel and EPDM washers.

2.04 ROOFING ACCESSORIES

- A. Steel Ridge Cap: Match the roof steel materials and construction.
- B. Translucent Ridge Light: Acrylic, standard ridge profile, acrylic and polyester resins with gel coat UV protective layer.; ASTM D3841, minimum 8 ounces per square foot, 65 percent visible light transmission.
- C. Vents: Ridge vent, and low profile ridge ventilator as shown on Drawings,
- D. Cupola: Provide manufacturer's standard cupola as shown on Drawings.
- E. Cupola and Weathervane: Provide manufacturer's standard cupola and weathervane as shown on Drawings.
- F. Eave Overhang Fascia Flashing:
 - 1. Size: 12 inches nominal.
 - 2. Size: 24 inches nominal.
 - 3. Fascia Flashing Color: To be selected by Owner from Manufacturer's Standard colors.
 - 4. Vented Soffit Color: To be selected by Owner from Manufacturer's Standard colors.
- G. End Overhang Fascia Flashing:
 - 1. Size: 12 inches nominal.
 - 2. Size: 24 inches nominal.
 - 3. Fascia Flashing Color: To be selected by Owner from Manufacturer's Standard colors.
 - 4. Vented Soffit Color: To be selected by Owner from Manufacturer's Standard colors.

- H. Gutters and Downspouts: Provide manufacturer's standard gutters and downspouts as shown on Drawings.
- I. Closure Strips: Closed cell, 2 pcf density polyethylene foam, premolded to match configuration of panels.

2.05 JOINT SEALANT MATERIALS

- A. Sealant: Manus 75-A for applications that will not be painted, contains no solvents or isocyanates, non-yellowing.
 - 1. Color: Manus Clear.
 - 2. Color: Manus White.
 - 3. Color: Manus Bronze.
- B. Sealant: Manus 75-AM for applications that will be painted, contains no solvents or isocyanates, non-yellowing. Use white or bronze color for nearest match to adjacent substrate.
 - 1. Color: Manus Clear.
 - 2. Color: Manus White.
 - 3. Color: Manus Bronze.
- C. Sealant Tape: Manus-Bond 64-A Polysul Grip tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that site conditions are acceptable. Commencement of work by erector/installer is acceptance of site conditions

3.02 INSTALLATION

- A. Metal Roofing:
 - 1. General: Install in accordance with manufacturer's instructions. Secure to structural framing aligned, level and plumb. Space fasteners per Manufacturer's instructions unless noted otherwise.
 - 2. Sidelap: Minimum one full corrugation.
 - 3. Accessories: Install as shown on approved submittals or Manufacturer's instructions.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Extent of each type of flashing and sheet metal work is indicated on drawings and by provisions of this section.
- B. Types of work specified in this section include the following:
 - Collector boxes, gutter, and downspouts.
 - Miscellaneous sheet metal accessories.
 - Counterflashing.
 - Thru-wall Flashing.
- C. Roofing accessories which are installed integral with roofing membrane are specified in roofing system sections as roofing work.

1.02 SUBMITTALS

- A. Product Data; Flashing, Sheet Metal, Accessories: Submit manufacturer's product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- B. Samples: Flashing, Sheet Metal, Accessories: Submit 8" square samples of specified sheet materials to be exposed as finished surfaces.

Submit 12" long, completely finished units of specified factory-fabricated products exposed as finished work.
- C. Compliance Submittals; Flashing, Sheet Metal, Accessories: Submit compliance submittals showing layout, joining, profiles and anchorages of fabricated work, including major counter-flashings, trim/fascia units, gutters, downspouts, scuppers and expansion joint systems.

1.03 PROJECT/SITE CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 PRODUCTS

2.01 FLASHING AND SHEET METAL MATERIALS

- A. Sheet Metal Flashing/Trim:

1. Aluminum: ASTM B 209, alloy 3003, temper H14, AA-C22A41 clear anodized finish; 0.32" thick (20 gage) except as otherwise indicated.
- B. Through-Wall Flashing:
1. Five-ounce per square foot copper sheet laminated with either resilient asphalt or cotton fabric. Kraft paper may be incorporated in lamination.
- C. Miscellaneous Material and Accessories:
1. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
 2. Bituminous Coating: FS TT-C-494 or SSPC - Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
 3. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
 4. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed; comply with FS TT-S-0027, TT-S-00230, or TT-S-001543.
 5. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.
 6. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
 7. Paper Slip Sheet: 5-lb. rosin-sized building paper.
 8. Polyethylene Underlayment: 6-mil carbonated polyethylene film; FS L-P-512.
 9. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
 10. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
 11. Roofing Cement: ASTM D 2822, asphaltic.

2.02 FABRICATED UNITS

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

- B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Aluminum Extrusion Units: Fabricate galvanized metal running units with formed or extruded aluminum joint covers, for installation behind main members where possible. Fabricate mitered and welded corner units.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install thruwall flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.

3.02 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.
- B. Protection: Installer shall advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

END OF SECTION

SECTION 07 90 00

JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The extent of each form and type of joint sealer is indicated on drawings and by provisions of this section.
- B. The applications for joint sealers as work of this section include the following:
 - Pavement and sidewalk joints.
 - Concrete construction joints where indicated on the drawings.
 - Concrete and masonry control joints.
 - Door frames to masonry joints.
 - Floor joints (interior).
 - Wall joints (exterior).
 - Flashing and coping joints.
 - Gasketing of assemblies.

1.02 SYSTEM PERFORMANCES

- A. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.
- B. Provide joint sealers that have been recommended by the manufacturer for service under the conditions of the particular joint application, including but not limited to exterior exposure, thermal or other movement, abrasion, or submergence.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each joint sealer product required, including instructions for joint preparation and joint sealer application.
- B. Product Certification: Submit certification in writing by the sealant manufacturer that each sealer product is recommended and suitable for the proposed application. The written certification shall name the sealer product and shall identify the specific structures and locations where the sealer will be installed.
- C. Product Tests: If required by the Engineer, submit certified test reports for elastomeric sealants on aged performances as specified, including hardness, stain resistance, adhesion, cohesion or tensile strength, elongation, low- temperature flexibility, compression set, modulus of elasticity, water absorption, and resistance (aging, weight loss, deterioration) to heat and exposure to ozone and ultraviolet.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multicomponent materials.

- B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General: Manufacturers listed in this article include those known to produce the indicated category of prime joint sealer material, either as a nominally pure generic product or as an equivalent-performance modification thereof or proprietary product.
- B. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

- 1. Manufacturers of Elastomeric Sealants (Liquid):

Dow Corning Corp.; Midland, MI
General Electric Co.; Waterford, NY
Gibson-Homans Co.; Waterford, NY
W.R. Meadows, Inc.; Elgin, IL
Pecora Corp.; Harleysville, PA
Sika Chemical Corp.; Lindhurst, NJ
Sonneborn, A Division of Rexnord; Minneapolis, MN
Tremco, Inc.; Cleveland, OH
Woodmont Products Inc.; Huntingdon Valley, PA
Or approved equal.

- 2. Manufacturers of Joint Fillers/Sealant Backers:

Dow Chemical Co.; Midland, MI
Hercules, Inc.; Middletown, DE
W.R. Meadows, Inc.; Elgin, IL
Sonneborn, A Division of Rexnord, Minneapolis, MN
Woodmont Products, Inc.; Huntingdon Valley, PA
Or approved equal.

2.02 MATERIALS

- A. General Sealer Requirements: Provide colors indicated or, if not otherwise indicated, as selected by Engineer from manufacturer's standard colors. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated. Where exposed to foot traffic, select nontracking materials of sufficient strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealer system.
- B. Elastomeric Sealants:
 - 1. Single-Component Polyurethane Sealant (1Pu-S): Except as otherwise indicated, provide manufacturer's standard, non-modified, one-part, polyurethane-based, air-curing, elastomeric sealant; complying with either ASTM C 920 type S Class 25, or FS TT-S-00230C Class A; self-leveling grade/type where used in joints of surfaces subject to traffic, otherwise nonsag grade/type. For use in all horizontal paving control joints.

Bituminous Modification (-Bit): Where joint surfaces contain or are contaminated with bituminous materials, provide manufacturer's modified type sealant which is compatible with joint surfaces (modified with coal tar or asphalt as required).

2. Single-Component Silicon Rubber Sealant (1SR-S): Except as otherwise indicated, provide manufacturer's standard, non-modified, one-part, silicone-rubber-based, air-curing, nonsag, elastomeric sealant; complying with either ASTM C 920 Type S Class 25 Grade NS, or FS TT-S-001543A Class A Type S Non-sag. For use in all vertical control joints in masonry, flashing and door frames.

C. Joint Fillers, Pavement Types:

1. Expanded Polyethylene Joint Filler (ExPe-JF): Provide flexible, compressible, closed-cell, polyethylene of not less than 10 psi compression deflection (25%); except provide higher compression deflection strength as may be necessary to withstand installation forces and provide proper support for sealants; surface water absorption of not more than 0.1 lbs. per sq. ft.
2. Open-Cell Polyurethane Joint Filler (OcPu-JF): Provide flexible, highly compressible, open-cell polyurethane foam of not less than 1.3 lbs. per cu. ft. density and not less than 2 psi compression deflection (25%), with not more than 10% compression set for 25 hours at 50% compression (ASTM D 3574 test methods).

D. Miscellaneous Materials:

1. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.
2. Bond Breaker Tape (BB-Tp): Provide polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant- contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.
3. Sealant Backer Rod (S-BR): Provide compressible rod stock of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.

PART 3 - EXECUTION

3.01 INSPECTION

1. Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 JOINT PREPARATION

1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements.
2. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; surface dirt and frost.

3. Clean concrete, masonry, unglazed surface of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 4. Remove laitance and form release agents from concrete.
 5. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- B. Joint Priming: Prime joint substrates where indicated, or where recommended by sealant manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION

- A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.
- B. Set joint filler units at depth or position in joint as indicated to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.
- C. Install sealant backer rod for liquid-applied sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated.
- D. Install bond breaker tape where indicated and where required by manufacturer's recommendations to ensure that liquid-applied sealants will perform as intended.
- E. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
- F. Install liquid-applied sealants to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of beads; (not applicable to sealants in lapped joints).

For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.

For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.

- G. Spillage: Do not allow sealants or compounds to overflow from confines of joints, or to spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- H. Do not overheat or reheat hot-applied sealants; discard (do not use).
- I. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.
- J. Bond ends of gaskets together with adhesive or "weld" by other means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners unless molded corner units are provided.

3.04 CURE AND PROTECTION

- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.
- B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.
- C. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability. Advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion. Cure and protect sealants in a manner which will minimize increases in modulus of elasticity and other accelerated aging effects. Replace or restore sealants which are damaged or deteriorated during construction period.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

- A. Extent of standard steel doors and frames is indicated and scheduled on drawings.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.
- B. Compliance Submittals: Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

Indicate coordinate of glazing frames and stops with glass and glazing requirements.

1.03 QUALITY ASSURANCE

- A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work boxed or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory-finished doors.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Engineer; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide steel doors and frames by one of the following:

1. Steel Doors and Frames, (General):

Allied Steel Products, Inc.
Amweld/Div. American Welding & Mfg. Co.

Ceco Corp.
Curries Mfg., Inc.
Mesker Industries, Inc.
Pioneer Bldrs. Products Corp./Div. CORE Industries, Inc.
Steelcraft/Div. American Standard Co.
Trussbilt, Inc.
Republic Builders Products Corp./Subs. Republic Steel
Or approved equal.

2.02 MATERIALS

- A. Hot-Rolled Steel Sheets and Strips: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
- B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.
- D. Supports and Anchors: Fabricate of not less than 18-gauge galvanized sheet steel.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.
- F. Each hollow metal door shall be equipped with the following hardware:
 - 1. 3 - Four ball-bearing hinges.
 - 2. 1 - Floor-type door bumper.
 - 3. 1 - Plunger-type door holder.
 - 4. 1 - Door closer (rack & pinion type) with hold-open arm.
 - 5. Heavy-duty cylindrical locks--all exterior doors, entrance, keyed alike; all interior doors, passage latch.
- G. Shop Applied Paint:
 - 1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.03 FABRICATION, GENERAL

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, wrap or buckle. Wherever practicable, fit and assemble units in manufacturer's plant.

Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with SDI-100 requirements as follows:

Interior and Exterior Doors: SDI-100, Grade III, extra heavy-duty, Model 2, minimum 16-gage faces.

- B. Fabricate exterior doors, panels, and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.
- C. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

- D. Finish Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.
- E. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
- F. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware," published by Door and Hardware Institute.
- G. Shop Painting:
 - 1. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
 - 2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
 - 3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

2.04 STANDARD STEEL DOORS

- A. Provide metal doors of types and styles indicated on drawings or schedules.
- B. Door Louvers:
 - 1. Provide sightproof stationary louvers for interior doors where indicated, constructed of inverted V-shaped or Y-shaped blades formed of 24-gage cold-rolled steel set into 20-gage steel frame.
- C. Vision Lites:
 - 1. Provide manufacturer's standard 12" x 12" vision lite glazing stops for 1/4" glass.

2.05 STANDARD STEEL FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gage cold-rolled furniture steel.

Fabricate frames with mitered and welded corners.
Form frames of hot-dip galvanized steel.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.
- C. Plaster Guards: Provide 26-gage steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- D. Borrowed Lite Stops: Provide manufacturer's standard glazing channels at all borrowed lites, size as required for 1/4" glass.

PART 3 - INSTALLATION

3.01 INSTALLATION

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.
 - 1. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 2. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.
 - 3. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
 - 4. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In open steel stud partitions, place studs in wall anchor notches and wire tie. In closed steel stud partitions, attach wall anchors to studs with tapping screws.
 - 5. Backcoat frames with asphaltic coating (Koppers Bitumastic No. 50 or equal) and fill with mortar at masonry construction.
- C. Door Installation:
 - 1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.
 - 2. Prime-Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
 - 3. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.
 - 4. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION

SECTION 08 31 14

ACCESS DOORS WITH SAFETY GRATING AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Exterior backflow preventer vault access doors with safety grating.

B. Related sections:

1. Section 05 50 00 - Metal Fabrications.

1.02 SYSTEM DESCRIPTION

A. Design Requirements:

1. Doors shall be single or double cover construction in sizes as shown on drawings. Covers shall be reinforced on the underside to withstand a live load of 300 pounds per square foot with a maximum deflection of 1/150th of the span.
2. Doors shown on drawings with drainable frames shall have a 1/4" thick, 3" wide by 3-1/2" tall drainage channel frame around the entire perimeter of door with a 1-1/2" diameter drain coupling welded to underside of frame.
3. Drainage frame and standard (plain) frame doors shall fit flush with top of frame.
4. Hinges for drainage frame doors shall be heavy-duty pin hinges (3/8" minimum diameter pins) and shall pivot so cover does not protrude into channel frame. Hinges shall be designed for horizontal installation.
5. Hinges for standard frame doors shall be cam-action hinges and pivot on torsion bars for smooth, easy and controlled opening throughout entire opening and closing of door. Operation shall not be affected by temperature. Hinges shall be designed for horizontal installation.
6. Drainage frame doors shall be fitted with an adequate number and size of compression spring operators for smooth, easy, counterbalanced, controlled operation through entire opening and closing of door. Operation shall not be affected by temperature. Compression springs shall be fully enclosed in telescopic tubes. Upper tube shall be outside of lower tube to prevent accumulation of moisture, grit and debris inside tube assembly. Lower tube shall interlock with a flanged support shoe fastened to a 1/4" gusset support plate.
7. Doors shall be equipped with a steel hold-open arms which will automatically lock doors in open position. A release handle shall be conveniently located for closing.
8. Doors shall be equipped with snap locks and fixed turn handles mounted on underside of doors. Removable latch handles shall be provided and the latch releases shall be protected by a flush gasketed, removable screw plugs. Doors shall have lift handles that are designed to be flush with walking surface when not in use.

B. Safety Grating Requirements:

1. Doors where safety grating is indicated shall have a permanently hinged grate which combines covering of the opening, fall-through protection per OSHA 1910.23 and controlled confined space entry per OSHA 1910.146. The grating shall have 5" by 5" openings and shall be designed to withstand a minimum live load of 300 pounds per

square foot with a maximum deflection of 1/150th of the span.

2. Each safety grating leaf shall have an opening arm with a red vinyl grip handle positioned so that the grating serves a barrier between the operator and the pit. The opening shall be equipped with provision for attaching a controlled confined entry space lock.
3. The safety grating in the open position shall form a barrier around the opening. The grating design shall be configured so that it is impossible to close the access door until the fall-through protection is in place.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for each type of accessory door assembly, including setting drawings, templates, instructions, and directions for installation of anchorage devices. Include complete schedule, including types, general locations, sizes, wall, floor and ceiling construction details, finishes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Bilco Co. - New Haven, CT
- B. Flygt Corporation – Trumbull, CT

2.02 MATERIALS

- A. **Frame and safety grating:** Aluminum.
- B. **Covers:** Aluminum checkered plate.
- C. **Hardware:** Type 316 stainless steel.

2.03 FABRICATION

- A. **General:** Furnish each access door assembly manufactured as an integral unit, complete with all parts and ready for installation.
- B. **Fabrication:** Fabricate units of continuous welded construction, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

2.04 FINISHES

- A. **General:** Aluminum and stainless steel components shall be mill finish. Aluminum surfaces in contact with concrete or mortar shall have a bituminous coating applied to those surfaces.
- B. **Safety Grating:** Aluminum safety grate shall be painted "OSHA safety orange."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's instructions for installation.
- B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- C. Frame drain shall be piped to daylight, or if shown on the drawings, to an internal sump or

wetwell.

3.02 ADJUSTING

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

3.03 SCHEDULES

- A. Comply with manufacturer's instructions for installation.

NUMBER	LOCATION	CLEAR OPENING		MATERIAL	FRAME	NOTES
		W (FT)	H (FT)			
C-EFF-AH01	Effluent Filter Structure	2.0	2.0	Aluminum	Drainage channel	a, c
C-EFF-AH02	Lift Station Valve Vault	3.0	3.0	Aluminum	Drainage channel	a, c
C-EFF-AH03	Flow Meter Vault	2.0	2.0	Aluminum	Drainage channel	a, c

Notes:

- a. Provide secondary fall protection
- b. Route to sump
- c. Route to daylight

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

Part 1 - GENERAL

1.01. SUMMARY

- A. Extent of finish hardware required is indicated on drawings and in schedules.
- B. Types of finish hardware required include the following:
 - Hinges.
 - Lock cylinders and keys.
 - Lock and latch sets.
 - Exit devices.
 - Closers.
 - Door trim units.
 - Protection plates.
 - Weatherstripping for exterior doors.
 - Thresholds.
- C. Silencers included integral with hollow metal frames are specified with door frames elsewhere in Division 8.

1.02. DEFINITIONS

- A. Definition: "Finish Hardware" includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

1.03. SUBMITTALS

- A. Product Data: Submit manufacturers technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.
- B. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
 - 1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening.
 - Include the following information:
 - Type, style, function, size and finish of each hardware item.
 - Name and manufacturer of each item.
 - Fastenings and other pertinent information.
 - Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 - Mounting locations for hardware.
 - Door and frame sizes and materials.
 - 2. Submittal Sequence: Submit schedule at earliest possible date particularly where

acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.

- C. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.04. QUALITY ASSURANCE

- A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or who employs an experienced engineer hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Engineer and Contractor.

1.05. DELIVERY, STORAGE, AND HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- E. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

Part 2 - PRODUCTS

2.01. SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following.
 - 1. Manufacturer's Product Designations: One or more manufacturers are listed for each hardware type required. An asterisk (*) after a manufacturer's name indicates whose product designation is used in the Hardware Schedule for purposes of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers

which comply with requirements including those specified elsewhere in this section.

2. ANSI designations used elsewhere in this section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this section.

Butts and Hinges: ANSI A156.1.

- a) *H. Soss.
- b) Hager.
- c) Stanley.

Mortice Locks & Latches: ANSI A156.13.

- a) *Schlage Lock Co.
- b) Corbin.
- c) Russwin.

Door Controls - Closers: ANSI A156.4.

- a) *LCN.
- b) Dorma.
- c) Norton.

Architectural Door Trim-Flatgoods & Stops: ANSI A156.6.

- a) *Quality.
- b) Ives.
- c) Rockwood.

Thresholds and Weatherstripping:

- a) *Premko.
- b) National Guard.
- c) Reese.

- B. Keying shall be master keyed into one group and keyed alike as directed by Owner. Locks shall match existing key system.
- C. Stops shall be wall type where possible; where not possible use floor type or overhead type as required.

2.02. MATERIALS AND FABRICATION

A. General:

1. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
2. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated. Do not furnish "optional"

materials or forming methods for those indicated, except as otherwise specified.

3. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
4. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
5. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use set screw fasteners.
6. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance and removal and replacement of finish hardware.

2.03. SCHEDULE

Set 1 - Doors A and E: Each single door shall have the following:

1 1/2 pr.	Butts x 430TBB 26D 4 1/2 X 4 1/2 NRD
1 ea.	Lock D53PD Rhodes 626
1 ea.	Kickplate 8" x 2" L.D.W. x 630 x .050
1 ea.	Closer 4110N CUSH A.L.
1 ea.	Threshold 52005AS
1 set	Weatherstripping 290ASH and J.
1 ea.	Door Bottom 34 5AV
1 ea.	Drip Cap 346A

2.04. HARDWARE FINISHES

- A. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
- B. Provide finishes which match those established by BHMA or, if none established, match the Engineer's sample.
- C. Provide quality of finish, including thickness of plating or coating (if any) composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.
- D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer".
- E. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI A156.18 "Materials & Finishes Standard," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

Part 3 - EXECUTION

3.01. INSTALLATION

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Engineer.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.02. ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to

acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of painting work is indicated on the drawings and schedules and as specified herein. The painting work shall include, but not be limited to, process piping, secondary clarifier equipment, peak flow clarifier equipment, etc.
- B. Work includes preparation, painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated.
 - 1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
- C. Work includes field painting of exposed 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 mechanical and electrical work, except as otherwise indicated.
- D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- E. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules." Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Engineer will select these from standard colors or finishes available.
- F. Following categories of work are not included as part of field-applied finish work.
 - 1. 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) acoustic materials, architectural casework, and finished mechanical and electrical equipment, including light fixtures, switchgear and distribution cabinets.
 - 2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces and duct shafts.
 - 3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
 - 4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.
- G. The following categories of work are included under other sections of these specifications.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.
 2. Unless otherwise specified, shop priming of fabricated components such as shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these specifications.
 3. Mechanical and Electrical Work: Painting of mechanical and electrical work is specified in Division 15 and 16, respectively, except as indicated in this Division.
- H. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Manual, or any equipment identification, performance rating, name, or nomenclature plates.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.
- B. Schedule: Submit a schedule listing together the substrates applicable to the project, the coating product to be used for each substrate and location, and the surface preparation to be performed for each substrate and location. Submittal of coating product data and certifications will not be accepted if they are not included on the coating schedule.
- C. Product Certification: Submit certification in writing by the paint manufacturer that each coating product is recommended and suitable for the specified substrate. The certification shall name the paint and any required primer, and shall include surface preparation instructions.
- D. Samples: Prior to beginning work, Engineer will be furnished color chips for surfaces to be painted. Use representative colors when preparing samples for review. Submit samples to Engineer for Owner's review of color and texture only. Provide a listing of material and application for each coat of each finish sample. Owner shall choose color of paint to be used.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- B. Coordination of Work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.
- C. Furnish paints that have been recommended by the manufacturer for the substrates and service conditions specified.
- D. Paint applicators shall have at least 5 years of experience in the application of coatings for water and wastewater facilities.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
 - 1. Name or title of material.
 - 2. Fed. Spec. number, if applicable.
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Manufacturer's name.
 - 5. Contents by volume, for major pigment and vehicle constituents.
 - 6. Thinning instructions.
 - 7. Application instructions.
 - 8. Color name and number.
 - 9. Material Safety Data Sheet (MSDS)
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.05 JOB CONDITIONS

- A. Apply water-base paints only when temperature of surface to be painted and surrounding air temperatures are between 50°F (10°C) and 90°F (32°C), unless otherwise permitted by paint manufacturer's printed instructions.
- B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45°F (7°C) and 95°F (35°C), unless otherwise permitted by paint manufacturer's printed instructions.
- C. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.
 - 1. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.
- D. Provide a minimum of 15 foot candles of lighting on surfaces to be finished,

1.06 SAFETY

- A. In accordance with the requirements of the OSHA Regulations for Construction, the Contractor shall provide and require the use of personal protective and lifesaving equipment for all persons working in or about the project.

- B. All pertinent local, state and federal safety regulations shall be adhered to rigidly. All safety precautions noted on the manufacturers Product Data Sheet and Material Safety Data Sheet shall be observed.
- C. Material Safety Data Sheets (MSDS) and Product Data Sheets for all paint, solvents and chemicals used, shall be available on the job site at all times.
- D. No smoking will be permitted in areas where paint mixing and thinning are in progress.
- E. Spray equipment must be grounded at all times during sandblasting and painting.
- F. Head and face protection and respiratory devices: Applicable health and safety precautions required by appropriate regulatory agencies such as OSHA, ANSI, etc. shall be followed.
- G. Ventilation shall be adequate to reduce the concentration of air contaminant to the degree that a hazard to the worker does exist.
- H. Whenever the occupational noise exposure exceeds the maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices. Noise levels cannot exceed OSHA or local regulations for other workers or residents.
- I. All temporary ladders and scaffolding shall conform to the applicable requirements of the OSHA Regulations for Construction. They shall be erected where requested by the Owner's Representative to facilitate proper inspection and be moved by the Contractor to locations requested by the Owner's Representative.
- J. The Contractor shall follow and strictly adhere to all applicable health and safety regulations and precautions as required by local, state, and federal regulatory agencies such for the surface preparation, removal, and waste disposal of all lead-based paint systems.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Tnemec
 - 2. Carboline Co.
 - 3. PPG
 - 4. Sherwin-Williams Company
 - 5. Or Approved Equal

2.02 MATERIALS

- A. Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

1. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.
 2. Federal Specifications establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums.
 3. Manufacturer's products which comply with coating qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to Engineer. Furnish material data and manufacturer's certificate of performance to Engineer for any proposed substitutions.
- B. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

PART 3 EXECUTION

3.01 INSPECTION

- A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.
- B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION

- A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
 1. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Engineer in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
 2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
 3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
- B. Cementitious Materials: Prepare cementitious surfaces of concrete and concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Remove existing paint or coatings on existing structures in

accordance with coating system manufacturer's recommendations for surface preparation.

1. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
- C. Ferrous Metal Surfaces: Clean non-galvanized, ferrous surfaces, which have not been shop-coated of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning, complying with Steel Structures Painting Council (SSPC) recommendations.
1. Blast clean steel surfaces as recommended by coating system manufacturer and in accordance with SSPC specifications for type of blast cleaning required. Minimum levels of surface preparation shall be SP5, White Metal Blast Cleaning for submerged surfaces and SP10, Near-White Blast Cleaning for exposed surfaces.
 2. Treat bare and sandblasted or pickled clean metal with metal treatment wash coat, prior to priming.
 3. Touch-up shop applied prime coats which have been damaged or bare areas. Wire-brush, solvent clean, and touch-up with same primer as shop coat.
 4. Blast clean existing equipment and piping as recommended by coating manufacturer and in accordance with SSPC recommendations. Where other surface preparations are proposed, submit manufacturer's written recommendations for the specific location considered.
- D. Ferrous metal surfaces which have an existing coating, please refer to the specific preparation requirements for the coating to be applied per this section.
- E. Non-Ferrous Metal Surfaces: Clean non-ferrous and galvanized surfaces in accordance with coating system manufacturer's instructions for type of service, metal substrate, and application required.

3.03 MATERIALS PREPARATION

- A. General: Carefully mix and prepare materials in compliance with manufacturer's directions.
1. Do not mix coating materials produced by different manufacturers, unless otherwise permitted by manufacturer's instructions.
 2. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 3. Stir materials before application to produce a mixture of uniform density, and as required during application. Do not stir film, which may form on surfaces, into material. Remove film, if necessary, strain material before using.
- B. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.04 APPLICATION

- A. General: Apply special coatings by brush, roller, spray, squeegee, or other applicators in accordance with manufacturer's directions. Use brushes best suited for type of material being applied. Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
1. Coating colors, surface treatments, and finishes, are indicated in "schedules" of the contract documents.
 2. Provide finish coats which are compatible with prime paints used.
 3. The number of coats and coating film thickness required is same regardless of the application method. Do not apply succeeding coats until previous coat has cured as recommended by coating manufacturer. Sand between coat applications where required to produce an even smooth surface in accordance with coating manufacturer's directions.
 4. Apply additional coats when undercoats or other conditions show through final coat until the cured film is of uniform finish, color and appearance.
 5. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces.
 6. Coat backsides of access panels, removable or hinged covers to match exposed surfaces.
- B. Minimum Coating Thickness: Apply each material at not thinner than manufacturer's recommended spreading rate. Provide a total dry film thickness of entire coating system as recommended by manufacturer, unless otherwise indicated.
- C. Prime Coats: Before application of finish coats, apply prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
1. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- D. Brush Applications: Brush-out and work brush coats onto surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
1. Brush apply primer or first coats, unless otherwise permitted to use mechanical applicators.
- E. Mechanical Applications: Use mechanical methods for coating application when permitted by coating material manufacturer's recommendations, governing ordinances, and trade union regulations.
1. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass, unless recommended by coating material manufacturer.

- F. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or recoat work not in compliance with specified requirements.

3.05 FIELD QUALITY CONTROL

- A. The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:
 - 1. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.
 - 2. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.
- B. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.06 CLEANUP AND PROTECTION

- A. Cleanup: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each workday.
 - 1. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer.
 - 1. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
 - 2. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.07 EXTERIOR COATING SCHEDULE

- A. General: Provide the following coating systems for the various substrates as indicated.
 - 1. Ferrous Metals:
 - a. Submerged Equipment, Structural Metals & Miscellaneous Metals:

Surface Prep.: SSPC SP10

First Coat:

PPG : Novaguard 840
4.0-8.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
3.0-5.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Second Coat:

PPG : Novaguard 840
4.0-8.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Third Coat:

PPG : Novaguard 840
4.0-8.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Or approved equal.

b. Submerged Piping – Ductile Iron Pipe:

Surface Prep.: NAPF 500-03-04 (piping)
NAPF 500-03-05 (fittings)

First Coat:

PPG: Amerlock Series
5.0-8.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
3.0-5.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Second Coat:

PPG: --

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Third Coat:

PPG : Amerlock Series
5.0-8.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Or approved equal.

c. Submerged Piping:

Surface Prep.: SSPC SP10

First Coat:

PPG: Novaguard 840
8.0-10.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
3.0-5.0 mils D.F.T.

Tnemec: Series 1
2.5-3.5 mils D.F.T.

Second Coat:

PPG: --

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
4.0-5.0 mils D.F.T.

Third Coat:

PPG : Novaguard 840
8.0-10.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Or approved equal.

d. Non-submerged Equipment, Structural Metals & Miscellaneous Metals:

Surface Prep.: SSPC SP6

First Coat:

PPG : Ameracoat 68 HS
3.0-5.0 mils D.F.T.

Sherwin-Williams: Corothane Galvapak
3.0-5.0 mils D.F.T.

Tnemec: Series 94-H2O
2.5-3.5 mils D.F.T.

Second Coat:

PPG: Pitt-thane Ultra Polyurethane 95 Series
2.0 to 3.0 mils DFT

Sherwin-Williams: Acrolon 218 HS
3.0-5.0 mils D.F.T.

Tnemec: Series 73 Endura-Shield
2.0-3.0 mils D.F.T.

Third Coat:

PPG : Corafon ADS Fluoropolymer Coating Gloss
1.5-2.0 mils D.F.T.

Sherwin-Williams: Fluorokem HS 100
2.0-3.0 mils D.F.T.

Tnemec: Series 700 Hydroflon
2.0-3.0 mils D.F.T.

Or approved equal.

e. Non-submerged piping – Ductile Iron Pipe:

Surface Prep.: NAPF 500-03-04 (piping)
NAPF 500-03-05 (fittings)

First Coat:

PPG : Amerlock 2 VOC
3.0-5.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
3.0-5.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Second Coat:

PPG: Amerlock 2 VOC
3.0 – 5.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
3.0-5.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Third Coat:

PPG: Amershield Series or Amercoat 450
3.0 – 4.0 mils D.F.T.

Sherwin-Williams: Acrolon Ultra
2.0-3.0 mils D.F.T.

Tnemec: Series 750
2.5-3.5 mils D.F.T.

f. Non-submerged piping:

Surface Prep.: SSPC SP6

First Coat:

PPG : Amerlock Series
3.0-5.0 mils D.F.T.

Sherwin-Williams: Corothane Galvpak
3.0-5.0 mils D.F.T.

Tnemec: Series 94-H2O
2.5 to 3.0 mils D.F.T.

Second Coat:

PPG: Amerlock Series
3.0 – 5.0 mils D.F.T.

Sherwin-Williams: --

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Third Coat:

PPG: Amershield Series or Amercoat 450
3.0 – 4.0 mils D.F.T.

Sherwin-Williams: Acrolon Ultra
2.0-3.0 mils D.F.T.

Tnemec: Series 750
2.5-3.5 mils D.F.T.

3.08 INTERIOR SPECIAL COATING SCHEDULE

A. General: Provide the following special coating systems for the various substrates as indicated.

1. Ferrous Metals:

a. Submerged Equipment, Structural Metals & Miscellaneous Metals:

Surface Preparation: SSPC-SP10 Near White Metal Blast Cleaning.

Primer Coat:

Tnemec: Series 91-H20 or 94H20 Hydro-Zinc
2.5 to 3.5 mils DFT

Sherwin-Williams: Zinc-Corothane 1 Galvapak
3.0 to 5.0 mils DFT

PPG: Amercoat 68HS Organic Zinc Rich Primer
2.5 to 3.5 DFT

Stripe Coat:

Tnemec: Series 20 Pota-Pox
2-3 mils

Sherwin-Williams: Sherplate PW
20 to 25 mils DFT

PPG: NovaGuard 840 Epoxy Novalac
20-24 mils

Finish Coat:

Tnemec: Series 22 Epoxoline
15-20.0 mils DFT

Sherwin-Williams: Sherplate PW
20 to 25 mils DFT

PPG: NovaGuard 840 Epoxy Novalac
15-20 mils DFT.

b. Non-submerged Equipment, Structural Metals & Miscellaneous Metals:

Surface Prep.: SSPC SP10

First Coat:

PPG : Amercoat 68HS
3.0-5.0 mils D.F.T.

Sherwin-Williams: Corothane Galvpak
3.0-5.0 mils D.F.T.

Tnemec: Series 94-H2O
2.5-3.5 mils D.F.T.

Second Coat:

PPG : Amerlock 2 Series
3.0-5.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Third Coat:

PPG : Amerlock 2 Seires
4.0-8.0 mils D.F.T.

Sherwin-Williams: Macropoxy 646
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Or approved equal.

c. Ductile Iron Pipe:

Surface Prep.: NAPF 500-03-04 (piping)
NAPF 500-03-05 (fittings)

First Coat:

PPG : Amerlock Series
3.0-5.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
3.0-5.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Second Coat:

PPG: Amerlock Series
3.0 – 5.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Third Coat:

PPG: Amersfield Series
3.0 – 5.0 mils D.F.T.

Sherwin-Williams: Macropoxy 646
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0mils D.F.T.

d. Non-submerged piping:

Surface Prep.: SSPC SP6

First Coat:

PPG : Amerlock Series
3.0-5.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
3.0-5.0 mils D.F.T.

Tnemec: Series 94-H2O
2.5 to 3.0 mils D.F.T.

Second Coat:

PPG: --

Sherwin-Williams: --

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

Third Coat:

PPG: Amerock sereis
3.0 – 4.0 mils D.F.T.

Sherwin-Williams: Macropoxy 5500
5.0-8.0 mils D.F.T.

Tnemec: Series 66HS
3.0-4.0 mils D.F.T.

3.09 INSPECTION

- A. At all times the Owner and/or the Engineer shall have access to the work in progress. Contractor shall perform, when requested, the inspections. Tests will be made for surface condition and profile after blasting, wet film thickness, dry thickness and pinholes. No pinholes will be allowed. The inspector will also check application practices. The Contractor shall re-paint all areas found defective and remove and replace any coatings placed using improper practices.
- B. In addition to the tests for surface profile, wet film thickness, dry film thickness and pinholes, which will be made during the progress of the work, the Contractor, in the presence of the Engineer, shall check the coatings after completion of the application for compliance with these specifications. All defects shall be promptly corrected by Contractor.
- C. Owner and Engineer shall be kept informed by Contractor as to the progress of the work. If Contractor fails to notify the Owner and Engineer of progressing work and the inspector has doubts of un-inspected work, the Contractor will be responsible to take whatever measures necessary including but not limited to re-blasting and/or repainting areas in question.

Key Areas of Owner and Engineer Notification by Contractor:

- a. Profile of blast
 - b. Prime coat film thickness
 - c. Stripe coat application and film thickness
 - d. Finish coat film thickness
- D. Owner and Engineer shall be kept informed by Contractor as to progress of work and any delays due to weather or equipment failure.

3.10 WARRANTY

- A. The Contractor shall warrant and guarantee that the materials and workmanship furnished under this contract shall be as specified and shall be free from defects for a period of one years from the date of final payment.
- B. Within the guarantee period and upon notification of the Contractor by the Owner, the Contractor shall promptly make all needed adjustments, repairs, or replacements arising out of defects which, in the judgment of the Owner and Engineer become necessary during such period.
- C. The costs of all materials, parts, labor, transportation, supervision, special tools and supplies required for replacement of parts, repair of parts, or correction of abnormalities shall be paid for by the Contractor, or by his surety under the terms of the Performance and Payment Bond.

- D. The Contractor also extend the terms of this guarantee to cover repair work and all replacement parts furnished under the guarantee provisions for a period of two years from the date of completion thereof.
- E. The coating will be inspected after one year to assure that no coating failure has occurred. If any corrosion, bubbling, delaminating or other indications of failure are detected, the Contractor will repair all affected areas.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01. SUMMARY

- A. This Section includes site preparation activities and items of earthwork necessary to complete the project.

1.02. SUBMITTALS

- A. Submit sieve analysis reports for all granular materials
 - 1. Analysis shall include the source location and material description
 - 2. Analysis shall have been performed within 12 months of the submittal.
- B. Submit to Engineer for approval the name, location, and qualifications of the independent soils testing agency selected and hired by the Contractor for compaction testing and soils inspection. Include the name and qualifications of the supervising professional engineer to be designated the Soils Engineer.
- C. Submit certified soils inspection and testing results as the work progresses:
 - 1. In-place moisture-density soil test reports. Fully document each specific location or stationing information, lift or approximate elevation, and date and other pertinent information.
 - 2. Inspection records of subgrade and compaction. Fully document each with specific location or stationing information, lift or approximate elevation, and date or other pertinent information.

1.03. QUALITY ASSURANCE

- A. American Society of Testing and Materials (ASTM):
 - 1. D698- Test method for laboratory compaction characteristics of soil using Standard Effort (12,400 ft-lbf-ft)
 - 2. D1556- Standard test method for density and unit weight of soil in place by the Sand-Cone Method.
 - 3. D1557- Test method for laboratory compaction characteristics of soil using Modified Effort (56,000 ft-lbf/ft³(2,700 KN-M/M³))
 - 4. D2167- Standard test method for density and unit weight of soil in place by the Rubber Balloon Method.
 - 5. D2922- Standard test methods for density of soil and soil aggregate in place by Nuclear methods (shallow depth)

6. D2937- Standard test method for density of soil in place by the Drive Cylinder Method.
 7. D4253- Standard test method for Maximum Index Density and unit weight of soil using a Vibratory Table.
 8. D4718- Standard practice for correction of unit weight and water content for soils containing oversize particles.
- B. American Association of State Highway and Transportation Officials Standard Method of Test (AASHTO):
1. T-96- Resistance to degradation of small size coarse aggregate by abrasion and impact by the Los Angeles Machine.
 2. T-99- The moisture density relations of soils using a 2.5 KG (5.5 lb) rammer and a 305 mm (12 in) drop.
 3. T-104- Soundness of aggregate by use of Sodium Sulfate or Magnesium Sulfate test.

1.04. SITE CONDITIONS

- A. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent interruptions of facility operations or travel.
- B. Lines and grades shall be as indicated on the plans.
- C. Contractor shall be responsible for all construction layout/staking to construct the work from control data furnished or established by the Engineer.
- D. Carefully maintain all bench marks, monuments and other reference points. Contractor shall be responsible for replacement if disturbed or destroyed.
- E. Disposition of Existing Facilities, Structures and Property:
1. Adequately protect from damage all existing utilities, structures and property and remove or relocate only as indicated, specified or as directed by the Engineer.
 2. Report inactive and abandoned utilities encountered in excavating and grading operations. Remove, plug, or cap as directed.
 3. Confine operations to that area provided through easements, licenses, agreements and rights-of-way. The Contractor's entrance upon any lands outside of that area provided by easements, licenses, agreements or public rights-of-way, shall be at the Contractor's sole liability.

PART 2 - PRODUCTS

2.01. MATERIALS

- A. Materials Classification:
1. All materials encountered, regardless of type, character, composition, or condition thereof, shall be unclassified.

- B. Excavation shall include all materials found within the designated limits for excavation.
 - 1. Determine quantity of various materials to be excavated prior to submitting Bid Form.
 - 2. Arrangements for entry to site for purpose of conducting subsurface investigations, including test borings, shall be made with Owner.
- C. Material properties for compaction:
 - 1. Cohesionless materials include gravels, gravel-sand mixtures, sands and gravelly sands exclusive of clayey and silty material - materials which are free-draining and for which impact compaction will not produce a well-defined moisture-density relationship curve and for which the maximum density by impact methods will generally be less than by vibratory methods.
 - 2. Cohesive materials include silts and clays generally exclusive of sands and gravel - materials for which impact compaction will produce a well-defined moisture-density relationship curve.
- D. Waste Materials:
 - 1. Includes excess suitable material and material unsuitable for use in the Work.
 - 2. Remove from work area as excavated.
 - 3. Keep excess suitable material segregated from other waste material.
 - 4. Dispose of waste material on site as directed by the Engineer, or off site.
 - 5. Grade waste areas and leave them with an orderly and neat appearance.
- E. Borrow Materials:
 - 1. Refers to all backfill and embankment material obtained from approved locations on or off the jobsite.
 - 2. Borrow shall include all excavating, handling and final disposal of material as specified.
 - 3. Material removed from borrow area(s) shall be approved by the Engineer.
 - 4. Leave on-site borrow area(s) graded to drain and to present a neat appearance.
- F. Granular Fill and Pipe Embedment Materials.
 - 1. Material shall be crushed limestone or crushed natural gravel with the following gradation:
 - 2.
 - 3.
 - 4.
 - 5.

Sieve Designation	Percent Passing By Weight
1"	G. 100
1/2"	H. 55-90
No. 4	I. 8-40
No. 10	J. 0-15
No. 200	K. 0-4

1. Material shall not have a loss of more than 15% after 5 cycles when tested for soundness with sodium sulfate as described in AASHTO T104.
2. Use:
 - a. Under slabs on grade.
 - b. To correct over excavation in trenches.
 - c. As pipe embedment.

L. Aggregate Drainage Materials:

1. Material shall be crushed limestone or crushed natural gravel with the following gradation:

2.02. SIEVE DESIGNATION	2.03. PERCENT PASSING BY WEIGHT
2.04. 1"	A. 100
2.05. 3/4"	A. 50-100
2.06. 1/2"	A. 0-15
2.07. NO. 10	A. 0-4

1. Material shall not have a loss of more than 15% after 5 cycles when tested for soundness with sodium sulfate as described in AASHTO T104.
2. Use:
 - a. Under slabs and mats where pressure relief valves or perforated drains are used for groundwater control.
 - b. At base of walls where perforated drains are shown.

B. 1-IN Minus (MoDOT Type 1) Aggregate:

1. Material shall consist of crushed stone, sand and gravel or reclaimed asphalt or concrete. Aggregate shall have the following gradation:

2.08. SIEVE DESIGNATION	2.09. PERCENT PASSING BY WEIGHT
2.010. 1"	A. 100
2.011. 1/2"	A. 60-90
2.012. NO. 4	A. 35-60
2.013. NO. 30	A. 10-35

1. Aggregate shall not contain more than 15 percent deleterious rock and shale.
2. The fraction of material passing the No. 40 sieve shall have a minimum plasticity index of six (6).
3. Any sand, silt and clay or deleterious rock, shale shall be uniformly distributed throughout the material
4. Use:
 - a. Under slabs and mats where engineered granular fill is required to remediate highly plastic and low strength soils.
 - b. As directed on the plans.

B. Base Stabilization Rock:

1. Crusher run limestone, 4" maximum size.

C. Topsoil Materials:

1. Includes those materials obtained from excavation or borrow area(s) which are free from roots, rocks and debris and which are suitable for supporting growth of vegetation.

D. Backfill Materials:

1. Include suitable approved materials from excavations and borrow area(s).
2. Shall be friable sandy or silty clay containing fine material sufficient to provide a dense mass free of voids and capable of satisfactory compaction.
3. Shall be free of roots or other organic matter, refuse, cinders, ice, snow, frozen earth, or other unsuitable matter.

4. Do not use material containing gravel, stones, or shale particles greater in dimension than one-half the depth of the layer to be compacted.
 - a. Larger rocks may be incorporated in embankments where specifically directed by the Engineer.

PART 3 - EXECUTION

3.01. CLEARING AND GRUBBING

- A. Perform clearing and grubbing where indicated and as necessary to perform excavation, trenching, embankment, borrow and other work required.
- B. Clearing:
 1. Clearing includes felling and disposal of trees and brush. Remove only those trees necessary for prosecution of the work. Preserve and protect all trees not specifically required to be removed.
 2. Temporarily remove existing fences within the limits of clearing.
- C. Grubbing:
 1. Removal and disposal of tree stumps and roots larger than 3 inches in diameter.
 2. Remove to a depth of at least 18 inches below existing grade.
 3. Backfill all excavated depressions with approved material and grade to drain.

3.02. DEMOLITION

- A. Remove existing equipment or structures as indicated, or as required to perform new construction.
- B. Materials not indicated or specified to be relocated or returned to Owner shall be disposed of as specified in "Disposal of Debris" in this section.
- C. Relocation and return of material or equipment:
 1. Carefully dismantle, in manner to avoid damage, all materials and equipment specified or indicated to be relocated or returned to Owner.
 2. Store materials and equipment to be reused in a manner to avoid corrosion, staining, breakage, or damage.
 3. Material or equipment specified or indicated to be relocated or returned to the Owner and damaged due to Contractor's negligence shall be repaired or replaced as directed by Engineer.
- D. Obstructions:
 1. Sidewalks, driveways, curb and gutter, drainage structures and similar obstructions permitted to be removed shall be cut in straight lines or removed to the nearest construction joint if located within five feet of the edge of the excavation. In no case

shall the joint or line of cut be less than one foot outside the edge of the excavation. Surface obstructions removed to permit construction shall be reconstructed as specified and to the dimensions, lines and grades of original construction.

2. Fences interfering with construction, and located within public rights-of-way or as may be allowed for in permits or agreements, may be removed by the Contractor. Provide narrow trench openings in fence with a temporary gate, maintained in a closed position except to permit passage of equipment and vehicles. Fences within temporary construction easements may be removed by the Contractor provided that temporary fencing is installed in such a manner as to serve the purpose of the fencing removed. The Contractor shall locate and record all fence corners prior to removal. Restore all removed fencing to the condition existing prior to construction unless otherwise specified or directed. The Contractor shall be solely liable for the straying of any fenced or corralled animals or other damage caused by any fence so removed.

3.03. STRIPPING

- A. Remove topsoil from areas within limits of excavation, trenching, borrow and areas designed to receive embankment or compacted fill.
- B. Scrape areas clean of all brush, grass, weeds, roots and other unsuitable material.
- C. Strip to a minimum depth of 6 inches, and to a sufficient depth to remove excessive roots in heavy vegetation or brush areas and as required to segregate topsoil.
- D. Stockpile topsoil reasonably free of subsoil, debris and stones larger than 2-inch diameter, in sufficient quantity to complete the work. Stockpile shall not interfere with construction operations and existing facilities.

3.04. DISPOSAL OF DEBRIS

- A. Dispose of debris off the jobsite at a location provided by the Contractor.
- B. Combustible waste material and debris may be burned if permitted by local regulations. Burning is subject to the Contractor obtaining required permits and conducting burning operations in accordance with Federal, State and local regulations.

3.05. EXCAVATION SUPPORT

- A. Support excavations and slopes using sheeting, bracing, or other means as necessary to:
 1. Protect life and property.
 2. Conform to Federal, State and local regulations.
 3. Avoid excessively wide cuts in unstable material.
 4. Protect existing structures and facilities from soil movement.
- B. Plan layout of excavation operations to protect adjacent property and existing structures and facilities.
- C. Take precautions against movement or settlement of existing structures. Establish and record elevations of existing facilities near excavations before excavating. Remove sheeting and bracing in a manner that does not create voids or induce settlement of adjacent soil.

- D. If existing or adjacent structures show structural distress, or become endangered by any condition or event, cease operations immediately and notify Engineer. Do not resume operations prior to correction or modification of procedures leading to the unstable condition.

3.06. EXCAVATION

A. General:

- 1. Includes excavation for the installation to the alignment and elevation indicated of ground wires, electrical conduits, storm drainage pipes, process piping and structures.

B. Trenches:

1. Ground Wires and Electrical Conduits:

- a. Remove material required for alignment and elevation, or minimum depth of installation.

2. Pipes:

- a. Trench depth to provide embedment and to remove unsuitable bottom material.
- b. Trench width, at top of pipe and below, to be between pipe outside diameter plus 1 foot (minimum) and plus 2 foot (maximum).
- c. Trench walls to be vertical below the top of pipe and may be vertical or sloped above top of pipe as determined by the stability of the material being trenched.
- d. Trenches to be sheeted and braced when required.
- e. Maximum length of open trench shall comply with local codes and shall not exceed 400 feet.
- f. Erect barriers or other appropriate protection to prohibit accidental or unauthorized entry of persons into trenches.

C. Structures: Perform as specified for "Trenches" and as follows:

- 1. Excavate area adequate to permit erection and removal of forms.
- 2. Trim to neat lines where concrete is to be deposited against earth.
- 3. Excavate by hand in areas where space and access will not permit use of machines.
- 4. Notify Engineer immediately when excavation has reached the depth indicated. Do not proceed further until approved.
- 5. Restore bottom of excavation to proper elevation in areas over excavated, as follows:
 - a. For structures supported by piles or caissons, with compacted embankment.
 - b. For structures supported by concrete footings or mats, with concrete.

6. Excavate rock, where encountered, to a distance of at least three (3) feet away from outside of structure walls. Bench any additional rock excavation required for stability during construction to maintain vertical cuts. Perform such additional excavation and furnish any additional backfill subsequently required at no extra cost to Owner.

D. Blasting:

1. Blasting shall not be allowed within the scope of this project without written authorization of the Owner and Engineer,

3.07. DEWATERING

- A. Control grading around excavations to prevent surface water from flowing into excavation.
- B. Drain or pump surface and groundwater as required to continually maintain all excavations and trenches free of water or mud. Commence when water first appears and continue until work is complete to the extent that no damage will result from the presence of water.
- C. Discharge to approved drains or channels. Contractor shall obtain State or local permits for discharge if such are required. Water discharged to streams shall be free of silt and other objectionable materials. Discharge water so that the work in progress and other properties are not damaged. Do not interfere unduly with the use of streets, alleys, private drives, or entrances.
- D. Use pumps of adequate capacity to ensure rapid drainage.
- E. Construct and use drainage channels and subdrains as required.
- F. Remove unsuitable excessively wet materials and replace with approved material.

3.08. STOCKPILING

- A. Stockpile in amounts sufficient for and in a manner to segregate materials suitable for backfilling trenches and structures.
- B. Do not obstruct or prevent access to roads and drives.
- C. Do not obstruct drainage patterns.
- D. Stockpile material in such a manner as to limit potential for erosion and inundation as a result of local or global flooding. Coordinate stockpiles locations with Owner.

3.09. COMPACTION AND TESTING FOR EMBANKMENT, BACKFILLING, AND SUBGRADE

- A. Perform wetting or drying of compacted material as required to obtain specified density. Moisture content at time of placement shall not be less than optimum or more than 4 percent above optimum as determined by ASTM D 698.
- B. Do not place snow, ice or frozen earth in compacted soil and do not place compacted soil on a frozen surface.
- C. Remove waste material, trees, organic material, rubbish, or other deleterious substances from soil to be compacted.

- D. An acceptable testing laboratory shall be selected and paid for by the Contractor to perform all laboratory and field soil testing necessary to demonstrate compliance with compaction requirements. The soil density testing frequency shall be as follows:
 - 1. For trenches within street right-of-way, or under drives or parking lots, density tests representative of each three (3) feet of trench depth shall be taken at five hundred (500) linear foot intervals along the lines. Concentrate tests at cross streets and drives.
 - 2. For trenches outside the street right-of-way, density tests representative of each three (3) feet of trench depth shall be taken at one thousand (1000) linear foot intervals along the lines.
 - 3. For structural backfill, density tests representative of each 100 cubic yards of fill shall be taken.
 - 4. For compacted subgrade, density tests representative of each 500 square yards of subgrade shall be taken.
- E. Perform testing in accordance with ASTM D 698 where AASHTO T-99 or "Standard Proctor" has been indicated. AASHTO T-99 may be used only with prior written approval of the Engineer.
- F. Cohesionless material shall be compacted to 75% of relative density as determined by ASTM D4253 unless otherwise noted.

3.010. EMBANKMENT

- A. Placement:
 - 1. Place to the contours and elevations indicated.
 - 2. Place embankment material in lifts not exceeding eight (8) inches (uncompacted depth).
 - 3. When rocks larger than four inches are present, they shall be scattered and thoroughly consolidated with sufficient compacted soil to completely fill all voids between the rocks. Exclude rocks larger than one half the depth of the lift from the top two (2) feet of the embankment.
- B. Compaction:
 - 1. Cohesive material in embankment shall be compacted to 95% of maximum density at optimum moisture as determined by ASTM D 698.
 - 2. Cohesionless material in embankment shall be compacted to 75% of relative density as determined by ASTM D4253.

3.011. BACKFILLING

- A. Place backfill to the elevations indicated.
- B. In areas requiring 95 percent compaction, place backfill in lifts not exceeding eight (8) inches (uncompacted depth). Place in twelve (12) inch maximum lifts in other areas.

- C. Obtain compaction specified by normal methods and equipment. Accomplish without inundation or flooding.
- D. Complete promptly after approval to proceed.
- E. Backfill failing to meet specified densities shall be removed or scarified and recompacted to meet specified densities.
- F. Use acceptable topsoil materials for top layers of compacted backfill in pasture land, lawns, parks, and gardens.
- G. Trenches:
 - 1. Backfill pipes in 6 inch lifts deposited alternately on opposite sides of pipe to a plane 12 inches above pipe.
 - 2. Compact backfill to 95 percent of maximum density (ASTM D 698) under all areas to be surfaced with concrete, asphaltic concrete, or gravel, including streets, drives, sidewalks, and parking areas, and under developed lots and lawns. Compact all other backfill to 90 percent of maximum density (ASTM D 698).
 - 3. No rock greater than one (1) foot, measured along its longest axis, shall be placed within two (2) feet of the top of a pipe in any backfill. No rocks greater than one (1) foot will be allowed in the backfill above service line terminations, tees and wyes.
- H. Structures:
 - 1. Compact backfill to 95 percent of maximum density (ASTM D 698) under all structures and in excavations adjacent to structures.
 - 2. Backfill only after concrete has attained 70 percent of its design strength.
 - 3. Backfill adjacent to structures only after, in the opinion of the Engineer, a sufficient portion of the structure has been completed to resist the imposed soil load.
 - 4. Remove all forms and debris from excavation prior to placing backfill.
 - 5. Backfill within one (1) foot of structure shall be free of gravel, rock or shale particles larger than four (4) inches.
 - 6. Bring lifts up simultaneously on all sides of structures.
 - 7. Exercise caution in the use of heavy equipment in areas adjacent to structure to avoid high lateral stress on the structure walls. Use only light equipment to place backfill within twenty (20) feet of the structure.
 - 8. Where structural excavation has been through rock, backfill with compacted granular fill to top of rock formation, unless indicated otherwise on the drawings. Where entire excavation is in rock, terminate granular backfill 2 feet below finished grade. Place geotextile filter fabric over granular backfill and continue backfill to finish grade with suitable approved material.

3.012. SUBGRADE PREPARATION

A. General:

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Earthwork

1. Excavate or place embankment as required to construct subgrades to elevations and grades indicated.
 2. Remove all unsuitable material and replace with approved embankment material. Perform all wetting, drying, shaping, and compacting required to prepare a suitable subgrade.
- B. Roughen subgrade for embankment by discing or scarifying and wet or dry the top 6 inches as required to insure bond with embankment.
- C. Extend subgrade the full width of surfaced areas plus one foot.
- D. Compact the top six inches of subgrades for traffic areas and slabs on grade to 95 percent of maximum density (ASTM D 698).
- E. Proofroll subgrade after moisture conditioning and compaction to identify soft or disturbed areas. Use a fully loaded tandem axle dump truck or equipment providing an equivalent loading for proofrolling. Undercut and replace soft areas identified by proofrolling with structural backfill if so directed by the Engineer.

3.013. GRANULAR FILL, PIPE EMBEDMENT

- A. Place on subgrades where indicated prior to placing concrete slabs on grade.
- B. Place in trench to limits indicated. Provide for proper support of pipe and even distribution around pipe.
- C. Compact as indicated, in lifts not to exceed 6 inches, using approved vibratory equipment.
- D. Trenches: At intervals not to exceed 400 feet, or closer if so indicated, provide trench bedding cut-off wall 5 feet in length constructed of select impermeable material hand-placed and compacted around pipe.

3.014. PLACEMENT OF TOPSOIL

- A. Place topsoil on all areas indicated.
- B. Placement:
1. Clear site of vegetation heavy enough to interfere with proper grading and tillage operations.
 2. Clear surfaces of all stones or other objects larger than 3 inches in thickness or diameter, all roots, brush, wire, grade stakes, or other objectionable material.
 3. Loosen subgrade by discing or scarifying to a depth of 2 inches wherever compacted by traffic or other causes to permit bonding of the topsoil to the subgrade.
 4. Distribute topsoil over required areas without compaction other than that obtained with spreading equipment.
 5. Place material within following limits:
 - a. Not less than four (4) inches in depth.

- b. Not more than six (6) inches in depth.
- 6. Shape cuts, fills and embankments to contours indicated.
- 7. Grade to match contours of adjacent areas and permit good natural drainage.
- 8. Grade a gentle mound over trenches.
- C. After spreading topsoil, clear surface of stones or other objects larger than two (2) inches in thickness or diameter and of objects that might interfere with planting and maintenance operations.
- D. Protect areas from erosion until grass is established. Repair eroded areas as required.

3.015. MAINTENANCE AND REPAIR

A. Maintenance:

- 1. Protect newly graded areas from actions of the elements.
- 2. Settling or erosion shall be filled, repaired and grades reestablished to elevations and slopes indicated.

B. Correction of Settlement:

- 1. Settlement of embankments, backfill, or trenches occurring within the One Year Correction Period after Final Acceptance shall indicate defective work and shall be promptly corrected if the settlement results in the following:
 - a. Visible depressions, ruts, or ground slumping.
 - b. Pooling of water where positive slope existed or has been required.
 - c. Voids beneath or beside slabs or structures.
 - d. Movement of soil exposing unfinished or waterproofed structure surfaces.
 - e. Movement of structures or facilities, including but not limited to foundation settlement, differential settlement, cracking, misalignment of adjacent objects, or movement of vertical elements out of plumb.
- 2. Contractor shall correct settlement and damages arising from or attributable to the settlement.
- 3. Make repairs within ten (10) days from and after due notification by Owner of embankment or backfill settlement and resulting damage.
- 4. Make own arrangements for access to the site for purposes of correction and maintenance of corrected areas.

END OF SECTION

SECTION 31 23 23

FLOWABLE FILL

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes flowable fill for use as a removable high density backfill material where shown on the drawings. Flowable fill is a controlled low strength material and shall not be used in place of concrete.

1.02 SUBMITTALS

- A. Product Data: Submit data for proprietary materials including admixtures.
- B. Mix design for each mix used with aggregate gradation information.
- C. Mill Certification of cement.
- D. Class and source of fly ash.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the latest editions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:
 - 1. American Society for Testing and Materials (ASTM):
 - C33 - Concrete Aggregates.
 - C40 - Organic Impurities in Sands for Concrete.
 - C94 - Ready-Mixed Concrete.
 - C150 - Portland Cement.
 - C231 - Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - C233 - Testing Air-Entraining Admixtures for Concrete.
 - C260 - Air-Entraining Admixtures for Concrete.
 - C311 - Sampling and Testing Fly Ash or Natural Pozzolans for Use as Mineral Admixtures in Portland Cement Concrete.
 - C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - 2. American Concrete Institute (ACI):
 - 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

PART 2 PRODUCTS

2.01 FLOWABLE FILL MATERIALS

- A. Portland Cement: ASTM C 150 Type I.

- B. Fly Ash: Class C or F.
- C. Fine Aggregate: Uniformly graded sand conforming to ASTM C33 except that the following gradation limits shall apply:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch	100
No. 200	0 - 5

- D. Mixing Water: Drinkable and free from foreign materials in amounts harmful to concrete.
- E. Air-Entraining Admixtures: Conform to ASTM C260 and manufacturer's recommendations for use. Technical assistance of the manufacturer's field representative shall be furnished upon request. Testing of air-entraining admixtures shall conform to ASTM C233.

2.02 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for flowable fill on the basis of field experience.
- B. Flowable Fill Qualities Required: Design flowable fill mixes to provide a flowable, non-segregating slurry:
 - 1. Air content shall be between 5 to 7 percent.
 - 2. Flowable fill is not intended to achieve a compressive strength in excess of 200 pounds per square inch. A compressive strength of 20 psi is required at 3 days to assure adequate in-place bearing as a fill. Testing of flowable fill for compressive strength shall not be required unless directed by the Engineer.
- C. Cement and Fly Ash Content: Each cubic yard of flowable fill shall contain quantities of cement and fly ash within the following limits per cubic yard:

Cement	50 - 100 pounds
Fly Ash	100 - 300 pounds

The water content of the flowable fill mix shall be as required to obtain the proper solids suspension and flowability.

- D. Mix Design: Field experience using test results within the preceding 90 days with the materials and plant to be employed shall be the basis of mix proportions. Proposed mix proportions shall be sent to Engineer, and his approval obtained prior to placing all flowable fill.
- E. Measurement of materials shall conform to ACI 304. Measure materials within 1 percent by weight for aggregates and cement, and within 1-1/2 percent by volume or by weight for water.
- F. Mixing and delivery shall conform to ACI 304. Batch Plant Mixer shall conform to Mixer Manufacturers Bureau Concrete Mixer Standards, AGC, adequate to handle 1 or more full-sack batches.
- G. Mixing of flowable at the plant off the jobsite requires a central mixer or truck mixer. Truck mixer shall conform to "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau," of the National Ready-Mix Concrete Association. Ready-mixed flowable fill shall be produced

and delivered conforming to ASTM C94 as applicable. Contractor shall furnish Owner with a delivery ticket for each load of flowable fill. The ticket shall have the following information recorded:

1. Mix number.
2. Ticket number.
3. Time batched.
4. Time arrived on jobsite.
5. Amount of flowable fill (by volume).
6. Quantities of materials batched (by weight).

PART 3 EXECUTION

3.01 FLOWABLE FILL PLACEMENT

- A. Flowable fill shall be discharged by any reasonable means into the area to be filled. Fill levels shall be kept uniform. Levels on opposite sides of a pipe or structure shall be kept at approximately the same elevation at all times.
- B. When filling enclosed locations such as abandoned pipes, basins or tanks, sufficient means for displacement of air shall be made. Cutting or breaking access holes may be required. Filling shall be confirmed by visual observation of fill overflowing from the highest openings. Fill placement in enclosed locations shall be uninterrupted.
- C. Flowable fill shall be contained to avoid spillage into other areas. Forms or bulkheads shall have sufficient strength to resist the fluid pressure of the fill before hardening. Culverts or structures shall have joints and cracks covered with approved engineering fabric to prevent leakage. Aggregate drainage material adjacent to flowable fill shall be covered with approved engineering fabric.
- D. Culverts, pipes, tanks and basins shall be secured to avoid flotation. Temporary restraint with equipment such as a backhoe will not be acceptable. If flotation occurs or is suspected, filling operations shall be terminated. Previously placed fill shall be immediately removed, and the structure shall be reset and secured properly.
- E. Obtain approval of Engineer prior to placing fill against structures. Daily depth of fill against structures may be limited to prevent damage due to fluid pressure.

3.02 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Fluidity: Testing for fluidity shall be performed as requested by the Engineer if the consistency of the mix appears inadequate for the work to be performed. Contractor shall furnish test equipment and trained personnel to perform all required field tests.

Fluidity of the flowable fill shall be measured by the Corps of Engineers flow cone method (Corps specification CRD-C611-80). Prior to filling the flow cone with flowable fill, the mixture shall be passed through a 1/4 inch screen. Time of efflux shall be 10 to 16 seconds for

placement in enclosed locations, and 10 to 26 seconds for placement in open locations such as trenches. Contractor shall adjust mix proportions as necessary to produce flowable fill of the required consistency.

END OF SECTION

SECTION 31 25 13
DUST AND EROSION

CONTROL

PART 1 - GENERAL

1.01. SUMMARY

- A. This item shall consist of temporary control measures during the life of a contract to control air pollution, soil erosion, and siltation through the use of berms, dikes, dams, sediment basins, fiber mats, gravel mulches, grasses, slope drains, and other erosion control devices or methods.

The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

1.02. SUBMITTALS

- A. Prior to the commencement of construction activities, submit:
1. A detailed proposal of all methods of control and preventative measures to be utilized to limit discharge of soil sediment and other significant materials from the construction site.
 2. A drawing of the work area, haul routes, storage areas, access routes, etc. Provide a detailed assessment of the current land conditions, including trees and vegetation.
 3. A copy of the NPDES permit for storm water discharges from the construction site, when applicable.
 4. A copy of the stormwater pollution prevention plan (SWPPP) for review and comment by the Owner and Engineer.

1.03. RELATED SECTIONS

- A. Section 310000 – Site Preparation & Earthwork

1.04. REFERENCES

- A. "Protecting Water Quality, a Field Guide to Erosion, Sediment and Storm Water Best Management Practices for Development Sites in Missouri and Kansas".

1.05. SITE DESCRIPTION – ONONDAGA CAMP

- A. Project Name: Onondaga Campground Water and Wastewater Improvements
- B. Location: Leasburg, Missouri
- C. County: Crawford
- D. Description:
 - 1. NW1/4 Sec35 T39N R3W
- E. Developer: State of Missouri, 620 N Jefferson St, St. James, MO 65559
- F. Project Description: Project involves the installation of a new water line connecting the existing water line into a loop, replacing a PRV, replacing and relocating a PRV, modifying the ground storage tank, and demolition and reconstructing a new well house.
- G. Predevelopment Runoff Coefficient: C=0.362
- H. Post Development Runoff Coefficient: C=0.362
- I. Total Area of Site: 4.87 Acres
- J. Disturbed Area: 1.62 Acres
- K. Receiving Stream:
 - 1. Meramec River
- L. SWPPP Coordinator: Contractor to designate:
- M. MoDNR Regional Office: P.O. Box 176, Jefferson City, MO 65102
- N. MoDNR Phone: 573-751-3443

1.06. SITE DESCRIPTION – MERAMEC CAMP

- A. Project Name: Meramec Campground Water and Wastewater Improvements
- B. Location: Sullivan, Missouri
- C. County: Franklin
- D. Description:
 - 1. Sec12 T40 R2W
- E. Developer: State of Missouri, 620 N Jefferson St, St. James, MO 65559
- F. Project Description: Project involves the installation of a new waterlines connecting the existing water line into two loops, adding a PRV, and demolition and reconstructing a new well house.

- G. Predevelopment Runoff Coefficient: C=0.496
- H. Post Development Runoff Coefficient: C=0.496
- I. Total Area of Site: 19.54 Acres
- J. Disturbed Area: 2.98 Acres
- K. Receiving Stream:
 - 1. Meramec River
- L. SWPPP Coordinator: Contractor to designate:
- M. MoDNR Regional Office: P.O. Box 176, Jefferson City, MO 65102
- N. MoDNR Phone: 573-751-3443

PART 2 - PRODUCTS

2.01. MATERIALS

- A. Compost Berms:
 - 1. Compost should consist of both fine and coarse grades for maximum filtration. Fine grades shall have a maximum particle size of 3/8" to 1/2". Coarse grades shall have a maximum particle size of 2" to 3". All berms shall have a ratio of coarse and fine material of 1:1. No particle should be greater than 3".
 - 2. The recommended moisture content ranges from 20-50%.
 - 3. The percentage of carbon based materials in finished compost should range between 40-70%.
 - 4. The pH should be between 5.0 and 8.5.
 - 5. Nitrogen Content: 0.5-2.0%.
 - 6. Compost should have a minimum soluble salt level between 4.0 and 6.0 mmhos/cm.
 - 7. Compost must be weed and pesticide free, with manmade materials comprising less than 1%
- B. Erosion Control Blankets:
 - 1. Erosion control blanket shall be an extended-term machine produced blanket of 70 percent agricultural straw and 30 percent coconut fiber matrix with a functional longevity of up to 24-months. The blanket shall be of consistent thickness with the straw and coconut evenly distributed of the entire area of the blanket.
 - 2. The blanket shall be covered on the top side with heavy weight photodegradable polypropylene (3.0lbs/1000 sq. ft) netting having ultraviolet additives to delay breakdown and an approximate mesh opening of 0.5 by 0.5-inches.

3. The blanket shall have a light weight (1.5lbs/1000 sq. ft) photodegradable polypropylene netting on the bottom, with a mesh opening of approximately 0.5 by 0.5-inches.
 4. The blanket shall be sewn together with degradable thread.
- C. Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all Federal and state regulations and to the standards of the Association of Official Agricultural Chemists.
- D. Grass. Grass which will not compete with the grasses sown later for permanent cover shall be a quick-growing species (such as ryegrass or cereal grasses) suitable to the area providing a temporary cover.
- E. Inlet Pavement Filters:
1. Inlet pavement filters shall consist of 9-inch diameter tubes made of synthetic filter fabric filled with recycled discrete synthetic fibers.
 2. Pavement filter length shall be 24-inches greater than inlet curb opening or grate dimension.
 3. Aggregate filter pouch shall be present for use with grated or combination inlets.
- F. Mulches. Mulches may be hay, straw fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials.
- G. Silt Fence:
1. The geotextile fabric shall be composed of high-tenacity polypropylene, nylon, polyester ethylene yarns, which are woven into a stable network such that the yarns retain their relative position.
 2. The geotextile fabric shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis and acids.
 3. The geotextile fabric shall meet AASHTO M288-00 specification for Class 1 unsupported silt fence.
 4. Support posts shall be 1.25" (min.) diameter hardwood or 1lbs/linear foot steel. The posts shall have projections for fastening the geotextile fabric.
 5. The height of the silt fence shall not exceed 36-inches above the existing grade. The storage height of the fence should not exceed 18-inches.
- H. Slope Drains. Slope drains may be constructed of pipe, fiber mats, rubble, portland cement concrete, bituminous concrete, or other materials that will adequately control erosion.
- I. Straw bales:
1. Straw bales shall consist of rectangular-shaped bales of hay or straw weighing at least 50 pounds per bale with a minimum size of 1.0' x 1.5' x 3.0'.
 2. The hay or straw material shall be free from primary noxious weed seeds and rough or woody materials.

J. Triangular Silt Dike:

1. Temporary silt dikes shall be triangular-shaped, having a height of at least eight to ten inches (8" - 10") in the center with equal sides and a sixteen- to twenty-inch (16" - 20") base.
2. The triangular-shaped inner material shall be urethane foam.
3. The outer cover shall be a woven geotextile fabric placed around the inner material and allowed to extend beyond both sides of the triangle two to three (2' - 3') feet.
4. Standard length of each dike will be seven feet (7') unless otherwise indicated on the plans.
5. The Dikes shall be attached to the ground with wire staples. The staples shall be No. 11 gauge wire and be at least six to eight (6" - 8") inches long. Staples shall be placed as indicated on the installation detail."

K. Straw Wattles:

1. Straw wattles shall consist tightly rolled bales of hay or straw, having a diameter of at least eight to twenty inches (8"-20").
2. The hay or straw material shall be free from primary noxious weed seeds and rough or woody materials.
3. Stakes shall be willow or wooden stakes.

- L. Other. All materials shall meet commercial grade standards and shall be approved by the Engineer before being incorporated into the project.

2.02. SIGNIFICANT MATERIAL INVENTORY

- A. The following list of significant materials that might potentially be released with storm water discharges from the job site during construction. The contractor shall be responsible for monitoring and assuring that the materials listed in the inventory do not migrate off site via storm water runoff during construction.

Material Trade Name	Chemical/Physical Description	Storm Water Pollutants
Erosion	Solid Particles	Soil, sediment
Fertilizer	Liquid or solid grains	Nitrogen, phosphorus
Pesticides (insecticides, fungicides, herbicides, rodenticides)	Various colored to colorless liquid, powder, pellets, or grains	Chlorinated hydrocarbons, organophosphates, carbonates, arsenic
Asphalt	Black solid	Oil, petroleum distillates
Concrete	White solid	Limestone, sand
Plaster	White granules or powder	Calcium Sulphate, calcium carbonate, sulfuric acid
Glue, adhesives	White or yellow liquid	Polymers, epoxies
Paints	Various colored liquid	Metal oxides, Stoddard solvent, talc, calcium carbonate, arsenic
Curing compounds	Creamy white liquid	Naphtha
Wood preservatives	Clear amber or dark brown liquid	Stoddard solvent, petroleum distillates, arsenic, copper, chromium.
Hydraulic oil/fluids	Brown oily petroleum hydrocarbon	Mineral oil
Gasoline	Colorless, pale brown or pink petroleum hydrocarbon	Benzene, ethyl benzene, toluene, xylene, MTBE
Diesel Fuel	Clear, blue-green to yellow liquid	Petroleum distillate, oil & grease, naphthalene, xylenes
Antifreeze/coolant	Clear green/yellow liquid	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)

PART 3 - EXECUTION

3.01. GENERAL.

- A. The contractor shall be responsible for managing storm water runoff and erosion during the course of construction. The contractor shall implement BMPs as deemed necessary to adequately retain sediment and construction materials on-site. Any modifications to the implemented BMPs shall be documented using the appropriate forms, which shall be kept in a log book. The log book shall be kept on the job site and shall be available immediately for review by governing authorities, at their request.

- B. All BMPs shall be inspected once a week and immediately after each significant rain event (0.5-inches in 24-hours). All appropriate measures must be taken to repair BMPs if damage is observed during the investigations.
- C. The appropriate inspection and maintenance forms must be filled out during each inspection. The inspection and maintenance forms must be saved in the log book for the project. The log book shall be kept on the job site and shall be available immediately for review by governing authorities, at their request. The inspection and maintenance forms may be found in Specification Section 02370.3.20, located in the Project Manual.
- D. The contractor shall establish a minimum of one temporary construction entrance per development site to provide access to adjacent public right-of-way. All vehicular access to the site(s) shall occur via the temporary construction entrance.
- E. No area shall be left denuded for longer than 14 consecutive days. Areas left denuded for longer than 14 consecutive days without heavy construction traffic or work shall be temporarily seeded and mulched so as to limit erosion.
- F. All temporary diversion berms, diversion ditches and soil stockpile areas shall be seeded and mulched immediately after grading.
- G. Where possible, the contractor shall maintain and protect existing trees and vegetation.
- H. After the site has been seeded and permanent vegetation has been established, the contractor shall remove each BMP as indicated on each BMP detail sheet. Excess debris and sediment shall be removed from each BMPs and wasted on the site in such a manner as to eliminate any movement of the material off of the site.
- I. In the event of a conflict between these requirements and pollution control laws, rules, or regulations of other Federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

3.02. MATERIAL MANAGEMENT PRACTICES

- A. All materials stored on-site shall be stored in a neat, orderly manner in their appropriate containers. If possible, materials shall be stored under a roof or other enclosure.
- B. Products shall be kept in their original containers with the manufacturer's label. Substances shall not be mixed with one another unless recommended by the manufacturer. Whenever possible, all of the product shall be used up before disposing of the container. The manufacturer's recommendations for the proper use and disposal of their products shall be followed. The construction manager shall inspect the on-site materials daily to ensure the proper use and disposal.
- C. Hazardous products shall be kept in resealable containers. Original labels and material safety data shall be retained. All federal, state and city regulations shall be followed when disposing of any hazardous waste.

3.03. SPILL CONTROL PRACTICES

- A. All on-site vehicles shall be monitored for leaks and shall receive regular preventative maintenance to reduce the chance of leakage.
- B. Concrete trucks shall only wash-out or discharge surplus concrete, or drum-wash water, at dedicated concrete truck wash-out areas. No excess concrete or drum wash water shall be released from the

site. The contractor shall be responsible for creating dedicated concrete truck wash-out areas and communicating the locations of the areas to all subcontractors.

- C. Petroleum products shall be stored in tightly sealed containers which are clearly labeled.
- D. All asphaltic substances used on-site shall be applied according to the manufacturer's recommendations.
- E. Fertilizers shall be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer shall be worked into the soil to limit exposure to storm water. The contents of any partially used bags of fertilizer shall be transferred to a sealable plastic container to avoid spills.
- F. All spills shall be cleaned up immediately after discovery. The manufacturer's recommended methods for spill cleanup shall be relayed to site personnel and they shall be made aware of the location of the cleanup supplies. Materials and equipment necessary for spill cleanup shall be stored on-site. In case of a spill, the spill area shall be kept well ventilated and cleanup personnel shall wear the appropriate clothing to prevent injury from contact with the hazardous substance. Spills of toxic and hazardous material, regardless of the size of the spill, shall be reported to the appropriate state and local government agencies immediately after discovery.

3.04. ADDITIONAL SITE BMPS

- A. The following is a list of additional site management BMPs that will be incorporated to prevent contamination of storm water runoff.
 - 1. Provide trash containers onsite and perform regular site clean up for proper disposal of solid waste. Solid waste shall include, but not be limited to, scrap building materials, product/material packaging, food and drink containers.
 - 2. Provide containers for the disposal of waste paints, solvents, cleaning compounds, etc.
 - 3. Store construction materials away from drainage courses and low areas.
 - 4. Install containment berms and drip pans at petroleum product and liquid storage tanks and containers.
 - 5. Concrete trucks shall not discharge surplus concrete or wash water on the ground or into ditches on site. Dedicated concrete truck wash-out areas will be designed to ensure concrete particles will not be released from the construction site.

3.05. COMPOST BERMS.

- A. Installation Procedure:
 - 1. For slopes 3:1 or less, install a compost berm 1-2 ft high and 2-4 ft wide at the base. For maximum filtration properties, install the berm in a trapezoidal shape, with a 4-6 ft base, and a 2-3 ft wide top. Larger berms should be used for steeper slopes. The basic rule of thumb is that the base should be twice the height of the berm.
 - 2. Berms can be placed around the perimeter of affected areas, if the area is flat or the perimeter is on contour. Berms should be placed using "smiles" and j-hooks. Do not place berms where they cannot pond water. See typical Silt Fence Placement details for further installation information.

3. For steeper slopes, an additional berm can be constructed on the top shoulder of the slope.
4. Do not use compost berms in areas of concentrated flow, as they are intended to control and filter sheet flow only.
5. Once adequate stabilization of all up hill areas has been achieved, compost berms can be left onsite and seeded, or spread out in place as a soil enhancement.

B. Maintenance and Inspection Procedure:

1. Inspect the compost berm weekly and after each significant storm event (0.5-inch of rain in 24-hours). Repair any erosion near the compost berm immediately.
2. Remove sediment from the compost berm when sediment dike is approximately 1/2 the total height of the berm.

3.06. DIVERSIONARY CHANNEL.

A. Installation Procedure:

1. Temporary diversion channels must be installed as a first step in the land-disturbing activity and must be functional prior to upslope land disturbance.
2. The channel should be cleared grubbed and adequately compacted to prevent failure.
3. Temporary or permanent seeding and mulch shall be applied to the channel immediately following its construction.
4. The channel should be located to minimize damages by construction operations and traffic.

B. Maintenance and Inspection Procedure:

1. The measure shall be inspected once a week and after every significant storm event (0.50-inches in 24-hours). Any necessary repairs to the channel should be performed immediately.
2. Damages caused by construction traffic or other activity must be repaired before the end of each working day.
3. If vegetation has not been established, reseed damaged and sparse areas immediately

3.07. EROSION CONTROL BLANKET.

A. Installation Procedure:

1. Grade and shape area of installation. Remove all rocks, clods, vegetative or other obstructions so that the installed blankets, or mats will have direct contact with the soil.
2. Prepare seedbed by loosening 2-3 inches of topsoil above final grade. Incorporate amendments, such as lime and fertilizer, into soil according to soil test and the seeding plan. Seed area before blanket installation for erosion control and re-vegetation. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be reseeded.

Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

3. U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor mats to the ground surface. Wire staples should be a minimum of 11 gauge. Metal stake pins should be 3/16 inch diameter steel with a 1 1/2 inch steel washer at the head of the pin. Wire staples and metal stakes should be driven flush to the soil surface. All anchors should be 6-8 inches long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils. For installation of erosion control blankets and turf reinforcement mats on slopes and in channels, refer to manufacturer's installation instructions.
4. Lay the erosion control blanket loosely, on top of the graded and seeded soil and stake or staple to maintain contact with soil. Do not stretch the blanket. The erosion control blanket shall be installed such that the roll length extends in a down hill direction, perpendicular to the contour lines.

B. Maintenance and Inspection Procedure:

1. The measure shall be inspected once a week and after every significant storm event (0.50-inches in 24-hours). Any necessary repairs to the channel should be performed immediately.
2. If wash-out or breakage of the erosion control blanket occurs, reinstall the blanket only after repair and reseeded of slope or drainage way.

3.08. INLET PAVEMENT FILTER.

A. Installation Procedure:

1. Install curb inlet pavement filter in front of the curb inlet opening, as directed by BMP manufacturer. Each end of the filter shall overlap the curb inlet opening approximately 12".

B. Maintenance and Inspection Procedure:

1. Inspect the curb inlet pavement filter weekly and basin after each significant storm event (0.5-inch of rain in 24-hours). Clean all accumulated silt and debris located in the vicinity of the filter.

3.09. MULCHING.

A. Installation Procedure:

1. Mulch shall be applied to any site where soil has been disturbed and the protective vegetation has been removed, as a means of providing temporary stabilization of soil, until permanent stabilizing vegetation is established. On steep slopes, greater than 2.5:1, or where the mulch is susceptible to movement by wind or water, the mulch material should be hydraulically applied or the straw mulch should be appropriately anchored. Hydraulic fiber mulches and/or tackifying agents shall be used to effectively bind the straw together and prevent displacement by wind or rain.
2. Straw mulch shall be applied to a depth of 2-4 inches on seeded sites, unless it is incorporated into the soil by tracking, disking, or other techniques. The mulch layer shall have a uniform thickness across the site. For seeded sites, apply 1.5 to 2 tons of straw mulch per acre. For unseeded sites, apply 2 to 3 tons of straw mulch per acre. The straw mulch shall not be applied

at rates higher than 3 tons/acre (7 tons/ha). Straw mulch may be applied by hand on small sites and blown on by machine on large sites.

3. Prior to mulching, install any needed erosion and sediment control practices such as diversions, grade stabilization structures, berms, dikes, grass-lined channels and sediment basins, etc.
4. Straw mulch must be anchored immediately to minimize loss by wind or water. Straw mulch is commonly anchored by:
 - a. Crimping, Tracking, Disking, or Punching into the Soil;
 - 1) On small sites, where straw has been distributed by hand, it can be anchored by hand punching it into the soil every 1-2 feet with a dull, round-nosed shovel. A sharp shovel will merely cut the straw and not anchor it.
 - 2) A mulch anchoring tool is a tractor drawn implement designed to punch and anchor mulch into the top 2-8 inches of soil. This practice affords maximum erosion control but is limited to flatter slopes where equipment can operate safely.
 - 3) Tracking is the process of cutting straw into the soil using a bulldozer or other equipment that runs on cleated tracks. Tracking is used primarily on slopes 3:1 or shallower; where this type of equipment can safely operate. This is an effective way to crimp straw on fill slopes. Tracking equipment must operate up and down the slope so the cleat tracks are perpendicular to flow.
 - b. Covering with a Netting
 - 1) Nettings of biodegradable paper, plastic or cotton netting can be used to cover straw mulch.
 - c. Spraying with Asphaltic or Organic Tackifier;
 - 1) Polymer tackifiers are generally applied at rates of 40-60 lbs/ac, however manufacturer's recommendations may vary. Organic tackifiers are generally applied at rates of 80-120 lbs/acre, however manufacturer's recommendations vary.
 - 2) Applications of liquid mulch binders shall be heavier at edges, in valleys, and at crests of banks and other areas where the mulch may be moved by wind or water. All other areas shall have a uniform application of the tackifier.
 - 3) Tacking with cellulose fiber mulch at a rate of 750 lbs/ac.

B. Maintenance and Inspection Procedure:

1. Inspect the mulch weekly and after each significant storm event (0.5-inch of rain in 24-hours). Repair any erosion near the mulch immediately.

3.010. RIPRAP OUTLET PROTECTION.

A. Installation Procedure:

1. Prepare the subgrade to the required lines and grades shown on the plans. The subgrade will have to be cut sufficiently deep so that the finished grade of the riprap will be at the elevation of

the surrounding grade. Brush, trees, stumps and other deleterious materials must be removed before installation of the riprap.

2. The sand and gravel filter blanket shall then be placed after the subgrade is prepared. For gravel, spread the filter stone in a uniform layer of the specified depth. If a filter fabric is used in the place of sand or gravel, place the filter fabric directly on the prepared foundation, making sure to overlap the edges of the fabric by 12-inches and place anchor pins every 3-feet along the overlap. Geotextile filter fabric shall be Lynx 180EX, 8-oz, non-woven geotextile fabric. A 4-inch layer of fine gravel or sand may be needed above the filter fabric where large stones are used or machine placement is difficult.
3. Riprap (Min. 8"-12", Average Size =10"). Riprap shall be crushed limestone (no sandstone or other deleterious material).
4. Riprap material should be placed in one operation. The Riprap should not be placed by dumping through chutes or other methods that could possibly cause segregation of stone sizes. Care must be taken to not dislodge the underlying base of filter when the placing of the riprap material.
5. The toe of the riprap should be keyed to a stable foundation at its base. The toe should be excavated to the depth of 1.5 times the design thickness of the riprap and should extend horizontally from the slope.

B. Maintenance and Inspection Procedure:

1. The riprap outlet protect should be inspected weekly and after each significant rainfall event (0.5-inches in 24-hours). Repair any scour or dislodged stones.

3.011. ROCK CHECK DAM.

A. Installation Procedure:

1. Divert runoff from undisturbed areas away from the rock dam and basin area.
2. Excavate the foundation for the apron, using it as a temporary sediment basin during construction of the dam.
3. Clear and grub the area under the dam, removing and properly disposing of all root material, brush and other debris. Grade the earth abutments no steeper than 2.5:1; 3:1 where vehicles must cross. Smooth the dam foundation.
4. Cover the entire foundation, including both earth abutments, with filter fabric, making sure the upstream strips overlap the downstream strips at least 1 foot and the upslope end is keyed in. Filter fabric shall be Lynx 180EX, 8-oz, non-woven geotextile fabric.
5. Construct the dam to planned dimensions. Key the stone into channel banks and extend it beyond the abutments a minimum of 18-inches to prevent flow around the dam.
6. Once the dam is in place, clear the sediment basin area properly disposing of the cleared material.

B. Maintenance and Inspection Procedure:

1. Inspect the rock dam weekly and basin after each significant storm event (0.5-inch of rain in 24-hours).
2. Remove sediment when it accumulates to half the height of the dam.
3. Check the dam and abutments for erosion, piping or rock displacement and repair immediately.
4. If the basin does not drain between storms, replace the stone on the upstream face of the dam.
5. Once the construction site has become permanently stabilized, remove the structure and any unstable sediment. Smooth the basin site to blend with the surrounding area and stabilize. All water and sediment should be removed from the basin prior to dam removal. Sediment should be placed in designated disposal areas and not allowed to flow into streams or drainage ways during structure removal.

3.012. SEEDING.

A. Installation Procedure:

1. Seeding Material and Application Rates:
 - a. Annual rye grass, wheat, or oats should be used for temporary seeding. Apply the rye grass at 120 lbs. per acre. Apply the wheat or oats at 100 lbs. per acre.
 - b. A mixture of 65% kentucky bluegrass and 35% chewing fescue or creeping red fescue should be used for permanent seeding. Apply the mixture at 2 lbs. per 1000 square feet.
2. Seeded Preparation:
 - a. Install necessary mechanical erosion and sedimentation control practices before seeding, and complete grading according to the approved plan.
 - b. Lime and fertilizer needs should be determined by soil test. Apply the lime and fertilizer evenly and incorporate into the top 4-6 inches of soil by discing or other suitable means.
3. Seeding:
 - a. All seeding shall be performed during favorable weather conditions and only during normal and accepted planting seasons when satisfactory growing conditions exist. The planting operations shall not be performed during times of extreme drought, when ground is frozen or during times of other unfavorable climatic conditions unless otherwise approved by owner's representative. The contractor assumes full and complete responsibility for all such plantings and operations.
 - b. Seed should be labeled in accordance with the U.S. Department of agriculture rules and regulations under the federal seed act and comply with the requirements of the missouri seed law. Labels contain important information on seed purity, germination, and presence of weeds. Weed seed should not exceed 1.0% by weight of the mixture.
 - c. Apply seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydroseeder. Small grains should be planted no more than 1 inch deep, and grasses and legumes no more than 1/2 inch.
 - d. Seeding - Maintenance:

- 1) Generally, a permanent stand of vegetation cannot be determined to be fully established until soil cover has been maintained for one full year from planting. Inspect seeded areas for failure and make necessary repairs and re-seedings within the same season, if possible.

3.013. SILT FENCE.

A. Installation Procedure:

1. Posts shall be placed on the downstream side of the fabric and shall be spaced at a maximum of 6-ft, unless supported by 16-gauge backing wire with a 6" mesh. If the silt fence is supported by a backing wire, a maximum post spacing of 10-feet is allowed. The posts shall be driven at least 2-feet into the ground.
2. A trench for anchoring the fabric shall be dug along the upslope side of the posts. The trench shall be at least 6 inches wide and 6 inches deep. The fabric shall be laid in the trench, which then shall be backfilled and compacted to prevent water and sediment from passing underneath the fabric fence.
3. The filter fabric shall be furnished in a continuous roll cut to the length of the silt fence to avoid splices. When splices are necessary, the fabric shall be spliced at a support post with a minimum 6-inch overlap, folded over, and securely fastened.

B. Maintenance and Inspection Procedure:

1. Inspect silt fence for proper installation and compaction by pulling up on the fence while kicking the toe of the fabric. If the fence comes out of the ground, do not "accept" the installation.
2. Silt fences and filter barriers shall be inspected weekly and after each significant storm (0.5-inch in 24 hour). Any required repairs shall be made immediately.
3. Sediment should be removed when it reaches 1/2 height of the fence or 18-inches maximum. The removed sediment shall conform with the existing grade and be vegetated or otherwise stabilized.
4. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized and any sediment stored behind the silt fence has been removed.

3.014. STRAW BALE SEDIMENT TRAP.

A. Installation Procedure:

1. Grade and shape area of installation. Remove all rocks, clods, vegetative or other obstructions so that the installed blankets, or mats will have direct contact with the soil.
2. Straw Bale Sediment Traps (SBST) shall be placed in small drainage channels to limit the transference of sediment from the site. The straw bales will be placed downstream of the specified areas to be cleared and graded. The bales shall be placed on even contours.

3. If SBSTs are to be used as perimeter controls, the SBST shall be installed on an even contour, 6-ft from the toe of slope.
4. Bales shall be placed in a row with ends tightly abutting the adjacent bales. Bales should be stacked no more than one bale high. Straw, rocks or filter fabric shall be used to fill any gaps between bales.
5. Each bale shall be embedded in the soil a minimum of 4". Once each bale is placed, backfill bale and tamp backfill material to prevent erosion under or around the bales.
6. Bales shall be securely anchored in place by stakes or rebars driven through the bales. The first stake in each bale shall be driven towards previously laid bale to force the two together. Drive the stakes at least 18-inches into the ground.
7. Bales shall remain in place and maintained until site vegetation has been reestablished (normally one full growing season).

B. Maintenance and Inspection Procedure:

1. The measure shall be inspected once a week and after every significant storm event (0.50-inches in 24-hours). Any necessary repairs to the channel should be performed immediately.
2. If wash-out or breakage of the erosion control blanket occurs, reinstall the blanket only after repair and reseeding of slope or drainage way.

3.015. TEMPORARY CONSTRUCTION ENTRANCE.

A. Installation Procedure:

1. The temporary construction entrance shall meet the requirements of the necessary permitting agencies.
2. The temporary construction entrance should be crowned to provide for adequate drainage. All drainage must be directed away from existing public right of ways.
3. Clear all vegetation, roots and other obstructions in preparation for the entrance. The entrance shall be graded and compacted prior to placement of the geotextile fabric.
4. Place Lynx 180EX, 8-oz, non-woven geotextile fabric on compacted subgrade.
5. Place 2" to 4" of crushed stone (Ave Dia = 2") on top of the geotextile fabric.

B. Maintenance and Inspection Procedure:

1. The temporary construction entrance will be inspected weekly and after each significant rainfall event (0.5-inches in 24-hours). Repair any washout of crushed stone.
2. Replace crushed stone if tracking of sediment onto public right of way occurs.
3. All sediments, and all other materials, tracked onto public roadways shall be removed immediately

3.016. TEMPORARY SEDIMENTATION BASIN.

A. Installation Procedure:

1. The temporary sediment basin shall be constructed on-site by excavating or building an embankment before any clearing or grading work begins.
2. Areas under the embankment and any structural works shall be cleared, grubbed and stripped of any vegetation and rootmat. In order to facilitate cleanout and restoration, the basin area shall be cleared, grubbed and stripped of any vegetation.
3. Embankment and structural works shall be installed as shown on the details. A cut-off trench shall be excavated along the centerline of the earth fill embankments. The minimum depth shall be 2 feet. The cut-off trench shall extend up both abutments to the riser crest elevation.
4. Fill material for the embankment should be clean mineral soil free of roots, woody vegetation, oversized stones, rocks or other objectionable material. The fill material shall contain sufficient moisture so that it can be formed by hand into a ball without crumbling. Fill material shall be placed in 6-inch lifts, continuous layers over the entire length of the fill. Compacting shall be obtained by routing the hauling equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment, or by the use of a compactor. The embankment should be constructed to an elevation of 10 percent higher than the design height to allow for settlement if compacting is achieved with hauling equipment. If compactors are used for compacting, the overbuild may be reduced to not less than 5 percent.
5. The principle spillway riser shall be securely attached to the discharge pipe by welding all around. All connections shall be watertight. The pipe and riser shall be placed on a firm, smooth soil foundation. The connection between the riser and the riser base shall be watertight.
6. Pervious materials such as sand, gravel or crushed stone shall not be used as backfill around the pipe or anti-seep collars. The fill material around the pipe spillway shall be placed in 4-inch layers and compacted under the shoulders and around the pipe to at least the same density as the adjacent embankment. A minimum of 2 feet of compacted backfill shall be placed over the pipe spillway before crossing it with construction equipment.
7. The emergency spillway shall not be installed in fill.
8. Elevations, design width, and entrance and exit channel slopes are critical to the successful operation of the emergency spillway.
9. Baffles shall be constructed with straw bale sediment barriers or silt fence.
10. The embankment and emergency spillway shall be stabilized with vegetation immediately following construction.
11. Construction operations shall be carried out in such a manner that erosion and water pollution will be minimized.

B. Maintenance and Inspection Procedure:

1. Inspect sedimentation basins weekly and after each significant storm event (0.5-inches in 24-hours).

2. All damages caused by soil erosion or construction equipment shall be repaired before the end of each working day.
3. Remove sediment when the sediment storage zone is half full. This sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the embankment or in or adjacent to a stream or floodplain.
4. When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposit shall be leveled or otherwise disposed of in accordance with the approved erosion and sediment control plan.
5. If the basin does not drain between storms, replace the stone on the upstream face of the dam.
6. Once the construction site has become permanently stabilized, remove the structure and any unstable sediment. Smooth the basin site to blend with the surrounding area and stabilize. All water and sediment should be removed from the basin prior to dam removal. Sediment should be placed in designated disposal areas and not allowed to flow into streams or drainage ways during structure removal.

3.017. TEMPORARY SEDIMENT TRAP

A. Installation Procedure:

1. The temporary sediment trap shall be constructed on-site by excavating or building an embankment before any clearing or grading work begins.
2. Areas under the embankment shall be cleared, grubbed and stripped of any vegetation and rootmat. In order to facilitate cleanout and restoration, the basin area shall be cleared, grubbed and stripped of any vegetation.
3. The embankment shall be installed as shown on the details. A cut-off trench shall be excavated along the centerline of the earth fill embankments. The minimum depth shall be 2 feet. The cut-off trench shall extend up both abutments to the spillway crest elevation.
4. Fill material for the embankment should be clean mineral soil free of roots, woody vegetation, oversized stones, rocks or other objectionable material. The fill material shall contain sufficient moisture so that it can be formed by hand into a ball without crumbling. Fill material shall be placed in 6-inch lifts, continuous layers over the entire length of the fill. Compacting shall be obtained by routing the hauling equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment, or by the use of a compactor. The embankment should be constructed to an elevation of 10 percent higher than the design height to allow for settlement if compacting is achieved with hauling equipment. If compactors are used for compacting, the overbuild may be reduced to not less than 5 percent.
5. Geotextile fabric shall be Linq 180EX, non-woven or approved equal. Install geotextile fabric on the base of the channel, extending it up the sides to the top of the embankment. Key all free edges of geotextile fabric 6" into subgrade.
6. Riprap shall be 3" to 9" diameter (mean diameter = 6") crushed limestone. Place riprap to the lines and grades, working smaller stones into voids to achieve a dense mass. The spillway crest should be level with a minimum width of 5 feet.

7. Cover the inside face of the stone outlet section with a 1-foot layer of well graded stone (2-inch minus).
8. Set a clean-out measurement stake in the basin at a height equal to one-half the distance from the bottom to the spillway crest.
9. Elevations, design width, and entrance and exit channel slopes are critical to the successful operation of the spillway.
10. Flow diversion baffles shall be constructed with silt fence.
11. The embankment shall be stabilized with vegetation immediately following construction. Place silt fence at toe of embankment slope, immediately downhill of temporary sediment trap.
12. Construction operations shall be carried out in such a manner that erosion and water pollution will be minimized.

B. Maintenance and Inspection Procedure:

1. The measure shall be inspected once a week and after every significant storm event (0.50-inches in 24-hours). Any necessary repairs to the channel should be performed immediately.
2. All damages caused by soil erosion or construction equipment shall be repaired before the end of each working day.
3. Remove sediment when the sediment storage zone is half full. This sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the embankment or in or adjacent to a stream or floodplain.
4. When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposit shall be leveled or otherwise disposed of in accordance with the approved erosion and sediment control plan.

3.018. TRIANGULAR SILT DIKE

A. Installation Procedure:

1. Clear and grub channel bottom and remove all debris, roots, brush, etc. Perform preliminary grading of channel.
2. Cut a 3" to 6" square trench at the leading edge of the front geotextile apron. The front geotextile apron shall be tucked into the trench and 6" No. 11 gauge wire staples shall be driven through the fabric into undisturbed earth. The staples must be installed at 4'-0" cts. The trench must then be backfilled with soil.
3. The apron, triangular silt dike and other appurtenances must be secured to the soil with 6" No. 11 gauge wire staples spaced at 2'-0" cts. Where triangular silt dike units overlap, staples shall be placed at the center of each unit.
4. The triangular silt dike shall extend up the channel bank so that there is a minimum of 1'-0" elevation difference between the terminus of the dike and the top of the dike located in the

channel bottom, so as to eliminate the potential for flows around the edges of the triangular silt dike unit.

B. Maintenance and Inspection Procedure:

1. Inspect the triangular silt dike weekly and after each significant storm event (0.5-inch of rain in 24-hours). Repair any erosion near the dike immediately.
2. Remove sediment from the dike when sediment dike is approximately 1/2 the total height of the dike.

3.019. STRAW WATTLE

A. Installation Procedure:

1. Prepare the slope before the wattling procedure is started.
2. Shallow gullies should be smoothed as work progresses.
3. Dig small trenches across the slope on contour, to place rolls in. The trench should be deep enough to accommodate half the thickness of the roll. When the soil is loose and uncompacted, the trench should be deep enough to bury 2/3 of its thickness because the ground will settle.
4. It is critical that rolls are installed perpendicular to water movement, parallel to the slope contour.
5. Start building trenches and install rolls from the bottom of the slope and work up.
6. Construct trenches at the contour intervals of three to twelve feet (3'-12') apart depending on the steepness of slope. The steeper the slope, the close together the trenches.
7. Lay the roll along the trenches fitting it snugly against the soil. Make sure no gaps exist between the soil and straw wattle.
8. Use a straight bar to drive holes through the wattle and into the soil for the willow or wooden stakes.
9. Drive the stake through prepared hole into soil. Leave only 1 or 2 inches of stake exposed above the roll.
10. Install stakes at least every 4 feet apart through the wattle, additional stakes may be driven on the downslope side of the trenches on highly erosive or very steep slopes.

B. Maintenance and Inspection Procedure:

1. Inspect straw wattles weekly and after each significant event (0.5-inches in 24-hours).
2. All damages caused by soil erosion or construction equipment shall be repaired before the end of each working day.
3. Remove sediment when the sediment storage zone is half full. This sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the embankment or in adjacent to a stream or floodplain.

4. When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposit shall be leveled or otherwise disposed of in accordance with the approved erosion and sediment control plan.

3.020. SCHEDULE.

- A. Prior to the start of construction, the Contractor shall submit schedules for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the Engineer.

3.021. RECORD KEEPING.

- A. The contractor shall create and maintain a log book documenting all monitoring and repair operations associated with each BMP. The log book shall include the forms contained within this specification. The forms contained within this specification include:
 1. Form 1 – Inspection form for Structural Controls
 - a. Form 1 shall be completed each time an inspection of structural controls occurs. Structural Controls include, but are not limited to: inlet protection, rock dams, silt fences, straw bale sediment traps, temporary sediment traps, temporary sediment basins, triangular silt dikes, etc.
 2. Form 2 – Inspection form for Stabilization Measures
 - a. Form 2 shall be completed each time an inspection of stabilization measures occurs. Stabilization measures include, but are not limited to: temporary seeding, permanent seeding, mulching, hydroseeding, sodding, etc.
 3. Form 3 – Inspection Certification Form.
 - a. Form 3 shall be completed after each inspection to legally certify that the inspection has been performed and that the site has been found to be in compliance with the project plans and specifications.
 4. Form 4 – Form for changes in Pollution Prevention Plan
 - b. Form 4 shall be completed after changes are made to the proposed BMPs and project plans due to unforeseen conditions and construction techniques.
- B. The log book shall be maintained at the job site at all times, in a neat and orderly fashion. The log book shall be available immediately for review by the engineer, the owner and local, state and federal governing authorities during normal business hours.
- C. The log book shall contain copies of all local, state and federal land disturbance permitting issued for the project.

FORM NO. 1 – INSPECTION FORM FOR STRUCTURAL CONTROLS

Inspector: _____ Date: _____

Days Since Last Rainfall: _____

Amount of Last Rainfall: _____

Location of Control	In Place?	Condition of Control	Sediment Depth (in)	Washed-out or overtopped?

Maintenance Required:

To Be Performed By: _____

On or Before: _____

FORM NO. 2 – INSPECTION FORM FOR STABILIZATION MEASURES

Inspector: _____

Date: _____

Days Since Last Rainfall: _____

Amount of Last Rainfall: _____

Area	Date of Last Disturbance	Stabilized ?	Stabilized With?	Condition

Stabilization Required:

To Be Performed By: _____

On or Before: _____

Form No. 3 – Inspection Certification Form

Project: _____

This certification must be completed after each inspection to signify that the inspection has been properly completed and the site has been found to be in compliance with the Storm Water Pollution Prevention Plan.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____

Name: _____

Title: _____

Company: _____

Address: _____

Telephone: _____

Date: _____

Form No. 4 – Form for Changes in Pollution Prevention Plan

Inspector: _____

Date: _____

Summary of Required Changes:

Reason(s) for Changes:

Inspector Signature: _____

Date: _____

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes crushed rock base and surface course.

1.02 SUBMITTALS

- A. Compliance submittals:
 - 1. Submit as specified in Division 1.
 - 2. Includes, but not limited to, the following:
 - a. Test results from testing laboratory indicating compliance with the specifications.
 - b. Certification of conformance with the specifications.

1.03 QUALITY ASSURANCE

- A. Applicable Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - C117 - Material Finer than 76-um (No. 200) Sieve in Mineral Aggregates by Washing.
 - C131 - Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - C136 - Sieve or Screen Analysis of Fine and Coarse Aggregates.
 - D423 - Liquid Limit of Soils.
 - D424 - Plastic Limit and Plasticity Index of Soils.
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - T99 - The Moisture Density Relations of Soils Using a 5.5-Pound (2.5 kg) Rammer and a 12-Inch (305 mm) Drop.

PART 2 PRODUCTS

2.01 GENERAL

- A. Crushed rock base and surface course shall consist of aggregate specified.

2.02 AGGREGATE

- A. Aggregate shall be crushed stone or crushed gravel, free from lumps or balls of clay or other objectionable matter, and reasonably free from thin and elongated pieces of dirt. Aggregates shall consist of angular fragments, durable and sound, and shall be reasonably uniform in density and quality.
- B. Percentage of wear shall not exceed 50 after 500 revolutions as determined by ASTM C131.
- C. Aggregate shall contain 75 percent by weight of pieces with two or more fractured surfaces if material is crushed gravel.
- D. Portion of aggregate passing No. 40 sieve shall be as follows:
1. Liquid Limit: Not more than 25 determined by ASTM D423.
 2. Plastic Index: Not more than 6 determined by ASTM D424.
- E. Gradation shall not vary from low limit on one sieve to high limit on adjacent sieve or vice versa. Test by ASTM C136 and C117, and conform to the following table:

Sieve Designation	Percent by Weight Passing Square-Mesh Sieve		
	Surface Course	Base Course	2"/Type 7
1 ½ -inch	--	--	100
1-inch	100	100	60-80
1/2-inch	--	60-90	
3/8-inch	65*	--	
No. 4	5-25	40-60	
No. 8	--	--	15-50
No. 30	--	15-35	
No. 200	--	--	0-12

*Indicates Maximum

2.03 EQUIPMENT

- A. General Requirements:
1. Maintain all equipment, tools, machines used in the performance of the work required by this Section in a satisfactory working condition at all times.
 2. Equipment shall be subject to the approval of the Engineer.

- B. Power Rollers:
 - 1. Rollers shall be self-propelled, three wheel, or tandem-type with wheels equipped with adjustable scrapers.
 - 2. Weight shall not be less than eight tons.
- C. Tamping Rollers:
 - 1. Rollers shall consist of one or more units arranged to adapt to uneven ground surfaces.
 - 2. Rolling units of multiple type shall be pivoted on the main frame.
 - 3. When fully loaded, rollers shall exert at least 300 psi on the combined areas of tamping feet in contact with the ground.
 - 4. Each unit shall be equipped with a watertight cylindrical drum with length 48 inches or greater.
 - 5. Tamping feet shall project not less than 7 inches from drum surface, with feet spaced not less than 10 inches, nor more than 10 inches measured diagonally from center to center.
- D. Rubber-Tired Rollers:
 - 1. Rollers shall consist of two axles on which are mounted not less than nine pneumatic-tired wheels, mounted so the rear group of tires do not follow in the tracks of the forward wheels but will be centered between the forward wheels.
 - 2. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading.
 - 3. Inflate tires uniformly.
 - 4. May be self-propelled.
 - 5. Tow with pneumatic-tired tractors or other pneumatic-tired equipment.
- E. Blade Graders shall be self-propelled with a wheelbase of not less than 15 feet, and a blade of not less than 10 feet.
- F. Sprinkling equipment shall consist of tank trucks, pressure distributors, or other similar equipment designed to apply water uniformly and in controlled quantities to variable width of surface.
- G. Hauling equipment shall consist of pneumatic-tired vehicles and dump bodies suitable for dumping materials in windrows or layers on the subgrade.
- H. Tampers shall be mechanical (of an approved type) and hand-operated, weight not less than 50 pounds, and have a face area of not more than 100 square inches.

- I. Miscellaneous equipment shall consist of scarifiers, tractors, spring-tooth or spike-tooth harrows, windrow equalizers, spreaders, and other equipment suitable for construction of select material.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Stockpiles:
 1. Clear and level storage sites prior to stockpiling.
 2. Place in the manner and at locations designated by Engineer, providing separate stockpiles for materials from separate sources.
 3. Stockpile material in such a manner as to limit the potential for erosion and inundation as a result of localized and global flooding. Coordinate the stockpile locations with the owner.
- B. Cold-Weather Limitations:
 1. Construction shall be prohibited when atmospheric temperature is below 35 degrees F.
 2. Do not place base course on frozen subgrade, or surface course on frozen base.
 3. Protect base course, surface course and subgrade in freezing weather and repair areas damaged by freezing by reshaping and recompacting.
- C. Preparation of Subgrade:
 1. Clear all vegetable matter such as trees, brush, down timber and other objectionable materials found on or above the surface.
 2. Scalp all excavation and embankment areas removing material such as sod, grass, residue or agricultural crops and decayed vegetable matter from the surface of the ground.
 3. Grub and dispose of all vegetable matter such as stumps, roots, buried trees and brush encountered below the surface of the ground or subgrade to a minimum depth of 6 inches.
 4. When deleterious materials are encountered below ground line which may be detrimental to the proposed improvement, these shall be removed to a depth necessary to provide adequate support for the proposed improvement.
 5. The subgrade surface shall be brought to the specified lines, grades and cross-section by repeatedly adding or removing material and compacting to the specified density.
 6. The top 6 inches of subgrade for pavements shall be compacted to 95 percent of the maximum density for the material used as determined by

ASTM D-698 and within a tolerance of plus 2 percent and minus 3 percent of the optimum moisture at maximum density as determined by the moisture density curve obtained.

7. The newly finished subgrade shall be repaired from action of the elements or others. Any settlement or erosion that occurs prior to placing the pavement thereon, shall be repaired and the specific lines, grades and cross-section reestablished.
 8. Any subgrade that has become unacceptable shall be reworked as necessary to restore the subgrade to shape, tolerance, density, and moisture content range for such density, immediately prior to the placing of the pavement.
- D. Grade Control: Establish and maintain by means of grade stakes placed in lanes parallel to the centerline of the area to be paved and spaced so string lines may be stretched between stakes.

3.02 MIXING AND PLACING OF MATERIALS

- A. Deposit and spread material in a uniform layer and compact to the thickness indicated on the plans and as specified below. Spread material uniformly on the prepared subgrade from moving vehicles or spreader boxes.
1. Level material to the required contour and grades with blade graders.
 2. Remove those portions of the layer which become segregated in spreading and replace with satisfactory mixture or remix as requested by Engineer.
 3. Add water to the extent necessary to prevent segregation during mixing operations.
 4. Add material to the mixture in such amounts and sizes as requested by the Engineer.
- B. Shaping and Compacting Mixed Materials:
1. Compact in layers no less than three nor more than seven inches thick.
 2. Roll to specified compaction requirements throughout full depth of layer with tamping rollers, power rollers, rubber-tired rollers or combination.
 3. Shape and smooth by blading and rolling with power roller or rubber-tired roller, or both.
 4. Hand-tamp in places not accessible to rolling equipment.
 5. Aerate by blade graders, harrows, or other approved equipment when mixture is moistened by rain.
- C. Degree of Compaction:
1. Base compaction on weight per cubic foot of material passing 3/4-inch sieve and compact to at least 100 percent of density at optimum moisture.

2. Determine and control compaction in accordance with AASHTO T99.

D. Smoothness Test:

1. Surface shall show no deviation in excess of 3/8-inch in any 10 feet when tested with a 10-foot straightedge applied parallel with and at right angles to the centerlines of the paved area.
2. Correct any deviation in excess of this amount by loosening, adding or removing material, reshaping, watering, and compacting as requested by the Engineer.

3.03 MAINTENANCE

- A. Maintain finished base course in a condition satisfactory to the Engineer until job completion or until surface is placed upon it.

3.04 WAYBILLS AND DELIVERY TICKETS

- A. Submit daily to the Engineer during progress of work.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.01. SUMMARY

- A. Section Includes: Asphaltic pavement for the purpose of repair of cut areas in existing asphalt paved areas.

1.02. REFERENCES

- A. 2023 (English) Edition of the "Missouri Standard Specifications for Highway Construction", Section 403 per the Missouri Highway and Transportation Commission.

1.03. DESCRIPTION OF WORK

- A. Extent of asphaltic pavement restoration paving area is shown on the drawings.
- B. Prepared subbase is specified in Section 310000 - Site Preparation and Earthwork.

1.04. SUBMITTALS

- A. Furnish samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

PART 2 - PRODUCTS

2.01. MATERIALS

- A. Coarse Aggregate:
 - 1. Shall consist of sound, durable rock, free from cemented lumps or objectionable coatings.
 - a. Test: AASHTO T 96, does not exceed 50% wear.
 - 2. The percentage of deleterious substances shall not exceed the following values.

Deleterious Material	Percent by Weight
Deleterious Rock	8.0
Shale	1.0
Other Foreign Material	0.5

- 3. Crushed stone shall be obtained from rock of uniform quality.
 - a. Test sourced from any approved ledges, and trial mix sample shall meet the following criteria.

Property	Value
Los Angeles Abrasion, AASHTO T 96, percent loss, max	50
Absorption, AASHTO T 85, percent, max	4.0

4. Gravel aggregate shall be washed sufficiently to remove any objectional coating and shall meet the following criteria.

Property	Value
Los Angeles Abrasion, AASHTO T 96, percent loss, max	50
Absorption, AASHTO T 85, percent, max	5.5

5. Steel slag consisting principally of a fused mixture of oxides and silicates shall be a synthetic aggregate produced as a by-product of basic oxygen, electric or open hearth steel making furnace.
- B. Fine Aggregate:
1. Shall be a fine, granular material passing the 3/8-inch sieve, naturally produced by the disintegration of rock of siliceous nature and/or manufactured by the mechanical reduction of sound durable rock.
 2. The percentage of deleterious substances shall not exceed the following values.

Deleterious Material	Percent by Weight
Clay lumps and shale	1.0
Total lightweight particles, including coal and lignite	0.5
Other deleterious substances	0.1

3. Lightweight particle requirement will not apply to wet bottom boiler slag, angular chert sand, or manufactured sand.
 4. Mineral filler shall be in accordance with AASHTO M 17. Prior to use manufacturer shall provide a certified test report with results tested in accordance with applicable section AASHTO M 17 and MoDOT test method TM-73.
 5. Hydrated lime shall be thoroughly dry and free of lumps.
 - a. Test: AASHTO M 303, Type I or II, except gradation shall be in accordance with AASHTO T 37.
- C. Asphalt Binder: Comply with requirements of Section 1015.10 in the 2023 (English) Edition of the "Missouri Standard Specifications for Highway Construction", for asphalt binder material.
- D. Additives:
1. Fiber additives for stone matrix asphalt mixture may be either cellulose or mineral fiber.
 - a. Test: AASHTO M 325 in accordance with MoDOT Test Method TM 60.
 2. Anti-Strip additive shall not be detrimental to the bituminous mixture.
 - a. Testing: Type I

Test	Test Method
Specific Gravity @ 77 F	AASHTO T 228
Brookfield Viscosity 77 F using an RVT viscometer. The report shall include a corresponding test temperature, speed, spindle and model of Instrument.	ASTM D2196
Pensky-Martens Closed Cup Flash Point or Cleveland Open Cup Flash Point	ASTM D93 AASHTO T 48
Infrared Spectrum (neat material)	Appropriate Method

b. Testing: Type II

Test	Test Method
Weight per Gallon @ 77 F	ASTM D1475
Brookfield Viscosity 77 F using an RVT viscometer. The report shall include a corresponding test temperature, speed, spindle and model of Instrument.	ASTM D2196
pH	Appropriate Method
Percent Solids	ASTM D1644 Method A
Infrared Spectrum (latex portion)	Appropriate Method

- c. Heat stability shall comply with requirements of Section 1071.5.2 in the 2023 (English) Edition of the "Missouri Standard Specifications for Highway Construction".
- d. Shall not significantly lower the unconditioned strength of AASHTO T 283.
 - 1) Testing shall comply with requirements of requirements of Section 1071.5.3 in the 2023 (English) Edition of the "Missouri Standard Specifications for Highway Construction".
- E. Refer to Section 403 in the 2023 (English) Edition of the "Missouri Standard Specification for Highway Construction", for more material requirements.

PART 3 - EXECUTION

3.01. INSTALLATION

- A. Asphaltic pavement shall be installed in accordance with MoDOT specifications noted above and all other related specifications noted therein.
- B. Do not place asphalt until the subbase has been checked for line and grade. Do not place asphalt around manholes or other structures until they are at the required finish elevation and alignment.
- C. Protect finished asphalt paving, complying with applicable requirements of Section 403 in the 2023 (English) Edition of the "Missouri Standard Specification for Highway Construction".

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

1. Fencing shall be chain link with three-strand barbed wire extension provided in the alignment and height indicated on the drawings.

1.02 SUBMITTALS

1. Submit manufacturer's product specifications and installation instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Framework: Type I or Type II Steel Pipe.

1. Type I - Schedule 40 steel pipe with 1.8 ounces of zinc coating per square foot of surface area conforming to Standard specification ASTM F-1083; or
2. Type II - Pipe manufactured from steel conforming to ASTM A 569, cold-formed, high frequency or induction welded and having a minimum yield strength of 50,000 PSI. External surface triple coated per ASTM F-1043, Type B with 1.0 ounce +/-0.1 ounce of zinc per square foot, 30 +/-15 micrograms of chromate per square inch and high performance polymer and shall demonstrate the ability to resist 1,000 hours of exposure to salt spray with a maximum of 5% red rust in a test conducted in accordance with ASTM B-117. Internal surface coated per ASTM F-1043, Type B or Type D coating.
3. All coatings to be applied inside and out after welding.
4. Pipe shall be straight, true to section and conform to the following weights:

Pipe Size Outside Diameter	Type I Weight Lbs/Ft.	Type II Weight Lbs/Ft.
1-5/8"	2.27	1.84
2"	2.72	2.28
2-1/2"	3.65	3.12
3"	5.79	4.64
3-1/2"	7.58	5.71
4"	9.11	6.56
6-5/8"	18.97	--

B. Fabric:

1. Zinc-coated fabric shall be galvanized after weaving with a minimum 1.2 ounces of zinc per square foot of surface area and conform to ASTM A-392, Class I. Fabric to be 9 gauge wire woven in a 2" diamond mesh.
2. Site boundary fencing shall have twisted and barbed top selvage and knuckled bottom selvage.

2.02 CONCRETE MIX

- A. ASTM C 94 Portland Cement concrete with maximum 3/4" aggregate having a minimum compressive strength of 4,000 PSI at 28 days. Conform to Division 3 specification requirements.

2.03 COMPONENTS

A. Fence Posts:

Fabric Height	Type I - II	
	Line Post O.D.	Terminal Post O.D.
Under 6'	2"	2-1/2"
6' to 8'	2-1/2"	3"
8' to 12'	3"	4"

B. Gate Posts:

Single Gate Width	Double Gate Width	Post O.D. Type II
Up to 6'	Up to 12'	3"
7' to 12'	13' to 25'	4"

C. Rails and Braces: 1-5/8" O.D.

- D. Gates: Frame assembly of 2" O.D. pipe Type I or Type II with welded joints, conforming to ASTM F900. Weld areas repaired with zinc-rich coating applied per manufacturer's directions. Fabric to match fence. Gate accessories, hinges, latches, center stops, keepers and necessary hardware of quality required for industrial and commercial application. Latches shall permit padlocking.

E. Fittings:

1. Post Caps - Pressed steel, cast iron or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Supply cone type caps for terminal posts and loop type for line posts. All fittings to conform to ASTM F-626.
2. Rail and Brace Ends - Pressed steel, cast iron or cast aluminum alloy, cup-shaped to receive rail and brace ends.
3. Top Rail Sleeves - Tubular steel, 0.051 thickness x 7" long, expansion type.

4. Tension Bars - Steel strip, 5/8" wide x 3/16" thick.
 5. Tension Bands - Pressed steel, 14 gauge thickness x 3/4" wide.
 6. Brace Bands - Pressed steel, 12 gauge thickness x 3/4" wide.
 7. Truss Rods - Steel rod, 3/8" diameter merchant quality with turnbuckle.
 8. Barbed Wire Arms - Pressed steel galvanized, cast iron or cast aluminum alloy fitted with clips or slots for attaching three strands or barbed wire. Arms shall be set outward on a 45 degree angle and be capable of supporting a 250 pound load at outer barbed wire connecting point without causing permanent deflection.
- F. Tension Wire: Marcellled 7 gauge steel wire with minimum coating of 0.80 ounces of zinc or 0.40 ounces of aluminum per square foot of wire surface and conforming to ASTM A-824.
 - G. Tie Wires: Aluminum, 9 gauge, alloy 1100-H4 or equal.
 - H. Hog Rings: Steel wire, 11 gauge, with a minimum zinc coating of 0.80 ounces per square foot of wire surface.
 - I. Barb Wire: Commercial quality steel, 12-1/2 gauge, two-strand twisted line wire with 4-point barbs at 5-inch spacing. Coating shall consist of a minimum of 0.80 ounces of zinc per square foot of wire surface conforming to ASTM A-121.
 - J. Padlocks: Keyed alike for all gates, provided 4 keys for each padlock required.

PART 3 EXECUTION

3.01 PREPARATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for adjustments during installation where taking field measurements before fabrication might delay work.

3.02 INSTALLATION

- A. General:
 1. The installed fence shall conform to the alignment and finished grade indicated on the drawings. The Contractor shall fill, cut, or grade where necessary to produce a smooth and uniform ground surface so the bottom of the fence fabric is not more than 2-inch clearance above the finished ground line. All posts shall be plumb true to line and grade and installed in concrete footings. Unless otherwise shown on the drawings or required, posts shall be spaced 10 feet apart.
 2. Concrete footings for line posts shall be a minimum 36 inches deep or as shown on the drawings. Concrete footings for terminal posts shall be a minimum of 42 inches deep or as shown on the drawings. Concrete footings for gate posts shall be a minimum of 54 inches deep or as shown on the drawings. Concrete footings shall be circular in horizontal section, with the diameter not less than 4 times the post O.D. for posts up to 4 inches in diameter and not less than 3 times the O.D. for posts greater than 4 inches in diameter.

Concrete footings shall be of a uniform thickness around the post and shall extend above the finish ground surface and must be crowned approximately one inch. Concrete for footings shall conform to Division 03 Concrete Specification. Each footing shall be cured for at least 72 hours before further work is done on the post.

3. Top rails and bottom tension wires shall be installed before the fence fabric. Top rails shall be securely connected to gate and terminal posts. Tension wires shall be installed approximately 6 inches above the finished grade and shall be attached to each post and securely anchored at terminal and gate posts.
4. Fabric shall be attached to the top rail and bottom tension wire at 24 inches centers and to the line posts at 15-inch centers. Barbed wire shall be fastened to each extension arm by internal clips or external fabric ties. Stretcher bars shall be provided at each gate and terminal post. Each stretcher bar shall be threaded through the fabric and anchored to the post at 15-inch centers. All fabric shall be stretched taut before it is attached to line posts or tension wire.
5. Each gate and terminal post shall be braced by a horizontal pipe brace and an adjustable truss extending to an adjacent line post. Corner posts shall be braced in both directions.

B. Gates.

1. Swing Gates

- a. Gates shall be swing type, hinged to swing 180 degrees from closed to open, complete with frames, latches, stops, keepers, hinges, fabric, braces, padlocks, and three strands of barbed wire. Gate leaves shall have intermediate members and diagonal truss rods required for rigid construction and shall be free from sag or twist. Gates shall be fitted with vertical extension arms or shall have frame end members extended to carry barbed wire. Joints between frame members shall be made by welding or by means of heavy fittings and shall be rigid and watertight. Gate fabric shall be the same as fence fabric and shall be attached to frame ends by stretcher bars, bolt hooks, or other mechanical means.
- b. Hinges shall be heavy pattern with large bearing surfaces and shall not twist or turn under the action of the gate. Latches shall be plunger bar type, full gate height, and arranged to engage the gate stop, except single gates less than 8 feet wide may be provided with a forked latch. Latches shall be arranged for padlocking with the padlock accessible from both sides of the gate. Stops shall consist of a roadway plate with anchor set in concrete and arranged to engage the plunger. Keepers shall consist of mechanical devices for securing and supporting the free end of the gates when in full open position.
- c. Gates shall be installed so that they cannot be removed without disassembly of the hardware. Hardware attachment bolts shall be peened so that removal will be difficult.

END OF SECTION

SECTION 32 91 10
LANDSCAPE WORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Extent of landscape development work includes all areas disturbed during construction.
- B. Subgrade Elevations: Excavation, filling and grading required to establish elevations shown on drawings are not specified in this section. Refer to earthwork sections.

1.02 SUBMITTALS:

- A. Provide the following Certifications:
 - 1. Submit certificates of inspection as required by governmental authorities. Submit manufacturer's or vendor's certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.
 - 2. Submit seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.
- B. Submit proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.
- C. Submit typewritten instructions, 2 copies to the Owner and 1 copy to the Project Engineer, recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period.

1.03 QUALITY ASSURANCE

- A. Subcontract landscape work to a single firm specializing in landscape work.
- B. Source Quality Control will include:
 - 1. Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.
 - 2. Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.
- C. Before delivery of topsoil, furnish Engineer with written statement giving location of properties from which topsoil is to be obtained, names and addresses of owners, depth to be stripped, and crops grown during past 2 years.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

1.05 JOB CONDITIONS

- A. Removal of trees and shrubs shall be only as directed by the project Engineer.
- B. Proceed with and complete landscape work as rapidly as portions of site become available, working with seasonal limitations for each kind of landscape work required.
- C. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required.
- D. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Engineer before planting.
- E. Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.
- F. All planting shall occur after final grades are established, unless otherwise acceptable to Engineer.

1.06 SPECIAL PROJECT WARRANTY

- A. Warranty vegetated areas through specified maintenance period and until final acceptance.

1.07 CLEANING UP

- A. The Contractor shall at all times keep the premises free from the accumulation of waste materials or rubbish caused by employees or work and, at the completion of the work, shall remove all rubbish, tools, and surplus materials from the premises, leaving the area in a neat and clean condition.

1.08 COORDINATION

- A. Coordinate all vegetation operations occurring on farmed ground with property owner.
- B. Coordinate all vegetation operations with general contractor.

PART 2 - PRODUCTS

2.01 TOPSOIL

- A. Topsoil will be stockpiled for re-use in landscape work. If quantity of stockpiled topsoil is insufficient, provide additional topsoil as required to complete landscape work.
- B. Provide 4 IN lift of new topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth.

1. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4"; do not obtain from bogs or marshes.

2.02 SOIL AMENDMENTS

- A. Soil amendments shall be added to the soil based upon results of soil testing and the recommendations of a state certified soil testing laboratory.
- B. Fertilizer:
 1. All fertilizer shall conform to applicable State Fertilizer Laws, uniform in composition, dry and free-flowing, delivered to the site in its original, unopened containers with each container bearing the manufacturer's guaranteed analysis.
 2. Any fertilizer that becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.
 3. Fertilizer for seeded areas shall be a complete fertilizer containing 8% nitrogen (1/2 organic, 1/2 inorganic), 32% phosphoric acid and 16% potash, or as recommended by soil testing laboratory.

2.03 MULCH

- A. Mulch for seeded areas shall be cereal straw from current year's crop free of noxious weed seed.
- B. At Contractor's option, seeded area may be hydro-mulched in lieu of straw mulching with a wood fiber mulch product.

2.04 SEEDED AREA

- A. Grass seed shall be fresh, clean seed of the current year's crop complying with tolerances for purity and germination established by the United States Department of Agriculture.
- B. Seed shall be labeled in accordance with the latest U.S. Department of Agriculture rules and regulations under the Federal Seed Act, and shall be approved. Wet, moldy, or otherwise damaged seed will not be acceptable. The pure live grass seed mix to be used shall be as follows (weed seed shall not exceed 0.5 percent by weight of the total of pure live seed and other material in the mixture):

Kinds of Seeds	Pounds Per Acre
K-31 Fescue (<i>Festuca elatior</i> var. <i>arund Inacae</i>)	25
Domestic Ryegrass (<i>Lolium perenne</i> and <i>L. Multiflorum</i>)	10
Orchard Grass (<i>Dactylis glomerata</i>)	<u>10</u>
Total Pounds Pure Live Seed Per Acre	45

- C. Seeding shall be accomplished in the first of the following two periods after completion of earthwork:

March 1st to June 1st
August 15th to October 1st

2.05 WATER

- A. Water will be furnished by the Owner and will be suitable for irrigation and free from ingredients harmful to plant life.
- B. Hoses and any other watering equipment required for the work shall be furnished by the Contractor.

PART 3 - EXECUTION

3.01 VEGETATION REMOVAL

- A. Every consideration shall be given to preservation of natural vegetation whenever possible.
- B. Contractor shall coordinate all vegetation removal with the project Engineer prior to demolition.
- C. Typically, all vegetation within the permanent easement may be removed. Vegetation within the temporary construction easement may be removed if under 8" caliper (as measured on trunk 6" from ground) and not flagged.
- D. All trees 8" and greater and all flagged trees and shrubs shall not be disturbed in any manner.

3.02 RE-VEGETATION

- A. In the event flagged vegetation and trees 8" or greater are disturbed, Contractor shall replace the vegetation with same variety at Contractor's expense.
- B. Trees shall be planted at a rate of a minimum of two trees replaced for each tree greater than eight inches diameter - at breast height removed, and three trees for each tree greater than twelve inches diameter removed. Replacement trees shall be at least four feet in height, excluding the root system.
- C. Provide trees, shrubs and plants of quantity, size, genus, species and variety indicated and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock." Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scale, injuries, abrasions, or disfigurement.
- D. Label each tree with securely attached waterproof tag bearing legible designation of botanical and common name.
- E. The Engineer may inspect trees either at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size and quality. Engineer retains right to further inspect trees and shrubs for size and condition of balls and root system, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from project site.

3.03 SOIL TESTS

- A. Obtaining Samples:
 - 1. After backfill and finish grading are completed and prior to seed bed preparation, Contractor shall obtain representative soil samples of disturbed areas to be revegetated.
 - 2. The method of soil sampling shall conform to guidelines of the soil testing laboratory.
 - 3. A maximum of 50 soil samples and tests shall be taken and performed.
 - 4. The number and location of soil samples shall be at the direction of the project Engineer.
- B. Testing Laboratory:
 - 1. Contractor shall deliver to a State approved testing laboratory the soil samples in accordance with that testing laboratory's guidelines.
 - 2. Testing laboratory shall perform standard testing procedures on properly obtained soil samples to determine the existing condition of the soil.
 - 3. Soil test report shall provide soil treatment recommendations for fertilizer (nitrogen, phosphorous and potassium), limestone and any other soil amendment necessary for proper germination and growth of seed (Reference Part 2 - Products, 2.04 Seeded Area).

3.04 PREPARATION

- A. Preparation for Planting Seeded Areas:
 - 1. Loosen subgrade of seeded areas to a minimum depth of 4". Remove stones over 1-1/2" in any dimension, sticks, roots, rubbish and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.
 - 2. Spread top soil to minimum depth of 4" as required to meet lines, grades and elevations shown, after light rolling and natural settlement.
 - 3. Apply one-half the total amount of fertilizer as recommended by the soil testing laboratory and incorporate into the top 2" of all seeded areas.
 - 4. Fine grade seeding areas to smooth, even surfaces with loose, uniformly fine texture. Roll, rake and drag seed areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.
 - 5. Restore seeded areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

3.05 PLANTING SEEDED AREAS

- A. Do not use wet seed or seed which is moldy or otherwise damaged in transit or storage.
- B. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 mi. per hr. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.
- C. Apply one-half of the fertilizer over the entire seeded area.

- D. Rake seed lightly into top 1/8" of soil, roll lightly, and water with a fine spray.
- E. Apply straw mulch at a rate of two tons per acre. The entire mulched area shall be coured by a mechanical slicer to secure the straw mulch to the soil. Mulch shall be a cereal straw from oats, rye, or other approved grain crop. Wheat straw shall not be used.
- F. At the Contractor's option, seeded area may be hydro-mulched, in lieu of straw mulching, with Excel Fibermulch as manufactured by American Excelsior Co., or approved equal, at a rate of 1400 pounds per acre.

3.06 PLANTING PROCEDURES

- A. Plant trees and shrubs as per the following requirements:
 1. Set balled and burlapped (B&B) stock in center of pit with top of ball at same elevation as adjacent finished grades. Remove burlap from sides of balls; retain on bottoms. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.
 2. Dish top of backfill to allow for mulching.
 3. Mulch pits and planted areas. Provide not less than following thickness of mulch and work into top of backfill and finish level with finish grades. Provide 4" thickness of mulch.
 4. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage. If deciduous shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again 2 weeks after planting.
 5. Wrap tree trunks of 2" caliper and larger. Start at ground and cover trunk to height of first branches and securely attach. Inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures before wrapping.
 6. Guy and stake trees immediately after planting.

3.07 MAINTENANCE

- A. Begin maintenance immediately after planting.
- B. Maintain seeded areas for not less than the period stated below, and longer as required to establish an acceptable cover.
 1. Seeded areas, not less than 60 days after substantial completion. If seeded in fall and not given full 60 days of maintenance, or if not considered acceptable at that time, continue maintenance the following spring until acceptable lawn is established.
 2. Maintain trees, shrubs and other plants until final acceptance but in no case less than 60 days after substantial completion of planting.
- C. Maintain seeded areas by watering, fertilizing, weeding, mowing, trimming, and other operations as required to establish a smooth, acceptable surface, free of eroded or bare areas.

- D. Maintain trees, shrubs and other plants by pruning, cultivating and weeding as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Restore or replace damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease.

3.08 CLEANUP AND PROTECTION

- A. During landscape work, keep pavements clean and work area in an orderly condition.
- B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors, trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

3.09 INSPECTION AND ACCEPTANCE

- A. When landscape work is completed, including maintenance, Engineer will, upon request, make an inspection to determine acceptability.
- B. Landscape work may be inspected for acceptance in parts agreeable to Engineer, provided work offered for inspection is complete, including maintenance.
- C. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Engineer and found to be acceptable.

END OF SECTION

SECTION 33 05 06

PIPE INSTALLATION AND TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes fabrication, handling, installation and testing of buried and interior pipe, fittings, valves, specials and appurtenances as indicated on the drawings and as specified herein.
- B. This section does not include installation of storm and sanitary drains or plumbing.
- C. Install all small piping to cooling or sealing water connections, vents, drains, control tubing, etc., required to complete the installation of each unit of mechanical equipment.

1.02 REFERENCES

A. American Society for Testing and Material (ASTM):

- 1. C12 - Installation of Vitrified Clay Pipe Lines.
- 2. C828 - Low Pressure Air Test of Vitrified Clay Pipe Lines.
- 3. D212 - Installation of PVC Pipe.
- 4. D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- 5. D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Pipe.

B. American Society of Mechanical Engineers (ASME):

- 1. B31 - Code for Pressure Piping.
- 2. B31.1 - Power Piping Section.
- 3. Boiler Code - Section 1.

C. American Water Works Association (AWWA):

- 1. B300 - Hypochlorites
- 2. B301 - Liquid Chlorine
- 3. C105 - Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids.
- 4. C206 - Field Welding of Steel Water Pipe.
- 5. C600 - Installation of Gray and Ductile Cast Iron Water Mains and Appurtenances.
- 6. C605 - Underground Installation of PVC and PCVO Pressure Pipe and Fittings.
- 7. C651 - Disinfecting Watermains.
- 8. M11 - Steel Pipe Design and Installation

D. Plastic Pipe Institute (PPI):

- 1. PPI TR-33 - Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe

1.03 DELIVERY, STORAGE AND HANDLING

- A. Handle pipe, valves, and fittings in a manner to insure installation in an undamaged condition.
 - 1. Do not drop or bump.
 - 2. Use slings, hooks and other devices designed to protect pipe, fittings, joint elements and coating when moving sections of pipe from storage area to installation location.
- B. Handle pipe and fittings with equipment having an adequate factor of safety against overturning.

PART 2 PRODUCTS

- 2.01** As specified in Divisions 33.

PART 3 - EXECUTION

3.01 INSTALLATION - BELOW GROUND PIPING

- A. Belowground Piping
 - 1. Utilize equipment, methods, and materials ensuring installation to lines and grades indicated.
 - a. Maintain within tolerances specified or acceptable laying schedule.
 - (1) Alignment: 2 inches.
 - (2) Grade: +1 inch per 100 feet.
 - b. Do not lay on blocks unless pipe is to receive total concrete encasement.
 - c. Accomplish horizontal and vertical curve alignments with fittings and pipe deflections. Limit joint deflection with ductile-iron pipe and fittings to conform to AWWA C600. Deflection may, with approval, exceed standard deflections by utilizing machined bells. Deflections for PVC pipe joints shall not exceed the manufacturer's recommendations.
 - d. Obtain acceptance of method proposed for transfer of line and grade from control to the work.
 - 2. Install pipe of size, materials, strength class, and joint type with embedment indicated for plan location.
 - 3. Insofar as possible, commence laying at downstream end of line and install pipe with spigot ends in direction of flow.
 - 4. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter if work is suspended or stopped.
 - a. Close open ends of pipe with snug-fitting closures.

- b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
 - c. Remove water, sand, mud and other undesirable material from trench before removal of end cap.
5. Brace or anchor as required to prevent displacement after establishing final position.
6. Perform only when weather and trench conditions are suitable. Do not lay in water.
7. Thermoplastic pressure pipe shall be installed in conformance with ASTM D2774 and manufacturer's requirements. Thermoplastic pipe installed for sewers and other gravity-flow applications shall be installed in conformance with ASTM D2321.
8. The Contractor shall provide and install tracing wire for locating purposes on all buried or below grade water mains. The tracer wire shall be attached to top of pipe and run the full length of the utility line and shall be terminated at dead-ends. The tracer wire shall be secured to the pipe every 5 ft. Contractor shall pull wire through and wrap wire around valve bonnets leaving 2' of extra wire in the valve curb box. Tracer wire shall consist of #10 AWG fully annealed, high carbon steel, copper clad conductor with a 30 mil high-density, high molecular weight polyethylene insulation rated for direct burial use at 30 volts, Copperhead or approved equal. Tracer wire insulation color shall conform to APWA color code standards for identification of buried utilities. Tracer wire shall be installed in such a manner as to limit wire splicing. Splicing shall be with 3M DBY/DBR direct bury splice kits or approved equal.
9. Location of Sewers with Respect to Water Mains:
 - a. Parallel Installation: Water mains shall be laid at least ten feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the Design Engineer and appropriate State Regulatory Agency must be contacted to determine, on a case by case basis, if a deviation is acceptable. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer and on either case, at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. In areas where the recommended separations cannot be obtained, either the waterline or the sewer line shall be constructed of mechanical joint pipe or cased in a continuous casing.
 - b. Crossings: Water mains crossing sewers shall be laid to provide a minimum vertical clear 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. At crossings, the full length of water pipe shall be located so both joints will be as far from the sewer as possible but in no case less than ten feet. Special structural support of the water and sewer pipes may be required. In areas where the recommended separations cannot be obtained either the waterline or the sewerline shall be constructed of mechanical joint pipe or cased in a continuous casing that extends no less than ten feet on both sides of the crossing.
 - c. Exception: Any variance from the specified separation distances in a. and b. must be submitted to the Design Engineer and appropriate Regulatory Agency for approval.
 - d. Force Mains: There shall be at least a ten-foot horizontal separation between water mains and sanitary sewer force mains and they shall be in separate trenches. In areas

where these separations cannot be obtained, either the waterline or the sewer line shall be cased in a continuous casing.

- e. Sewer Manholes: No waterline shall be located closer than ten feet to any part of a sanitary or combined sewer manhole.
- f. Disposal Facilities: No waterline shall be located closer than 25 feet to any on-site wastewater disposal facility, agricultural waste disposal facility, or landfill.

B. Jointing:

1. General Requirements:

- a. Locate joint to provide for differential movement at changes in type of pipe embedment, impervious trench checks, and structures. Joint to be not more than 2 feet from structure wall, unless supported by concrete cradle structurally continuous with base slab or footing.
- b. Perform in accordance with manufacturer's recommendations.
- c. Clean and lubricate all joint and rubber gasket surfaces with lubricant recommended.
- d. Utilize methods and equipment capable of fully homing or making up joints without damage.
- e. Check joint opening and deflection for specification limits.

2. Special Provisions for Jointing Ductile Iron Pipe:

- a. Conform to AWWA C600.
- b. Visually examine while suspended and before lowering into trench.
 - (1) Paint bell, spigot, or other suspected portions with turpentine and dust with cement to check for cracks invisible to the eye.
 - (2) Remove turpentine and cement by washing when test is satisfactorily completed.

3. Special Provisions for High Density Polyethylene (HDPE) Pipe:

- a. HDPE pipe shall be joined utilizing butt fusion welding techniques in conformance with manufacturer's installation instructions, PPI TR-33 and ASTM D2657 requirements.

C. Cutting Pipe:

- 1. Cut in neat manner without damage to pipe.
- 2. Ductile iron and steel pipe to be cut with a carborundum blade saw or other acceptable methods.
- 3. Remove burrs and sharp edges and smooth the pipe end by grinding.
- 4. Repair lining where required and as approved.

D. Closure Pieces:

1. Connect two segments of pipeline or a pipeline segment and structure with short sections of pipe fabricated for the purpose.
2. Location of joints, types of joints, and pipe materials and strength classifications shall comply with specifications.
3. May be accomplished with sleeve couplings:
 - a. Of length such that gaskets are not less than 3" from pipe ends.
 - b. Include spacer ring identical to pipe end such that clear space in closure does not exceed 1/4".

E. Remove plugs from existing pipe as indicated in order to complete connections to existing pipe. Removed plugs shall become the property of the Contractor.

F. Furnish and install test plugs where necessary to properly complete required testing.

1. Test plugs shall be as manufactured by pipe supplier.
2. Plugs shall be push-on, flanged, mechanical joint or restrained as required for ductile iron pipe and shall be watertight against heads equal to the specified test pressure.
3. Secure plugs in place to facilitate removal when required to connect pipe.
4. Restrain plugs to fittings where indicated.

G. Restrained joints or thrust blocks shall be installed where required to counteract internal pressure forces.

H. Install thrust blocks in accordance with Section 33 05 09, Thrust Blocks for Utility Piping.

3.02 INSTALLATION - INTERIOR AND ABOVE GROUND EXTERIOR PIPING

A. Interior piping installation includes:

1. Field welds.
2. Makeup of flanged, mechanical joints, grooved, screwed and solder joints.
3. Connection to existing pipe.
4. Connection to equipment.
5. Installation of hangers, supports, restraints and anchors.
6. Installation of miscellaneous valves.
7. Testing of piping systems.

- B. Install pipe, fittings and valves in accordance with recognized industry standards which will achieve permanently leakproof piping systems, capable of performing indicated service without failure.
- C. Install piping systems with a minimum of joints and couplings, but with adequate and accessible unions, flanged couplings adapters or sleeved couplings for disassembly and maintenance or replacement of valves and equipment.
- D. Welded pipe 2-1/2" and larger shall be fabricated such that a minimum of field welds are required.
- E. Split backing rings shall be used at all field welds for 2-1/2" and larger carbon steel pipe and fittings.
- F. All flanges shall be installed so that bolt holes straddle center lines.
- G. Install vents at all high points and drains at all low points. Vents and drains to be 3/4" unless noted otherwise.
- H. All piping runs shall be parallel with column row lines avoiding diagonal runs where possible.
- I. Restrained joints shall be used at tees and elbows to counteract internal pressure forces in mechanical joint pipe.
- J. Provide all holes, sleeves, flashing and concrete inserts required for erection and installation of piping.
 - 1. Cut holes thru existing concrete and masonry where required with a core drill and grout in sleeves or install link-seal devices.
 - 2. Field cut all openings required in grating and checkered plate. Openings larger than 4" in diameter thru grating shall be banded with a bar of the same size as the main bearing bars. Openings cut in steel shall be cleaned and painted with metal prime paint.
 - 3. Furnish and install hoods, flashing and caulking for all piping through outside walls and roofs.
- K. Furnish all temporary hangers required for erection and installation of pipes.
- L. Welding:
 - 1. All pipe welders performing work under this contract shall be qualified per Section IX of the ASME Code or the American Welding Society Standard AWS B3.0-77 "Welding Procedure and Performance Qualification."
 - 2. Documentation of welding procedure specifications and welders' qualifications shall be submitted for approval.
 - 3. Pressure piping shall be welded in accordance with ANSI B31.1.
 - 4. All butt welds shall have full penetration and shall be smooth and uniform on the pipe interior.
 - 5. Carbon steel welds shall be either gas tungsten arc welding or shielded metal arc welding on the root pass and completed by any of the acceptable metallic arc processes.

6. When welding low carbon grade stainless steel, low carbon electrodes or filler metal compatible to the base metal shall be used.
7. Fillet welds shall have complete penetration. Any cracks, holes, slag or lack of fusion appearing on the weld surface shall be removed before depositing the next layer.

3.03 CONNECTIONS WITH EXISTING PIPING

- A. Connections between new work and existing piping shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations with damage to adjacent property.
- B. For Connection to Dissimilar Pipe Materials. Where steel pipe is to be connected to buried or submerged concrete pipe, cast iron pipe, or to existing steel pipe, the connection shall be made by means of an insulating flange or transition coupling.

3.04 FIELD TESTING

A. Pressure Tests:

1. The Contractor shall furnish all pumps, piping, labor and other materials and services necessary to bring the piping up to the specified test pressure.
2. All pipes shall be pressure tested. Pipes which will be pressurized under normal operating conditions shall conform to the requirements of the hydrostatic pressure test. All other piping shall meet the requirements of the air leakage test.
3. Pipe in the sections to be tested shall be backfilled or center loaded, with thrust blocks installed and completely backfilled. Interior pipe supports and restraint systems shall be completely installed prior to testing.

B. Hydrostatic Pressure Test – Polyvinyl Chloride (PVC), Ductile Iron (DIP) and Other Non-HDPE Pipe:

1. Test connections shall be made and the pipe filled with water. Unless otherwise specified, a pressure of not less than 1.5 times the normal operating pressure (for the lowest point on the pipe line) but not less than 150 pounds per square inch (psi) or not more than the rated working pressure for the pipe shall be used for testing.
2. After air removal, water shall be pumped in to bring the pipe to the specified pressure. After two hours, additional water shall be drawn from a container of known volume. The amount of water required to return the system to the specified pressure shall not exceed the amount determined by the following formula:

$$Q = SD(P)^{1/2}/133000,$$

Where

- Q - Total allowable leakage in two hours, gallons.
- S - Length of section tested, feet.
- D - Nominal pipe diameter, inches.
- P - Test pressure, psi.

3. All exposed pipe, fittings, valves, hydrants and joints shall be inspected and all evidence of moisture appearing on the surface of the ground during the test shall be investigated by the Contractor by excavation where the pipe has been covered with backfill. Should the leakage test results exceed allowable leakage, the test pressure shall be maintained for an additional period of time as directed by the Engineer to facilitate location of leaks.
4. All pipe, fittings, valves, pipe joints, hydrants, and other materials which are found to be defective when the pipe line is tested shall be removed from the line immediately and replaced with new and acceptable material by and at the expense of the Contractor. The pressure test shall be repeated after repairing leaks and other defective work until the pipe line installation conforms to specified requirements and is accepted by the Engineer.

C. Hydrostatic Pressure Test – High Density Polyethylene (HDPE) Pipe:

1. Test connections shall be made and the pipe filled with water. Trapped air must be bled off from the pipeline. Unless otherwise specified, a pressure of not less than 1.5 times the normal operating pressure but not less than 150 pounds per square inch (psi) shall be utilized for testing. At no time shall the test pressure exceed the rated working pressure for the pipe. The test pressure shall be measured at the lowest elevation along the pipeline alignment.
2. Pressure testing of the pipeline shall occur after backfilling has been completed but not sooner than a time which is sufficient to allow for curing of any concrete placed for anchorage or embedment, along the pipeline alignment. Where concrete has been placed along the concrete alignment, pressure testing shall not be completed within 7-days of the concrete placement.
3. After air removal, water shall be pumped into the pipeline to bring the pipeline to the specified testing pressure and to allow for the initial expansion of the pipe. Additional water shall be added at hourly intervals so as to maintain the specified testing pressure. The specified testing pressure must be maintained for four (4) hours.
4. After the initial expansion of the pipe line is complete, testing may begin. Testing of the HDPE pipeline shall conform to one of the two methods listed below. Note that under no circumstances shall the total time of the test exceed 8-hours at specified testing pressure. If the test is not completed within this time limit, due to leakage, equipment failure, etc, the testing shall cease for a minimum of 8-hours before the next test sequence.
 - a. At the beginning of the testing phase, bring the internal pressure of the pipeline to the specified test pressure through the addition of water. Once the pipeline is at the specified test pressure, the pipeline pressure shall be reduced by 10-psi to obtain the target pressure. The reduced test pressure shall be maintained for period of 1-hour. At the end of the 1-hour testing period, the residual pipeline pressure shall be measured. If the residual pipeline pressure is within 5 percent of the target value, the pipe line shall be considered passed.
 - b. At the beginning of the testing phase, bring the internal pressure of the pipeline to the specified test pressure through the addition of water. The pipeline should be allowed to sit for a period of up to 3-hours. At the end of the testing period, water should be added to bring the pipeline back to the specified testing pressure. The volume of water added to the pipeline to achieve the specified testing pressure shall not exceed the volumes listed in the table below.

Allowance for Expansion under Test Pressure							
Nominal Pipe Size	U.S. Gals/100-ft of Pipe			Nominal Pipe Size	U.S. Gals/100-ft of Pipe		
	1-Hour	2-Hour	3-Hour		1-Hour	2-Hour	3-Hour
2"	0.08	0.12	0.15	20"	2.80	5.50	8.00
3"	0.10	0.15	0.25	22"	3.50	7.00	10.50
4"	0.13	0.25	0.40	24"	4.50	8.90	13.30
5"	0.21	0.41	0.63	28"	5.50	11.10	16.80
6"	0.30	0.60	0.90	30"	6.20	12.60	19.10
8"	0.50	1.00	1.50	32"	7.00	14.30	21.50
10"	0.75	1.30	2.10	36"	9.00	18.00	27.00
12"	1.10	2.30	3.40	42"	12.00	24.00	36.00
14"	1.40	2.80	4.20	48"	15.00	27.00	43.00
16"	1.70	3.30	5.00	54"	18.00	30.00	50.00
18"	2.20	4.30	6.50				

5. All exposed pipe, fittings, valves, hydrants and joints shall be inspected and all evidence of moisture appearing on the surface of the ground during the test shall be investigated by the Contractor by excavation where the pipe has been covered with backfill.
4. All pipe, fittings, valves, pipe joints, hydrants, and other materials which are found to be defective when the pipe line is tested shall be removed from the line immediately and replaced with new and acceptable material by and at the expense of the Contractor. The pressure test shall be repeated after repairing leaks and other defective work until the pipe line installation conforms to specified requirements and is accepted by the Engineer.

D. Air Leakage Test:

1. Contractor may perform air tests for all pipe sizes.
2. Air leakage testing shall be performed on lines as specified and on the following lines:
 - Outfall line.
 - Drain lines.
 - Sanitary sewer lines.
3. Furnish all facilities required including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator to avoid overpressurization, and all miscellaneous items required.
 - a. The pipe plug for introducing air to the line shall be equipped with two taps. One tap will be used to introduce air into the line being tested, through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fittings to accept a pressure test gauge indicating internal pressure in the sewer pipe. An additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.
 - b. The pressure test gauge shall meet the following minimum specifications:

Size (diameter)

4-1/2 inches

Pressure Range	0-15 psi
Figure Intervals	1 psi Increments
Minor Subdivisions	0.05 psi
Pressure Tube	Bourdon Tube or diaphragm
Accuracy	+ 0.25% of maximum scale reading
Dial	White coated aluminum with black lettering, 270° Arc and mirror edge
Pipe Connection	Low male ½" N.P.T.

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air tests are performed.

- Test each reach of sewer pipe between manholes after completion of the installation of pipe and appurtenances and the backfill of sewer trench.
- Plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe shall be presumed free of defects.

Pipe Size	Required Time per 100 LF	Maximum Required Time
8"	70 sec.	227 sec.
10"	110 sec.	283 sec.
12"	158 sec.	340 sec.
15"	248 sec.	425 sec.
18"	356 sec.	510 sec.
21"	485 sec.	595 sec.
24"	634 sec.	680 sec.
27"	765 sec.	765 sec.
30"	851 sec.	851 sec.
33"	935 sec.	935 sec.
36"	1020 sec.	1020 sec.
42"	1200 sec.	1200 sec.
48"	1400 sec.	1400 sec.

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired. Prior to acceptance, all constructed sewer lines shall satisfactorily pass the pressure air test.

6. In areas where ground water is known to exist, install a 1/2-inch diameter capped pipe nipple, approximately 10" long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, ground water level shall be determined by removing pipe cap, blowing air through pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to pipe nipple. The hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

E. Vacuum Testing of Manholes:

1. Each manhole shall be tested immediately after assembly and prior to backfilling.
2. All lift holes shall be plugged with an approved non-shrink grout.
3. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole.
4. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturers' recommendations. Test head shall be as manufactured by P.A. Glazier, Inc., of Worcester, Massachusetts, or equal.
5. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48-inch diameter, 75 seconds for 60-inch, and 90 seconds for 72-inch diameter and larger manholes.
6. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

F. Deflection Tests:

1. Deflection tests shall be performed on all flexible sewer pipe by the Contractor using a mandrel pull. The mandrel shall have not less than seven (7) arms. The mandrel pull cannot be performed any sooner than 30 days after the reach being tested has been installed and final backfill has been placed.
2. A section of sewer line reach shall be deemed as failed when the mandrel cannot be moved through it with reasonable force. The tests shall be performed without mechanical pulling devices.
3. At the conclusion of the mandrel pull, the Contractor, at his expense, shall be required to remove and replace all pipe which fails the test.
5. The mandrel diameter shall be based on 95% of the actual inside pipe diameter.

G. Test tracer wire or tracer tape following backfilling.

3.05 PIPING AND TEST SCHEDULE

- A. Refer to 33 14 16.1.013

3.06 CLEANING

- A. Clean and disinfect potable water distribution piping as follows:
 - 1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired, prior to use.
 - 2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, use the procedure described in AWWA C651, or as described below:
 - a. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours. Chlorine solutions shall be prepared from materials meeting AWWA B300 or B301.
 - b. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
 - c. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system.
 - d. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.
 - e. Prevent chlorine containing solutions from entering water bodies.

3.07 INSPECTION

- A. Inspection of pipe and fittings will be conducted by the Engineer as soon as practical after delivery to the job site.

3.08 ACCEPTANCE

- A. Pipe will be inspected by the Engineer for acceptance by Owner as specified in Division 33.

END OF SECTION

SECTION 33 05 09

THRUST RESTRAINT FOR UTILITY PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Joint restraint system.
- B. Related Requirements:
 - 1. Section 31 00 00 - Earthwork: Earthwork requirements for Site utilities.
 - 2. Section 33 14 16 - Site Water Utility Distribution Piping: Requirements for piping Work as required by this Section.

1.02 REFERENCE STANDARDS

- A. ASTM International:
 - 1. ASTM A48 – Gray Iron Casting.
 - 2. ASTM C150 – Portland Cement

1.03 COORDINATION

- A. Section 013100 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with installation of fittings and joints that require restraint.

1.04 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer catalog information for restrained joint details and installation instructions.
- C. Shop Drawings:
 - 1. Indicate restrained joint details and materials being used.
 - 2. Submit layout drawings showing piece numbers and locations.
 - 3. Indicate restrained joint locations.
- D. Samples: Submit two samples of joint restraint parts.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Delegated Design Submittals:

1. Submit signed and sealed Shop Drawings with design calculations and assumptions for restrained lengths.
2. Submit joint restraint details.
3. Use joint restraint devices specifically designed for applications described in manufacturer information.

G. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

H. Qualifications Statement:

1. Submit qualifications for manufacturer, fabricator, and licensed professional.

1.05 CLOSEOUT SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Project Record Documents: Record actual locations of joint restraints.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.01 PERFORMANCE AND DESIGN CRITERIA

A. Provide pressure pipeline with restrained joints at each bend, tee, and change in direction.

2.02 MATERIALS

A. Concrete:

1. 5-1/2 sack mix Portland Cement, compressive strength of 3,000 psi

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 330506 – Pipe Installation and Testing: Requirements for installation examination.

- B. Verify that pipe and fittings are ready to receive Work.
- C. Field measure and verify conditions for installation of Work.

3.02 PREPARATION

- A. Section 330506 – Pipe Installation and Testing: Requirements for installation preparation.
- B. Clean surfaces of pipe and fittings that are to receive joint restraint systems.

3.03 INSTALLATION

- A. Install at all buried tees, elbows, bends, and dead ends where indicated or required.
- B. Place against undisturbed earth.
- C. Of design indicated or specified.
 - 1. Bearing surface area may be adjusted should field conditions be in variance with design assumption. Engineer shall be contacted to inspect actual conditions prior to placement of thrust block.

END OF SECTION

SECTION 33 05 23

HORIZONTAL DIRECTIONAL DRILLING

1 PART 1 GENERAL

1.01 SUMMARY

- A. The work specified in this section documents the approved construction methods, procedures and materials for Directional Boring, also commonly called Horizontal Directional Drilling (HDD)
- B. HDD is a trenchless method for installing a product that serves as a conduit for liquids, gasses, or as a duct for pipe, cable, or wire line products. It is a multi-stage process consisting of site preparation and restoration, equipment setup, and drilling a pilot bore along a predetermined path and then pulling the product back through the drilled space. When necessary, enlargement of the pilot bore hole may be necessary to accommodate a product larger than the pilot bore hole size. This process is referred to as back reaming and is done at the same time the product is being pulled back through the pilot bore hole.

Accomplish alignment of the bore by proper orientation of the drill bit head as it is being pushed into the ground by a hydraulic jack. Determine orientation and tracking of the drill bit by an above ground radio detection device which picks up a radio signal generated from a transmitter located within the drill bit head. Then electronically translate the radio signal into depth and alignment.

In order to minimize friction and prevent collapse of the bore hole, introduce a soil stabilizing agent (drilling fluid) into the annular bore space from the trailing end of the drill bit. The rotation of the bit in the soil wetted by the drilling fluid creates a slurry. The slurry acts to stabilize the surrounding soil and prevent collapse of the bore hole as well as provides lubrication.

Select or design drilling fluids for the site specific soil and ground water conditions. Confine free flowing (escaping) slurry or drilling fluids at the ground surface during pull back or drilling. Accomplish this by creating sump areas or vacuum operations to prevent damage or hazardous conditions in surrounding areas. Remove all residual slurry from the surface and restore the site to preconstruction conditions.

- C. A frac-out mitigation contingency plan shall be developed for all horizontal directional drilling activities. The frac-out plans shall be submitted to the Owner and appropriate controlling authority for review and approval.

1.02 REFERENCES

- A. Pipe and fittings shall be designed and tested in accordance with manufacturers' recommended procedures and the following codes and applicable standards:

- 1. American Society for Testing and Materials (ASTM):
 - A139 - Electric Resistance Welded Steel Pipe

- D2477 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
- D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
- D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- F789 - Standard Specification for Type PS-46 and Type PS-115 Poly(Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings.

2. American Water Works Association (AWWA):

- C200 - Steel Water Pipe - 6 in. (150 mm) and Larger.

3. American Petroleum Institute (API):

- 2B - Specification for the Fabrication of Structural Steel Pipe.

1.03 COMPLIANCE SUBMITTALS

A. Submit as specified in Division 01.

B. Frac-out Mitigation Contingency Plan for Horizontal Directional Drilling (see example in the attached Exhibit A).

C. Boring Path Report

1. Furnish a Bore Path Report to the Engineer within seven days of completion of each bore path. Include the following in the report:

- a. Location of project and financial project number including the permit number when assigned.
- b. Name of person collecting data, including title, position and company name
- c. Investigation site location (Contract plans station number or reference to a permanent structure within the project right-of-way)
- d. Identification of the detection method used
- e. Elevations and offset dimensions as required in Section 33 05 23.3.04.D

D. As-Built Plans

1. Provide the Engineer a complete set of As-Built Plans showing all bores (successful and failed) within 30 calendar days of completing the work. Ensure that the plans are dimensionally correct copies of the Contract plans and include roadway plan and profile, cross-section, boring location and subsurface conditions as directed by the Engineer. The plans must show appropriate elevations and be referenced to a benchmark when provided, otherwise to a USGS grid system and datum, or a specific location. Plans must be same scale in black ink on white

paper, of the same size and weight as the Contract plans. Specific plan content requirements include but may not be limited to the following:

- a. The Contract plan view shows the center line location of each facility installed, or installed and placed out of service, to an accuracy of 1 inch at the ends and other points physically observed in accordance with the bore path report.
- b. As directed by the Engineer, provide either a profile plan for each bore path, or a cross-section of the roadway at a station specified by the Engineer, or a roadway centerline profile. Show the ground or pavement surface and crown elevation of each facility installed, or installed and placed out of service, to an accuracy within 1 inch at the ends and other exposed locations. On profile plans for bore paths crossing the roadway show stationing of the crossing on the Contract plans. On the profile plans for the bore paths paralleling the roadway, show the Contract plans stationing. If the profile plan for the bore path is not made on a copy of one of the Contract profile or cross-section sheets, use a 10 to 1 vertical exaggeration.
- c. If, during boring, an obstruction is encountered which prevents completion of the installation in accordance with the design location and specification, and the product is left in place and taken out of service, show the failed bore path along with the final bore path on the plans. Note the failed bore path as "Failed Bore Path - Taken Out of Service". Also show the name of the Utility owner, location and length of the drill head and any drill stems not removed from the bore path.
- d. Show the top elevation, diameter and material type of all utilities encountered and physically observed during the subsoil investigation. For all other obstructions encountered during a subsoil investigation or the installation, show the type of material, horizontal and vertical location, top and lowest elevation observed, and note if the obstruction continues below the lowest point observed.
- e. Include bore notes on each plan stating the final bore path diameter, product diameter, drilling fluid composition, composition of any other materials used to fill the annular void between the bore path and the product, or facility placed out of service. Note if the product is a casing as well as the size and type of carrier pipe placed within the casing as part of the Contract work.

E. Compliance Submittals

1. Mill certification sheets for new casing material demonstrating conformance to requirements of the plans and specifications.
2. Welder qualification records demonstrating AWS welder certification.
3. Coating submittal, conforming to requirements of Division 09 specifications.

1.04 JOB CONDITIONS

- A. Lines and grades shall be as indicated. Engineer will furnish a benchmark and a base line or other necessary horizontal control points to permit the Contractor to lay out, stake, and construct the work.

2 PART 2 PRODUCTS

2.01 MATERIALS

A. General:

1. Materials are defined as pipe or conduit that becomes the installed product. Incidental materials that may or may not be used to install the product depending on field requirements are not paid for separately and will be included in the cost of the installed product.

B. Material Type:

1. The following material standards are to be interpreted as the minimum in place standards. Use materials that are appropriate for the stresses generated by the selected equipment and field conditions. It is not intended to portray that the use of materials with these minimum material standards will retain their required properties if the stress limits are exceeded for which they were designed during installation. Ensure that the appropriate material is used to retain compliance once it is installed.

Material Standards for HDD Installation

Material Type	Non-Pressure	Pressure
Polyethylene (PE)	ASTM D 2447	ASTM 2513 ASTM D 2447
High Density Polyethylene (HDPE)	ASTM D 2447 ASTM D 3350 ASTM F714	ASTM D 2447 ASTM D 3350 ASTM F714 ASTM 2513
Polyvinyl-Chloride (PVC)	ASTM F 789	N/A
Steel	ASTM A139 Grade B ⁽¹⁾	AWWA C200 API 2B ⁽²⁾

⁽¹⁾No hydrostatic test required

⁽²⁾Dimensional tolerances only

3 PART 3 EXECUTION

3.01 SITE CONDITIONS

- A. Carry out excavation for entry, exit, recovery pits, slurry sump pits, or any other excavation as specified in Division 31 - Earthwork Sump pits are required to contain drilling fluids if vacuum devices are not operated throughout the drilling operation, unless approved by the Engineer.
- B. Within 48 hours of completing installation of the boring product, clean the work site of all excess slurry or spoils. Take responsibility for the removal and final disposition of excess slurry or spoils. Ensure that the work site is restored to pre-construction conditions or as identified on the plans.

3.02 DRILLING OPERATIONS

A. Product Bore Hole Diameter

1. Minimize potential damage from soil displacement/settlement by limiting the ratio of the bore hole to the product size. The size of the back reamer bit or pilot bit, if no back reaming is required, will be limited relative to the product diameter to be installed as follows:

Maximum Pilot or Back-Reamer Bit Diameter When Rotated 360 Degrees	
Nominal Inside Pipe Diameter (Inches)	Bit Diameter (Inches)
2	4
3	6
4	8
6	10
8	12
10	14
12 & Greater	Maximum Product OD plus 6

B. Drilling Fluids

1. Use a mixture of bentonite clay or other approved stabilizing agent mixed with potable water with a minimum pH of 6.0 to create the drilling fluid for lubrication and soil stabilization. Vary the fluid viscosity to best fit the soil conditions encountered. Do not use any other chemicals or polymer surfactants in the drilling fluid without written consent from the Engineer. Certify to the Engineer in writing that any chemicals to be added are environmentally safe and not harmful or corrosive to the facility. Identify the source of water for mixing the drilling fluid. Approvals and permits are required for obtaining water from such sources as streams, rivers, ponds or fire hydrants. Any water source used other than a potable water may require a pH test.

C. Installation Process:

1. Ensure adequate removal of soil cuttings and stability of the bore hole by monitoring the drilling fluids such as the pumping rate, pressures, viscosity and density during the pilot bore, back reaming and pipe installation. Relief holes can be used as necessary to relieve excess pressure down hole. Obtain the Engineer's approval of the location and all conditions necessary to construct relief holes to ensure the proper disposition of drilling fluids is maintained and unnecessary inconvenience is minimized to other facility users.
2. To minimize heaving during pull back, the pull back rate is determined in order to maximize the removal of soil cuttings without building excess down hole pressure. Contain excess drilling fluids at entry and exit points until they are recycled or removed from the site or vacuumed during drilling operations. Ensure that entry and exit pits are of sufficient size to contain the expected return of drilling fluids and soil cuttings.
3. Ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, or federal regulatory agencies. When drilling in suspected contaminated ground, test the drilling fluid for contamination and

appropriately dispose of it. Remove any excess material upon completion of the bore. If in the drilling process it becomes evident that the soil is contaminated, contact the Engineer immediately. Do not continue drilling without the Engineer's approval.

4. The timing of all boring processes is critical. Install a product into a bore hole within the same day that the pre-bore is completed to ensure necessary support exists.

3.03 BORING FAILURE

- A. If an obstruction is encountered during boring which prevents completion of the installation in accordance with the design location and specification, the pipe may be taken out of service and left in place at the discretion of the Engineer. Immediately fill the product left in place with excavatable flowable fill, as specified in Section 31 23 23, "Flowable Fill". Submit a new installation procedure and revised plans to the Engineer for approval before resuming work at another location. If, during construction, damage is observed to the owner's or adjacent facility, cease all work until resolution to minimize further damage and a plan of action for restoration is obtained and approved by the Engineer.

3.04 QUALITY CONTROL

- A. Notify the Engineer 48 hours in advance of starting work. Do not begin installation until the Engineer is present at the job site and agrees that proper preparations have been made.
- B. Product Testing:
 1. When there is any indication that the installed product has sustained damage and may leak, stop all work, notify the Engineer and investigate damage. The Engineer may require a pressure test and reserves the right to be present during the test. Perform pressure test within 24 hours unless otherwise approved by the Engineer. Furnish a copy of test results to the Engineer for review and approval. The Engineer is allowed up to 72 hours to approve or determine if the product installation is not in compliance with the specifications. The Engineer may require non-compliant installations to be filled with excavatable flowable fill, as specified in Section 02315, "Flowable Fill".
- C. Testing Methods
 1. All below ground piping will be tested in accordance with Section 18160, "Pipe Installation"
- D. Product Locating and Tracking:
 1. Use a locating and tracking system capable of ensuring that the proposed installation is installed as intended. The locating and tracking system must provide information on:
 - a. Clock and pitch information
 - b. Depth
 - c. Transmitter temperature

- d. Battery status
- e. Position (x,y)
- f. Azimuth, where direct overhead readings (walkover) are not possible (i.e. subaqueous or limited access transportation facility)
- g. Ensure proper calibration of all equipment before commencing directional drilling operation.
- h. Take and record alignment readings or plot points such that elevations on top of and offset dimensions from the center of the product to a permanent fixed feature are provided. Such permanent fixed feature must have prior approval of the Engineer. Provide elevations and dimensions at all bore alignment corrections (vertical and horizontal) with a minimum distance between points of 100-feet. Provide a sufficient number of elevations and offset distances to accurately plot the vertical and horizontal alignment of the installed product. A minimum of three elevation and plot points are required.
- i. Install all facilities such that their location can be readily determined by electronic designation after installation. For non-conductive installations, attach a minimum of two separate and continuous conductive tracking (tracer wire) materials. Tracer wire material and installation shall conform to requirements of Specification Section 18160. Conductors must extend 2-feet beyond bore termini. Test conductors for continuity. Each conductor that passes must be identified as such by removing the last 6-inches of the sheath. No deductions are allowed for failed tracking conductors. Failed conductor ends must be wound into a small coil and left attached for future use.

3.05 ACCEPTANCE

- A. Horizontal Directional Drilling and carrier pipe installation shall be inspected by Engineer for acceptance by owner at the construction site. Acceptance at the job site shall be paramount. Prior approval or payment for drilling and pipe rejected at the job site shall be null and void. Acceptance by Engineer at a point in the sequence of manufacture, delivery and installation will not relieve the Contractor of his responsibilities as set forth in the Contract Documents. Manufacturing defects that prohibit installed pipe from successfully passing leakage tests shall constitute rejection of the defective pipe.

END OF SECTION

EXHIBIT A

Onondaga Cave State Park Water and Wastewater Improvements

For

**State of Missouri, Department of Natural Resources, Missouri State Parks
CRAWFORD COUNTY, MISSOURI**

EXHIBIT A

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EXHIBIT A

FRAC-OUT CONTINGENCY PLAN (FCP)

1.0 Introduction and Purpose

Directional bore operations have a potential to release drilling fluids into the surface environment through frac-outs (A frac-out is the condition where drilling mud is released through fractured bedrock into the surrounding rock and sand and travels toward the surface.) Because drilling muds consist largely of a bentonite clay-water mixture, they are not classified as toxic or hazardous substances. However, if it is released into water bodies, bentonite has the potential to adversely impact fish and invertebrates.

While drilling fluid seepage associated with a frac-out is most likely to occur near the bore entry and exit points where the drill head is shallow, frac-outs can occur in any location along a directional bore. This Frac-Out Contingency Plan (FCP) establishes operational procedures and responsibilities for the prevention, containment, and clean-up of frac-outs associated with the proposed directional drilling utility project. All personnel and Sub-Contractors responsible for the work must adhere to this plan during the directional drilling process.

The specific objectives of this plan are to:

1. Minimize the potential for a frac-out associated with directional drilling activities;
2. Provide for the timely detection of frac-outs;
3. Protect the environmentally sensitive riverbed and associated riparian vegetation;
4. Ensure an organized, timely, and "minimum-impact" response in the event of a frac-out and release of drilling bentonite; and
5. Ensure that all appropriate notifications are made immediately to the customer, management and safety personnel.

2.0 Description of Work:

The proposed project consists of: Directional Drilling and installation of uncased water utilities.

Drilling operations will be halted by the drill rig operators immediately upon detection of a drop in drilling pressure or other evidence of a frac-out. The clean-up of all spills shall begin immediately. Management & safety department shall be notified immediately of any spills and shall be consulted regarding clean-up procedures. A spill kit shall be on-site and used if a frac-out occurs. A vacuum truck and containment materials, such as straw bales, shall also be on-site prior to and during all operations. The Site Supervisor will be immediately notified. In the event of a frac-out, the on-site foreman/supervisor will conduct an evaluation of the situation and direct recommended mitigation actions, based on the following guidelines:

- a. If the frac-out is minor, easily contained, has not reached the surface and is not threatening sensitive resources, drilling operations may resume after use of a leak stopping compound or redirection of the bore;
- b. If the frac-out has reached the surface, any material contaminated with Bentonite shall be removed by hand to a depth of 2-feet, contained and properly disposed of, as required by law. The drilling contractor shall be responsible for ensuring that the bentonite is either properly disposed of at an approved disposal facility or properly recycled in an approved manner. The Site Supervisor shall notify and take any necessary follow-up response actions in coordination with

EXHIBIT A

agency representatives. The Site Supervisor will coordinate the mobilization of equipment stored at off-site locations (e.g., vacuum trucks) on an as needed basis.

3.0 Site Supervisor/Foremen Responsibilities:

The Site Supervisor/Foremen has overall responsibility for implementing this FCP. The Site Supervisor/Foremen will ensure that all employees are trained prior to all drilling. The Site Supervisor/Foremen shall be notified immediately when a frac-out is detected. The Site Supervisor/Foremen will be responsible for ensuring that the safety department is aware of the frac-out, coordinating personnel, response, cleanup, regulatory agency notification and coordination to ensure proper clean-up, disposal of recovered material and timely reporting of the incident. The Site Supervisor/Foremen shall ensure all waste materials are properly containerized, labeled, and removed from the site to an approved disposal facility by personnel experienced in the removal, transport and disposal of drilling mud.

The Site Supervisor/Foremen shall be familiar with all aspects of the drilling activity, the contents of this Frac-out Contingency Plan and the conditions of approval under which the activity is permitted to take place. The Site Supervisor/Foremen shall have the authority to stop work and commit the resources (personnel and equipment) necessary to implement this plan. The Site Supervisor/Foremen shall assure that a copy of this plan is available (onsite) and accessible to all construction personnel. The Site Supervisor/Foremen shall ensure that all workers are properly trained and familiar with the necessary procedures for response to a frac-out, prior to commencement of drilling operations.

4.0 Equipment:

The Site Supervisor shall ensure that:

- o All equipment and vehicles are be checked and maintained daily to prevent leaks of hazardous materials;
- o Spill kits and spill containment materials are available on-site at all times and that the equipment is in good working order;
- o Equipment required to contain and clean up a frac-out release will either be available at the work site or readily available at an offsite location within 15-minutes of the bore site; and
- o If equipment is required to be operated near a riverbed, absorbent pads and plastic sheeting for placement beneath motorized equipment shall be used to protect the riverbed from engine fluids;

5.0 Training:

Prior to the start of construction, the Site Supervisor/Foremen, shall ensure that the crew members receive training in the following:

- o The provisions of the Frac-out Contingency Plan, equipment maintenance and site specific permit and monitoring requirements;
- o Inspection procedures for release prevention and containment equipment and materials;

EXHIBIT A

- o Contractor/crew obligation to immediately stop the drilling operation upon first evidence of the occurrence of a frac-out and to immediately report any frac-out releases;
- o Contractor/crew member responsibilities in the event of a release;
- o Operation of release prevention and control equipment and the location of release control materials, as necessary and appropriate; and
- o Protocols for communication with agency representatives who might be on-site during the clean-up effort.

6.0 Drilling Procedures:

The following procedures shall be followed each day, prior to the start of work. The Frac-out Contingency Plan shall be available on-site during all construction. The Site Supervisor/Foremen shall be on-site at any time that drilling is occurring or is planned to occur. The Site Supervisor/Foremen shall ensure that a Job Briefing meeting is held at the start of each day of drilling to review the appropriate procedures to be followed in case of a frac-out. Questions shall be answered and clarification given on any point over which the drilling crew or other project staff has concerns.

Drilling pressures shall be closely monitored so they do not exceed those needed to penetrate the formation. Pressure levels shall be monitored randomly by the operator. Pressure levels shall be set at a minimum level to prevent frac-outs. During the pilot bore, maintain the drilled annulus. Cutters and reamers will be pulled back into previously-drilled sections after each new joint of pipe is added. Exit and entry pits shall be enclosed by silt fences and straw. A spill kit shall be on-site and used if a frac-out occurs. A vacuum truck shall be readily available on-site prior to and during all drilling operations. Containment materials (Straw, silt fencing, sand bags, frac-out spill kits, etc.) shall be staged on-site at location where they are readily available and easily mobilized for immediate use in the event of an accidental release of drilling mud (frac-out). If necessary, barriers (straw bales or sedimentation fences) between the bore site and the edge of the water source, shall be constructed, prior to drilling, to prevent released bentonite material from reaching the water.

Once the drill rig is in place, and drilling begins, the drill operator shall stop work whenever the pressure in the drill rig drops, or there is a lack of returns in the entrance pit. At this time the Site Supervisor/Foremen shall be informed of the potential frac-out. The Site Supervisor/Foremen and the drill rig operator(s) shall work to coordinate the likely location of the frac-out. The location of the frac-out shall be recorded and notes made on the location and measures taken to address the concern. The following subsections shall be adhered to when addressing a frac-out situation.

Water containing mud, silt, bentonite, or other pollutants from equipment washing or other activities, shall not be allowed to enter a lake, flowing stream or any other water source. The Bentonite used in the drilling process shall be either disposed of at an approved disposal facility or recycled in an approved manner. Other construction materials and wastes shall be recycled, or disposed of, as appropriate.

6.1 Vac-Trailer:

A vacuum trailer shall be staged at a location from which it can be mobilized and relocated so that any place along the drill shot, can be reached by the apparatus, within 10 minutes of a frac-out.

6.2 Field Response to Frac-out Occurrence:

The response of the field crew to a frac-out release shall be immediate and in accordance with procedures identified in this Plan. All appropriate emergency actions that do not pose additional threats to sensitive resources will be taken, as follows:

EXHIBIT A

- a. Directional boring will stop immediately;
- b. The bore stem will be pulled back to relieve pressure on frac-out;
- c. The Site Supervisor/Foremen will be notified to ensure that management and the safety department is notified, adequate response actions are taken and notifications made;
- d. The Site Supervisor/Foremen shall evaluate the situation and recommend the type and level of response warranted, including the level of notification required;
- e. If the frac-out is minor, easily contained, has not reached the surface and is not threatening sensitive resources, a leak stopping compound shall be used to block the frac-out. If the use of leak stopping compound is not fully successful, the bore stem shall be redirected to a new location along the desired drill path where a frac-out has not occurred;
- f. If the frac-out has reached the surface, any material contaminated with Bentonite shall be removed by hand, to a depth of 2-feet, contained and properly disposed of, as required by law. A dike or berm may be constructed around the frac-out to entrap released drilling fluid, if necessary. Clean sand shall be placed and the area returned to pre-project contours; and
- g. If a frac-out occurs, reaches the surface and becomes widespread, the Site Supervisor/Foremen shall authorize a readily accessible vacuum truck and skid-loader stored off-site to be mobilized. The vacuum trailer may be either positioned at either end of the line of the drill so that the frac-out can be reached by crews on foot, or may be pulled by a skid-loader, so that contaminated soils can be vacuumed up.

6.3 Response Close-out Procedures:

When the release has been contained and cleaned up, response closeout activities will be conducted at the direction of the Site Supervisor/Foremen and shall include the following:

- a. The recovered drilling fluid will either be recycled or hauled to an approved facility for disposal. No recovered drilling fluids will be discharged into streams, storm drains or any other water source;
- b. All frac-out excavation and clean-up sites will be returned to pre-project contours using clean fill, as necessary; and
- c. All containment measures (fiber rolls, straw bale, etc.) will be removed, unless otherwise specified by the Site Supervisor/Foremen.

6.4 Construction Re-start:

For small releases not requiring external notification, drilling may continue, if 100 percent containment is achieved through the use of a leak stopping compound or redirection of the bore and the clean-up crew remains at the frac-out location throughout the construction period.

For releases requiring external notification and/or other agencies, construction activities will not restart without prior approval from the safety department.

6.5 Bore Abandonment:

Abandonment of the bore will only be required when all efforts to control the frac-out within the existing directional bore have failed.

7.0 Notification:

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In the event of a Frac-out that reaches a water source, the Site Supervisor/Foremen will notify safety department so they can notify the appropriate resource agencies. All agency notifications will occur within 24 hours and proper documentation will be accomplished in a timely and complete manner. The following information will be provided:

1. Name and telephone number of person reporting;
2. Location of the release;
3. Date and time of release;
4. Type and quantity, estimated size of release;
5. How the release occurred;
6. The type of activity that was occurring around the area of the frac-out;
7. Description of any sensitive areas, and their location in relation to the frac-out;
8. Description of the methods used to clean up or secure the site; and
9. Listing of the current permits obtained for the project.

7.1 Communicating with Regulatory Agency Personnel:

All employees and subcontractors will adhere to the following protocols when permitting Regulatory Agency Personnel arrive on site. Regulatory Agency Personnel will be required to comply with appropriate safety rules. Only the Site Supervisor/Foremen and the safety department are to coordinate communication with Regulatory Agency Personnel.

7.2 Documentation:

The Site Supervisor/Foremen shall record the frac-out event in his or her daily log. The log will include the following: Details on the release event, including an estimate of the amount of bentonite released, the location and time of release, the size of the area impacted, and the success of the clean-up action. The log report shall also include the: Name and telephone number of person reporting; Date, How the release occurred; The type of activity that was occurring around the area of the free-out: Description of any sensitive areas, and their location in relation to the frac-out: Description of the methods used to clean up or secure the site; and a listing of the current permits obtained for the project.

8.0 Project Completion and Clean-up:

- a. All materials and any rubbish-construction debris shall be removed from the construction zone at the end of each workday;
- b. Sump pits at bore entry and exits will be filled and returned to natural grade; and
- c. All protective measures (fiber rolls, straw bale, silt fence, etc.) will be removed unless otherwise specified by the Site Supervisor/Foremen.

SECTION 33 05 61
CONCRETE MANHOLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Modular precast concrete manholes and structures with tongue-and-groove joints and masonry transition to cover frame, covers, anchorage, and accessories.
2. Doghouse manhole connections to existing sanitary sewer lines.
3. Bedding and cover materials.
4. Pile support systems.
5. Vertical adjustment of existing manholes and structures.

B. Related Requirements:

1. Section 330130.61 - Packer Injection Grouting: Grout sealing as required by this Section.
2. Section 330130.86 - Manhole Rim Adjustment: Resetting existing castings and grates.
3. Section 333100 - Sanitary Sewerage Piping: Piping connections to manholes.

1.02 DEFINITIONS

- A. Bedding: Specialized material placed under the manhole prior to installation and subsequent backfill operations.

1.03 REFERENCE STANDARDS

A. American Association of State Highway Transportation Officials:

1. AASHTO M91 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
2. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
3. AASHTO M306 - Standard Specification for Drainage, Sewer, Utility, and Related Castings.

B. American Concrete Institute:

1. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.

C. ASTM International:

1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
4. ASTM C55 - Standard Specification for Concrete Building Brick.

5. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
6. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
7. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
8. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
9. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
10. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
11. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.04 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information for manhole covers, component construction, features, configuration, and dimensions.
- C. Shop Drawings:
 1. Indicate structure locations and elevations.
 2. Indicate sizes and elevations of piping and penetrations.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- F. Source Quality-Control Submittals: Indicate results of shop and/or factory tests and inspections.
- G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- H. Qualifications Statement:
 1. Submit qualifications for the manufacturer.

1.05 CLOSEOUT SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Project Record Documents: Record actual locations of manholes and connections, and record invert elevations.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

- B. Handling: Comply with precast concrete manufacturer instructions and ASTM C913 for unloading and moving precast manholes and drainage structures.
- C. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
 - 3. Repair property damaged from materials storage.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing them in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.07 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete: Reinforced, 4000 psi. Conform to Division 03.
- B. Manhole Frames and Covers:
 - 1. Units cast of gray iron, free of defects, conforming to ASTM A48.
 - 2. Machine bearing surfaces to provide even seating.
 - 3. Coat with coal tar pitch varnish.
 - 4. Non-bolt down lids shall be Neenah R-1642 or approved equal.
 - 5. Bolt down lid with waterproof gasket, Neenah R-1916-F or approved equal.
- C. Manhole Steps:
 - 1. Have a minimum width of 14 inches.
 - 2. Steel reinforced corrosion resistant polypropylene plastic.
 - 3. Fabricate with positive friction lock system.
 - 4. "PS 2 PF" as manufactured by M. A. Industries of Peachtree City, Georgia 30269, or approved equal.
- D. Waterproofing:
 - 1. As specified in Division 07.
- E. Joint Sealers:
 - 1. NPC Bidco C-56 butyl mastic sealant.

2. Press Seal EZ-Stik butyl mastic sealant.
3. Or approved equal. Joint sealant shall meet or exceed the requirements of the latest versions of AASHTO M-198 and ASTM C990. Minimum width of sealant strips shall be 1 inch.

F. Pipe to Manhole Connectors:

1. A-Lok Premium by A-Lok Products, Inc., for pipe deflections less than or equal to 10-degrees. Z-Lok boot by A-Lok Products, Inc., for pipe deflections greater than 10-degrees, but less than or equal to 25-degrees.
2. Or approved equal. Pipe to manhole connectors shall meet or exceed the requirements of the latest version of ASTM C923.

2.02 FABRICATION

A. Manholes:

1. Design: Construct as follows:
 - a. Precast manholes shall conform to ASTM C 478 except as specified herein. Minimum circumferential reinforcement per linear foot shall be as follows:

Manhole I.D.	Wall Thickness	Minimum Circumferential Reinforcement per Lineal Foot
48"	5"	0.18 sq. in.
60"	6"	0.21 sq. in.
72"	7"	0.28 sq. in.

- b. Cement shall be ASTM C150, Type II.
 - c. Manhole adjustment rings 4" or less in height shall be fiber reinforced.
2. Connections:
 - a. Manhole entry pipe gasket system shall be as specified above for Pipe-to-manhole Connectors. Leakage testing shall conform to ASTM C923.
 - b. Place pipe stub in manhole wall with bell or coupling outside manhole wall to provide flexible joint as indicated.
 - c. Make provisions for future connections where indicated.
3. Invert Channels:
 - a. Form invert channel with 4000 psi concrete, in conformance with Division 03.
 - b. Make changes in the direction of flow with smooth curves of as large a radius as size of manhole permits.
 - c. Make changes in size and grade smoothly and uniformly.
 - d. Slope floor of manhole adjacent to channels in drain thereto.
 - e. Finish channel bottom smoothly without roughness, irregularity, or pockets.
4. Waterproofing:
 - a. As specified in Division 07.
5. Joint Sealers:
 - a. Apply per manufacturer's instructions.
6. Manhole Frames and Covers:
 - a. Embedded into concrete construction where indicated on plans.
 - b. Set on double ring of mastic on top of manholes and grouted in place.
 - c. Install items level and in alignment.
7. Manhole Steps:
 - a. Steps shall be placed in wet concrete.
 - b. A minimum of 2 inches of plastic coating shall be embedded in the concrete wall.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 330506 – Pipe Installation and Testing: Requirements for installation examination.
- B. Verify that items provided by other Sections of Work are properly sized and located.
- C. Verify that built-in items are in the proper location and are ready for roughing into Work.
- D. Verify that the excavation base is ready to receive Work and excavations and that dimensions and elevations are as indicated on drawings.

3.02 PREPARATION

- A. Section 330506 – Pipe Installation and Testing: Requirements for installation preparation.
- B. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.
- C. Coordinate placement of inlet and outlet pipe or duct sleeves as required by other Sections.
- D. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.
- E. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.03 INSTALLATION

- A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.
- B. Remove large stones or other hard matter impeding consistent backfilling or compaction.
- C. Protect manhole from damage or displacement while backfilling operation is in progress.
- D. Excavating:
 - 1. As specified in Section 310000 – Earthwork on and in indicated locations and depths.
 - 2. Provide clearance around sidewalls of manhole or structure for construction operations granular backfill, and placement of geotextile filter fabric.
 - 3. If groundwater is encountered, prevent accumulation of water in excavations; place the manhole or structure in a dry trench.
 - 4. Where the possibility exists of a watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation as approved by Architect/Engineer.
- E. Base and Alignment:

1. Place foundation slab and trowel top surface level.
2. Place manhole sections plumb and level, trim to correct elevations and anchor to the foundation slab.

F. Backfilling: As specified in Section 310000 - Earthwork.

G. Precast Concrete Manholes:

1. Lift precast components at lifting points designated by the manufacturer.
2. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that the interior of the pipeline and structure remains clean.
3. Assembly:
 - a. Assemble multisection manholes and structures by lowering each section into the excavation.
 - b. Install rubber gasket joints between precast sections according to manufacturer recommendations.
 - c. Lower, set level, and firmly position the base section before placing additional sections.
4. Remove foreign materials from joint surfaces and verify that sealing materials are placed properly.
5. Maintain alignment between sections by using guide devices affixed to the lower section.
6. Joint sealing materials may be installed on-site or at the manufacturer's plant.
7. Verify that installed manholes and structures meet the required alignment and grade.
8. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.

END OF SECTION

SECTION 33 05 97

IDENTIFICATION AND SIGNAGE FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipeline marker posts.
2. Metal utility markers.
3. Plastic utility markers.
4. Marking flags.
5. Plastic ribbon tape for placement above direct-buried utility.
6. Trace wire for placement above direct-buried utility.

B. Related Requirements:

1. Section 331416 - Site Water Utility Distribution Piping: Piping, valves, and appurtenances requiring identification marking.
2. Section 333100 - Sanitary Sewerage Piping: Piping, valves, and appurtenances requiring identification marking.

1.02 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit product specifications and installation instructions for each identification material and device required.
- C. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03 CLOSEOUT SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. W. H. Brady Company.

- B. Seton Name Plate Corporation.
- C. Or approved equal.

2.02 IDENTIFICATION MATERIALS

- A. ANSI Standards: Comply with ANSI A13.1 for lettering, colors, and viewing angles of identification materials.
- B. Except as otherwise indicated, provide the manufacturer's standard products of categories and types required for each application.
- C. Painted Identification Materials:
 - 1. Stencils: Standard fiberboard stencils prepared for required applications with letter sizes generally complying with recommendations of ANSI A 13.1 for piping and similar applications, but not less than 1 1/4" high letters for ductwork, and not less than 3/4" high letters for access door signs and similar operational instructions.
 - 2. Stencil Paint: Standard exterior type stenciling enamel; black, except white where white provide greater visual contrast on application substrate, and except as otherwise indicated; either brushing grade or pressurized spray can form and grade.
 - 3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for systems, comply with ANSI A13,1 for colors.
- D. Plastic Pipe Markers:
 - 1. Provide manufacturer's standard pre-printed, self-sticking, permanent, color-coded, plastic sheet pipe markers, complying with ANSI A13.1.
 - 2. For external diameters less than 6" (including insulation if any), provide full band markers, extending 360° around pipe or conduit at each location, fastened by one of the following methods:
 - a. Adhesive lap joint in pipe marker overlap.
 - b. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1 1/2".
 - 3. For external diameters of 6" and larger (including insulation if any), provide either full-band or strip type markers, but not narrower than 3 times letter height (and of required length), fastened by tape to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1 1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
 - 4. Use the manufacturer's standard pre-printed nomenclature which best describes the piping system in each instance, as selected by Engineer in cases of variance with names as shown or specified.
 - 5. Print each pipe marker with arrows indicating the direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- E. Self-Adhesive Plastic Signs: Provide manufacturer's standard, self-adhesive or pressure sensitive, pre-printed, flexible vinyl signs for identification, operation instructions, or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application (as examples: EXHAUST FAN, KEEP OFF, FUEL OIL).
- F. Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20 gage steel; of standard red, black, and white graphics; 14" x 10" size except where 10" X 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording (as examples: KEEP AWAY BURIED CABLE, DO NOT TOUCH SWITCH).

- G. Provide the following sign at all nonpotable water hydrants NOTICE NONPOTABLE WATER NOT FOR DRINKING.

2.03 LETTERING AND GRAPHICS

- A. Coordinate names, abbreviations, and other designations used in identification work, with Engineer. Provide numbers, lettering, and wording as recommended by manufacturers or as required for proper identification systems.
- B. Where multiple systems of the same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Boiler No. 3, Air Supply No. 1H, Standpipe F12, Substation No. P2).

2.04 COLOR CODING FOR PROCESS PIPING

- A. All exposed process piping shall be color-coded for easy identification. The following process piping color coding scheme shall be implemented. Pipe identification and flow direction labels shall be stenciled in a contrasting color.

Raw sludge line	Gray
Sludge recirculation suction line	Brown with yellow bands
Sludge draw off line	Brown with orange bands
Sludge recirculation discharge line	Brown
Treated Effluent	Tan
Digested sludge line	Black
Sludge gas line	Red
Natural gas line	Red
Nonpotable water line	Purple
Potable water line	Blue
Fire main	Red
Chlorine line	Yellow
Sulfur Dioxide	Yellow with red bands
Sewage (wastewater) line	Gray
Compressed air line	Dark green
Process air line	Light green
Fuel oil/diesel	Red
Plumbing drains and vents	Black
Ferric Chloride	Orange
Polymer	Unpainted PVC (*)

(*) PVC exposed to UV radiation shall be painted white in accordance with Division 9, Specification Section 099000 – Painting (Industrial) and Coating.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General Installation Requirements:
 1. Where identification is to be applied to surfaces that require insulation, painting, or other covering or finish, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

2. 2. Install protective underlayment on uninsulated hot surfaces to receive plastic identification materials; secured with adhesive or anchorages as recommended by the insulation manufacturer.
3. Comply with governing regulations and requests of governing authorities for identification of services, systems, and equipment.
4. Provide colors to comply with governing regulations. Except as otherwise indicated.

B. Piping System Identification:

1. Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction flow (if any):
2. Self-adhered plastic signs but limited in use to surfaces recommended by the sign manufacturer as suitable for permanent adhesion.
3. Locate markers as indicated and as follows, where piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plethora), and exterior non-concealed locations.
 - a. Near each valve or other similar control device.
 - b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each line at the branch, where there could be a question of flow pattern.
 - c. Near locations where lines pass through walls or floors/ ceilings or enter non-accessible enclosures.
 - d. Near major equipment items and other points of origination and termination.
 - e. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of lines and equipment.
 - f. On lines above removable acoustical ceilings, except omit intermediately spaced markers.

END OF SECTION

SECTION – 33 13 00

DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection and testing of drinking water storage facilities.

1.02 REFERENCES

- A. Latest edition of the of AWWA C652, Disinfection of Water-Storage Facilities.

1.03 DESIGN REQUIREMENTS

- A. Ground Storage Tank, 20,000 gallon capacity.

1.04 SUBMITTALS

- A. Submit Testing Certification
 - 1. Reference Sub-Section 3.06

PART 2 PRODUCTS

- A. Reference Section 3.01 per testing method selected.

PART 3 EXECUTION

3.01 DISINFECTION AND CLEANING

- A. After the work is completed, inspected and approved, the tank shall be disinfected according to the latest standard of AWWA C652, Disinfection of Water-Storage Facilities.

1. Cleaning. All scaffolding, tools, rags and any other material that are not part of the structure or operating facilities of the tank shall be removed. Then all interior surfaces of the storage facility shall be cleaned thoroughly using a high-pressure water jet, sweeping, scrubbing or equally effective means. All water, dirt, and foreign material accumulated shall be removed and disposed of by the Contractor.

Following the cleaning, the vent screen, overflow screen and other screened openings shall be checked and put in satisfactory condition to prevent birds, insects and other possible contaminants from entering the facility.

2. Disinfection. Only one method of the two following methods will be required for water-storage tank disinfection, but a combination of the methods may be used if the Contractor chooses.

Method 1. A solution of not less than 200 mg/l available chlorine shall be applied directly to the surfaces of all parts of the storage tank that would be in contact with water when the storage tank is full to the overflow elevation.

The chlorine solution may be applied with suitable brushes or spray equipment. The solution shall thoroughly coat all surfaces to be treated including the inlet and outlet piping, and shall be applied to any separate drain piping such that it will have available chlorine of not less than 10 mg/l when filled with water. Overflow piping need not be disinfected.

The disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30 minutes, after which the solution shall be drained to waste and potable water shall be admitted. The drain piping shall be purged of the 10 mg/l chlorinated water, and the storage tank shall then be filled to its overflow level.

Following this procedure and subject to satisfactory bacteriological testing and acceptable aesthetic quality, such water may be delivered to the distribution system.

Method 2. Water and chlorine shall be added to the storage facility in amounts such that initially the solution will contain 50 mg/l available chlorine and will fill approximately 5 percent of the total storage volume. This solution shall be held in the storage facility for a period of not less than 6 hours. The storage facility shall then be filled to the overflow level by flowing potable water into the highly chlorinated water. It shall be held full for a period of not less than 24 hours and the strong chlorine solution drained to waste before potable water is admitted. All highly chlorinated water shall be purged from the drain piping.

Following this procedure and subject to satisfactory bacteriological testing and acceptable aesthetic quality, the remaining water may be delivered to the distribution system.

Chlorine shall be added to the storage tank by one of the following methods:

- a. Liquid chlorine shall be introduced into the water, filling the storage tanks in such a way as to give uniform chlorine concentration during the entire filling operation. Portable chlorination equipment shall be carefully operated and shall include a liquid-chlorine cylinder gas-flow chlorinator, chlorine ejector, safety equipment, and solution tube to inject the chlorine solution into the filling water. The solution tube shall be inserted through an appropriate valve located on the inlet pipe and near the storage tank.
- b. Sodium hypochlorite shall be added to the water entering the storage tank by means of a chemical-feed pump, or shall be applied by hand pouring into the storage tank and allowing the following water to provide the desired mixing.

When a chemical-feed pump is used, the concentrated chlorine solution shall be pumped through an appropriate solution tube so as to inject the high-concentration chlorine solution at a rate that will give a uniform chlorine concentration in the filling water.

When the sodium hypochlorite is poured into the storage tank, the filling of the storage tank shall be immediately thereafter or as soon as any removed manhole cover can be closed. The sodium hypochlorite may be poured through a clean out, or inspection manhole in the lower level of the storage tank, or in the riser pipe, or through the roof manhole. The sodium hypo-

chlorite shall be poured into water in the storage tank when the water is not more than 3 feet in depth, nor less than one foot in depth, and as close thereto as manhole locations will permit.

- c. Calcium hypochlorite granules or tablets broken to sizes not larger than ¼ inch may be poured into the storage tank through a clean out, or inspection manhole in the lower level of the storage facility, or in the riser pipe, or through a roof manhole. The granules or tablet particles shall be placed in the storage tank prior to flowing water into it, and they shall be located so that the in flowing water will ensure a current of water circulating through the calcium hypochlorite and dissolving it during the filling operation. The calcium hypochlorite shall be placed only on dry surfaces unless adequate precautions are taken to provide proper ventilation or protective breathing equipment.

The actual volume of the 50 mg/l chlorine solution shall be such that after the solution is mixed with filling water and the storage tank is held full for not less than 24 hours, there will be a free chlorine residual of not more than 2 mg/l.

- d. Disposal of heavily chlorinated water from the storage tank shall be in accordance with the requirements of Missouri Department of Natural Resources and at the expense of the Contractor.
- e. All water for testing and sterilization shall be furnished by the Owner.

3.06 TESTING

- A. After the disinfection is completed and before the storage tank is placed in service, water from the full tank shall be sampled and tested for coliform organisms in accordance with the latest edition Standard Methods for the Examination of Water and Wastewater. The testing shall be by either the multiple tube fermentation technique or the membrane filter technique.

The water in the full tank shall also be tested to assure that no offensive odor or taste exists.

Two or more consecutive samples shall be collected and analyzed to indicate microbiologically satisfactory water before the storage tank is placed in service. In the event tests show the presence of coliform bacteria, the storage tank shall again be subject to disinfection.

The Contractor will be responsible for the cost of all bacteriological testing. The Owner will be responsible for taking samples and delivery of samples to a laboratory for testing.

3.07 CLEANUP

- A. After construction of this portion of the project, the Contractor shall remove all tools, equipment, supplies, and excess material from the site and shall restore the site and the access road to its approximate original condition. The Contractor shall fill and grade around all footings and satisfactorily dispose of all excavated material, smooth up the site and the access road if rutted, and generally restore the ground surface to its original contour. All areas disturbed during construction of this section shall be finish graded and seeded according to specifications.

END OF SECTION

SECTION 33 14 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipe and fittings for Site water line, including domestic water line and fire water line.
2. Tapping sleeves and valves.
3. Backflow preventers.

B. Related Requirements:

1. Section 330509.33 - Thrust Restraint for Utility Piping: Tied joint-restraint system to anchor and resist forces developed in underground closed pipeline systems.
2. Section 330597 - Identification and Signage for Utilities: Pipe markers.
3. Section 331417 - Site Water Service Utility Laterals: Water main service connections.
4. Section 331419 - Valves and Hydrants for Water Utility Service: Fire hydrants, valves, and valve boxes for fire hydrant and water main installations.
5. Section 331900 - Water Utility Metering Equipment: Positive displacement meters as required by this Section.

1.02 REFERENCE STANDARDS

A. Pipe and fittings shall be designed and tested in accordance with manufacturers' recommended procedures and the following codes and applicable standards:

1. American National Standards Institute (ANSI):

- A21.4 - Cement Mortar Lining for Ductile Iron Pipe and Fittings.
- A21.10 - Ductile Iron and Gray-Iron Fittings, 3 in through 48 in, for Water.
- A21.11 - Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- A21.15 - Flanged Ductile-Iron Pipe with Threaded Flanges.
- A21.51 - Ductile Iron Pipe, Centrifugally Cast, for Water.
- A312 - Seamless and Welded Austenitic Stainless Steel Pipe.
- A403 - Wrought Austenitic Stainless Steel Piping Fittings.
- B16.1 - Cast Iron Flanged Fittings
- B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
- B16.5 - Pipe Flanges and Flanged Fittings.
- B16.9 - Factory-Made Wrought Buttwelding Fittings.
- B16.11 - Forged Fittings, Socket Welding and Threaded.
- B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
- B16.21 - Nonmetallic Gaskets for Pipe Flanges.
- B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- B16.25 - Butt Welding Ends.

2. American Society of Mechanical Engineers (ASME):

- B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
- B16.5 - Pipe Flanges and Flanged Fittings.

- B16.9 - Factory-Made Wrought Buttwelding Fittings.
- B16.11 - Forged Fittings, Socket Welding and Threaded.
- B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
- B16.21 - Nonmetallic Gaskets for Pipe Flanges.
- B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- B16.25 - Butt Welding Ends.
- B31.1 - Code for Pressure Piping, Power Piping Section. ASME Boiler Code Section 1.
- B36.10 - Welded and Seamless Wrought Steel Pipe.

3. American Society for Testing and Materials (ASTM):

- A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- A106 - Seamless Carbon Steel Pipe for High Temperature Service.
- A182 - Forged and Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service.
- A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- A307 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- A312 - Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- A403 - Wrought Austenitic Stainless Steel Pipe Fittings.
- A536 - Ductile Iron Castings.
- A674 - Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
- A746 - Ductile Iron Gravity Sewer Pipe.
- B75 - Seamless Copper Tube.
- B88 - Seamless Copper Water Tube.
- C150 - Portland Cement.
- D1248 - Polyethylene Plastics Extrusion Materials for Wire and Cable.
- D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (PVC) Compounds.
- D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- D2310 - Machine Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- D2737 - Polyethylene (PE) Plastic Tubing -CTS; CTS Tubing; DR; OD Controlled
- D2997 - Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (4" through 15").
- D3139 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- D3350 - Polyethylene Plastics Pipe and Fitting Materials.
- F477 - Elastomeric Seals (Gaskets) For Joining Plastic Pipe.
- F679 - Type PSM Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings (18" through 27").
- F714 - Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.

4. American Water Works Association (AWWA):

- C104 - Cement mortar Lining for Ductile Iron Pipe and Fittings.
- C105 - Polyethylene Encasement for Ductile Iron Pipe Systems.
- C110 - Ductile Iron and Gray-Iron Fittings.
- C111 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- C115 - Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
- C150 - Thickness Design of Ductile Iron Pipe.
- C151 - Ductile Iron Pipe, Centrifugally Cast.
- C153 - Ductile Iron Compact Fittings.
- C222 - Polyurethane Coating for Interior and Exterior of Steel Water Pipe and Fittings
- C600 - Installation of Ductile Iron Mains and Their Appurtenances.

- C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In.
- C901 - Polyethylene (PE) pressure pipe and tubing, ¾ inch through 3 inch, for Water Service.
- C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In.
- C950 - Fiberglass Pressure Pipe.

5. National Bureau of Standards, Voluntary Products Standard (NBS):

PS15-69 - Custom Contact Molded Reinforced Polyester Chemical Resistant Process Equipment.

6. National Sanitation Foundation (NSF):

NSF-61 - Drinking Water System Components – Health Effects.

NSF-372 - Drinking Water System Components - Lead Content.

1.03 SUBMITTALS

- A. Only request submittals needed to verify compliance with Project requirements.
- B. Section 013300 - Submittal Procedures: Requirements for submittals.
- C. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves, hydrants.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Include separate Paragraphs for additional certifications.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- G. Qualifications Statements:
 - 1. Submit qualifications for manufacturer and installer.

1.04 SUSTAINABLE DESIGN SUBMITTALS

- A. Manufacturer's Certificate:
 - 1. Certify that products meet or exceed specified sustainable design requirements.
 - 2. Materials Resources Certificates:
 - a. Certify source and origin for [salvaged] [and] [reused] products.
 - b. Certify recycled material content for recycled content products.
 - c. Certify source for regional materials and distance from Project Site.
- B. Product Cost Data:
 - 1. Submit cost of products to verify compliance with Project sustainable design requirements.
 - 2. Exclude cost of labor and equipment to install products.
 - 3. Provide cost data for following products:
 - a. Salvaged, refurbished, and reused products.
 - b. Products with recycled material content.

- c. Regional products.

1.05 CLOSEOUT SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 QUALITY ASSURANCE

- A. Valves: Mark valve body with manufacturer's name and pressure rating.
- B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.
- C. Perform Work according to Missouri Department of Natural Resources (MDNR) standards.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Block individual and stockpiled pipe lengths to prevent moving.
 - 3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
 - 4. Store PE and PVC materials out of sunlight.
- C. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.08 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

1.09 JOB CONDITIONS

- A. Lines and grades shall be as indicated. The engineer will furnish a benchmark and a baseline or other necessary horizontal control points to permit the Contractor to lay out, stake, and construct the work.

1.010 PIPING SYSTEM DESCRIPTIONS

- A. Piping is grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction. The table below identifies each piping classification, its utility designation and the system classification for each utility designation.

SYMBOL	SYSTEM	UTILITY DESIGNATOR	SIZE (IN)	PIPE MATERIAL	TEST PRESSURE (PSIG)
PW	1	Potable Water	Up to 3	Copper/HDPE	150 ⁽¹⁾
	1		4 and larger	PVC	150 ⁽¹⁾
PW	1	Potable Water	Up to 3	Ductile Iron	15 ⁽¹⁾
GST	1	Ground Storage Tank	4 and larger	Stainless Steel	15 ⁽¹⁾

(1) Minimum defer to Division 33, specification section 33 05 06.3.04 for further testing requirements

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Ductile Iron Pipe:
- American Cast Iron Pipe Co.
 - U.S. Pipe Supply.
 - Or approved equal.
- B. Plastic Pressure and Gravity Pipe (PVC):
- North American Specialty Products.
 - Diamond Plastics.
 - Or approved equal.
- C. Stainless Steel Pipe:
- Felker Bros. Corp.
 - Marmon/Keystone.
 - Or approved equal.
- D. High Density Polyethylene Pipe:
- Chevron-Philips.
 - ISCO Industries.
 - Or approved equal.

2.02 MATERIALS

- A. Pipes, fittings and appurtenances containing more than 0.25% lead calculated by weighted average shall not be used in potable water service.
- B. Ductile Iron Pipe and Fittings:

1. Ductile iron pressure pipe shall conform to AWWA C115, C150, and C151 except as otherwise specified.
2. Minimum thickness class for flanged pipe, AWWA C115, shall be class 53.
3. Joints:
 - a. All buried gravity pipe shall have push on joints conforming to AWWA C111 unless otherwise indicated or specified.
 - b. All interior and exposed exterior pipes shall be flanged unless otherwise indicated or specified. Contractor shall coordinate flange drilling and pressure class with connected valves, equipment and accessories supplied.
 - c. Pipe flanges shall be ductile iron, conforming to ANSI B16.1 and AWWA C115 and shall be drilled class 125 or class 250 where required for valves, equipment and accessories supplied.
 - d. Sleeved or coupled joints shall be provided where indicated. Furnish pipe ends suitable for installing the style of sleeve or coupling indicated or specified. Provide anchor couplings or thrust blocks where restraint is required to withstand specified operating or hydraulic test pressure and where indicated.
 - e. Flexible Joints (Unrestrained), where indicated on the drawings for buried piping shall be one of the following:
 - 1) Mechanical joint.
 - 2) Sleeve Coupling.
 - a) Ford FC1.
 - b) Romac 501.
 - c) Smith Blair 411.
 - d) Or approved equal.
 - 3) Sleeve couplings shall be cast iron, ductile iron, or fusion-bonded epoxy coated steel. Bolts and nuts shall be Type 304 or 316 stainless steel.
4. Restrained Joints:
 - a. Furnish restrained joints, harnesses, anchors, or thrust blocks at all locations, unless otherwise noted. All bolts, nuts and tie rods shall be Type 304 or 316 stainless steel.
 - b. Proprietary restrained joints for push-on pipe shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Flex Ring, American Cast Iron Pipe.
 - 2) Tr-Flex, U.S. Pipe Co.
 - 3) Fast-Grip Gasket, American Cast Iron Pipe Co. (12-inch and smaller pipe only).
 - 4) Snap-LOK, Griffin Pipe Products
 - 5) Or approved equal
 - 6) Joint restraint systems consisting solely of wedge elements in rubber gaskets will not be acceptable for pipe greater than 12-inch diameter.

- c. Restrained flexible joints shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Romac 400RG.
 - 2) Romac Alpha.
 - 3) EBAA Iron Mega Coupling Series 3800.
 - 4) Smith-Blair 470 Series.
 - 5) Or approved equal.
 - d. Restrained mechanical joints shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure
 - 1) EBAA Iron Mega-Lug.
 - 2) Stainless steel tie-rod assemblies. Tie rods shall connect no less than 50 percent of the bolts in the coupled glands.
 - 3) Or approved equal
 - e. Mechanical joint glands and field-assembled flanges using set screws bearing directly against the pipe for restraint will not be acceptable.
5. Fittings:
- a. Fittings shall conform to AWWA C110 or C153 and shall be ductile iron.
 - b. Fittings provided with buried pressure or flooded pipe shall have mechanical joints.
 - c. Fittings for gravity pipe with push-on joints shall be mechanical joints or push-on joints.
 - d. Provide all specials, taps, and plugs as specified or indicated.
 - e. Flanged fittings shall be provided for flanged pipe.
 - f. Flange faces shall be coated with a rust-preventive compound.
6. Lining:
- a. All pipe and fittings for potable water service shall be lined with cement mortar conforming to ANSI 21.4 and AWWA C 104, unless otherwise indicated.
 - b. All pipe and fittings for wastewater service shall be lined with cement mortar and coal tar epoxy with a minimum thickness of 24 mil applied to a surface prepared in accordance with manufacturer's recommendations unless otherwise indicated. Lining shall conform to ANSI A21.4/AWWA C104.
 - c. Where indicated, all pipe and fittings for wastewater service shall be lined with one of the following.
 - 1) Amine cured novalac epoxy containing at least 20 percent by volume of ceramic quartz pigment, Protecto 401, Permox-CTF, or approved equal. The lining shall be a minimum of 40 mils nominal dry film thickness. The inside of the socket shall be coated in accordance with the manufacturer's recommendations.
 - d. Lining shall extend from the edge of the plain end to the gasket seat in the bell socket.

- e. Lining application shall be in accordance with the manufacturer's recommendations.
7. All buried iron pipes and fittings shall be coated with the manufacturer's standard exterior bituminous coating. All exposed pipe and fittings shall be exterior coated with the finish coatings as specified in Division 9.
 8. Gaskets and Bolting Material:
 - a. Provide all gaskets, bolts, lubricants, and other accessories required to install pipe and fittings complete and ready for service.
 - b. Bolts and nuts for flanged and mechanical joints shall be Type 304 or 316 stainless steel.
 - c. Gaskets for flanged joints shall be 1/8" thick, full-faced synthetic rubber.
 - d. Gaskets for flanged joints on air service shall be rated for 22° F minimum.
 9. Polyethylene Encasement: Buried ductile iron piping shall be encased in polyethylene conforming to ASTM D 1248, Type 1, Class C, Grade E 1 when noted on the plans.
 10. Flanged Coupling Adapters:
 - a. Flanged Coupling Adapters shall have restraining anchor studs and/or harnesses and shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Ford FCA.
 - 2) Smith-Blair 913.
 - 3) Or approved equal.
 - b. Couplings shall be coated per Division 9.
 - c. Type 304 or 316 stainless steel bolts, nuts and tie rods shall be used.
 - d. Gaskets, except for air piping, shall be neoprene rubber. Gaskets for air piping shall be suitable for operation at a temperature of 250° F.
 11. Flanged Dismantling Joints:
 - a. Flanged Dismantling Joints shall have restraining tie rods and shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Ford FDJ.
 - 2) Smith-Blair 975.
 - 3) Or approved equal.
 - b. Couplings shall be coated per Division 9.
 - c. Type 304 or 316 stainless steel bolts, nuts, and tie rods shall be used.
 - d. Gaskets, except for air piping, shall be neoprene rubber. Gaskets for air piping shall be suitable for operation at a temperature of 250° F.
- C. PVC Pipe:
1. The materials of this pipe shall be uniformly blended with unplasticized polyvinyl chloride. Nothing used in its manufacture shall be injurious to humans or animals, nor shall it impart taste or odor to domestic water or in any manner alter the chemical content of waters flowing through the pipe. It shall consist of all new materials, and the manufacturer shall furnish a sworn statement that no reused or materials known as "mill shorts" were used in the manufacture of the pipe or fittings. All pipes shall have superior high tensile strength. The pipe shall conform to all requirements of commercial standards and ANSI, as specified on the drawings and/or in the Piping Schedule in Section 33 14 16.1.010. The PVC pipe shall conform to the following standard specifications:
 - a. AWWA C 900, Class 235, DR 18.

2. All plastic pipe shall be approved by and bear the National Sanitation Foundation seal of approval and will comply with the requirements for Class 12454 A or Class 12454 B virgin components as defined in ASTM D1784 with an estimated hydrostatic design basis (HDB) rating of 4000 psi (27.58 MPa) for liquid at 73.4°F (23°C). Pipe and fittings with elastomeric seal joints shall meet the requirements of ASTM D3139.
3. Certificates of conformance with the foregoing specifications shall be furnished with each lot of pipe supplied.
4. PVC Pipe. The pipe shall be joined by means of a rubber ring slip joint, by means of a bell joint which shall be an integral and homogeneous part of the pipe barrel.
 - a. At no point in the pipe bell, including the recess groove for rubber rings, shall the wall thickness be less than that for the pipe barrel.
 - b. Samples of pipe shall be submitted to the Engineer for acceptance.
 - c. Maximum laying length of pipe shall be 20 feet.
 - d. All pipes shall have a guide mark on the spigot end to enable checking of adequate seating into the bell.
 - e. The manufacturer shall provide a factory representative skilled in the installation of the type of pipe purchased to instruct the Contractor's personnel in the proper procedures for connecting and laying the pipe. This instruction is to be given at the beginning of pipe-laying operations.
5. Fittings for Pipe. Fittings for plastic pipe shall be ductile iron as specified. Ductile iron fittings for plastic pipes shall have a pressure rating not less than the pipe.
6. Restrained Joints:
 - a. Furnish harnesses, anchors, and/or thrust blocks were called for on the drawings and at all locations where required to prevent separation of joints under operating and specified test hydraulic test pressures. All bolts, nuts, and tie rods shall be Type 304 or 316 stainless steel.
 - b. Restrained flexible joints shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Romac Alpha.
 - 2) EBAA Iron Mega Coupling Series 3800.
 - 3) Smith-Blair 470 Series.
 - 4) Or approved equal.
 - c. Restrained mechanical joints shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) EBAA Iron Mega-Lug.
 - 2) Or approved equal.
 - 3) Stainless steel tie-rod assemblies. Tie rods shall connect no less than 50 percent of the bolts in the coupled glands.
 - d. Mechanical joint glands and field-assembled flanges using set screws bearing directly against the pipe for restraint will not be acceptable.

- D. High-Density Polyethylene Pipe (HDPE) and Fittings: Pipe and fittings shall conform to ASTM F714 or ASTM D2737.
1. General: Furnish maximum pipe lengths normally produced by the manufacturer, except for fittings, closures, and specials. Only solid wall HDPE pipe in accordance with ASTM F714 will be accepted. HDPE profile wall pipe and fittings will not be accepted. The pipe shall have a green stripe for wastewater service and a blue stripe for water service.
 2. Materials: The pipe shall be high performance, high molecular weight, high-density polyethylene pipe, Driscoplex 4000/4100 by CP Chem Performance Pipe, a division of Chevron Phillips Chemical Company, Plano, Texas, and shall conform to ASTM D3350, Material grade PE4710. Minimum cell classification shall be 445574 C as referenced in ASTM D 3350.
 3. Design: The pipe supplied under this specification shall have a nominal CTS (Copper Tube Size, ASTM D2737) OD unless otherwise specified. The SDR (Standard Dimension Ratio) of the pipe shall be SDR 9, 200 psi unless otherwise noted.
 4. Joints: Low-pressure flow systems shall be joined by use of the heat fusion technique of butt fusion resulting in a monolithic pipe. All joints shall be fully restrained and as strong as the pipe in both tension and hydrostatic loading. The joining of pipes of dissimilar materials shall be made using approved transition coupling and shall provide a permanent and watertight connection that will withstand the hydrostatic test pressure.
 5. Fittings: The fittings for low-pressure systems shall be molded from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe or shall be manufactured using a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe supplied under this specification. All fittings supplied under this specification shall be of the same manufacturer as the pipe being supplied. Minimum cell classification shall be 445574 C as referenced in ASTM D335.
- E. Stainless Steel Tube and Fittings:
1. Tubing and fittings shall be 304 stainless steel conforming to ASTM A269.
 2. Fitting shall be flared.

2.03 SHOP PAINTING

- A. Prepare surfaces and paint or coat all buried valves and interior of exposed valves and all related accessories standard of the manufacturer, unless otherwise specified herein.
- B. Exposed valves shall have exterior coating conforming to Division 9.
- C. Paint and coatings shall be suitable for the service intended.

2.04 ACCESSORIES

- A. Thrust Restraints: As specified in Section 330509 - Thrust Restraint for Utility Piping.
- B. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
- C. Vaults: As specified in Section 330563 - Concrete Vaults and Chambers.

- D. Metering Equipment: As specified in Section 331419 – Valves and Hydrants for Water Utility Service.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 330506 – Pipe Installation and Testing: Requirements for installation examination.
- B. Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

3.02 ACCEPTANCE

- A. Pipe will be inspected by the Engineer for acceptance by the owner at the construction site. Acceptance at the job site shall be paramount. Prior approval or payment for pipe rejected at the job site shall be null and void. Acceptance by the Engineer at a point in the sequence of manufacture, delivery, and installation will not relieve the Contractor of his responsibilities as set forth in the Contract Documents. Manufacturing defects that prohibit installed pipe from successfully passing leakage tests shall constitute rejection of the defective pipe.

3.03 PREPARATION

- A. Section 330506 – Pipe Installation and Testing: Requirements for installation preparation.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
- C. Remove scale and dirt on the inside and outside before assembly.
- D. Prepare pipe connections to equipment with flanges or unions.
- E. Protect and support existing distribution piping and appurtenances as Work progresses.

3.04 INSTALLATION

- A. Install pipe in accordance with Section 33 05 06 of Division 33.
- B. General Application: Use mechanical joint end valves for 3-inch and larger buried installation. Use threaded and flanged end valves for installation in pits and inside the building.
- C. Gate Valves: Comply with AWWA C600. Install buried valves with the stem pointing up and with a cast-iron valve box.
- D. Thoroughly clean and remove all shipping materials prior to setting. Operate all valves from fully opened to totally closed.

3.05 PIPING SYSTEM SCHEDULES

- A. SYSTEM 1 – Potable Water Piping
 - 1. Test requirements: Potable Water Service – see Section 33 05 06.

2. All materials must comply with NSF/ANSI/CAN 61.
3. Gaskets and O-rings:
 - a. O-rings: Neoprene or rubber
 - b. Flanged, push-on, and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11
 - c. Grooved coupling joints: Rubber, AWWA C606
 - d. Elastomeric gaskets with water-tight seal conforming to ASTM D3139, ASTM D3212, and ASTM F477 (PVC).
4. Pipe, Exposed Service, 3/4 to 2 IN:
 - a. Material: T304 Stainless Steel, Schedule 40, ASTM A312
 - b. Lining: None.
 - c. Coating: None
 - d. Fittings: Threaded, NPT.
 - e. Joints: Restrained.
5. Pipe, Buried Service, 3/4 to 3 IN:
 - a. Material: HDPE, 200 psi, DR-9 (ASTM D2737)
 - b. Lining: None.
 - c. Coating: None.
 - d. Fittings: Fully restrained compression or fusion welded
 - e. Joints: Restrained, fusion welded.
 - f. Tracer wire and warning tape per Division 33, Specification Section 33 05 97.
6. Pipe, Exposed Services, 3 to 54 IN:
 - a. Materials: Ductile iron, special thickness class 53, AWWA/ANSI C115/A21.15
 - b. Lining: Cement (with asphaltic seal coat) AWWA/ANSI C104/A21.4.
 - c. Coating: Primer (no asphaltic coating) and finish in compliance with Division 9, Specification Section 09910.
 - d. Fittings: AWWA/ANSI C110/A21.10 ductile iron flanged or grooved gasket.
 - e. Joints: Restrained.
7. Pipe, Buried Services, 4 to 54 IN:

- a. Materials: PVC, AWWA C-900, Class 235, DR 18
- b. Lining: None.
- c. Coating: None.
- d. Fitting: AWWA/ANSI C110/A21.10 ductile iron restrained or AWWA/ANSI C153/A21.53 ductile iron compact fittings restrained. Polyethylene Encasement per AWWA C105.
- e. Joints: Restrained.
- f. Tracer wire and warning tape per Division 33, Specification Section 33 05 97.

END OF SECTION

SECTION 33 14 19

VALVES FOR WATER UTILITY SERVICE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Valves.
2. Valve boxes.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints.
2. Section 099000 - Painting and Coating: Exterior finish for fire hydrants.
3. Section 310516 - Aggregates for Earthwork: Fire hydrant drainage gravel.
4. Section 330110.58 - Disinfection of Water Utility Piping Systems: Requirements for flushing and disinfecting.
5. Section 330509.33 - Thrust Restraint for Utility Piping: Thrust restraints as required by this Section.
6. Section 331413 - Public Water Utility Distribution Piping: Pressure testing of valves and hydrants.
7. Section 331416 - Site Water Utility Distribution Piping: Pressure testing of valves and hydrants.
8. Section 331417 - Site Water Service Utility Laterals: Piping, trenching, backfilling, and compaction requirements.

1.02 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service
2. AWWA C502 - Dry-Barrel Fire Hydrants.
3. AWWA C503 - Wet-Barrel Fire Hydrants.
4. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
5. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

B. National Fire Protection Association:

1. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants.

C. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.03 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information regarding component materials, fittings, assembly and parts diagram, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Source Quality-Control Submittals: Indicate results of shop or factory tests and inspections.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- G. Qualifications Statements:
 1. Submit qualifications for manufacturer and installer.
 2. Submit manufacturer's approval of installer.

1.04 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves and hydrants.

1.05 QUALITY ASSURANCE

- A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.
- B. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.
- C. Perform Work according to Missouri Department of Natural Resources (MDNR) standards.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Delivery:
 1. Seal valve and hydrant ends to prevent entry of foreign matter.
 2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.01 VALVE BODY MATERIAL

A. Valve body shall be similar to the material of the pipe (for metallic pipe) in which it is installed and shall be one of the following:

1. Carbon Steel - ASTM A216 WBC.
2. Ductile Iron - ASTM A536.
3. Stainless Steel - ASTM A182 316L.
4. Cast Iron - ASTM A126 Class B.
5. Bronze - ASTM B61.

2.02 GATE VALVES 2-1/2" AND LARGER:

A. Acceptable Manufacturers:

1. American.
2. M&H.
3. Mueller.
4. Or approved equal.

B. Gate valves from 3" - 12" size shall conform to AWWA C-515 and C-550:

1. Valves shall have a minimum design working pressure of 200 psi.
2. Valves shall open counterclockwise and be non-rising stem.
3. Valves stems shall use double O-ring seals.
4. Buried valves shall have mechanical joint ends.
5. Exposed valves shall have flanged ends. The valve interior shall be coated with the manufacturer's standard epoxy coating. The exterior coating shall conform to Division 9.
6. Bolts shall be stainless steel. Gaskets and seals shall be non-asbestos materials.
7. Buried valves shall be operated with a 2" x 2" nut and valve box unless a handwheel is indicated on drawings. Exposed valves shall have hand wheel operators.
8. All valves shall be NSF approved.

C. Cast iron or ductile iron gate valves of sizes other than those listed above installed in the process water or the sludge process systems shall conform to AWWA C500 and shall be as follows:

1. Valves 2 1/2" and smaller shall be designed for a 200 psig minimum working pressure. Valves over 12" shall have a 150 psig minimum working pressure.
2. Double disc type.
3. Mechanical joint ends for buried valves.
4. Flanged ends for exposed and interior valves.
5. Shall have a handwheel operator for exposed valves. Buried valves shall be operated with nut and valve box unless handwheel is indicated on drawings.
6. Valves shall be non-rising stem and open counterclockwise unless otherwise stated.
7. Stems shall be sealed with double O-rings.

2.03 ECCENTRIC PLUG VALVES

A. Acceptable Manufacturers:

1. DeZurik Corporation.
 2. Pratt Valves.
 3. Or approved equal.
- B. Plug valves shall be quarter-turn non-lubricated eccentric type with resilient faced plug. Alternate seat and plug materials may be considered provided this specification is met and, in addition, the manufacturer must prove prior to approval that the valve meets AWWA C504 "proof of design tests" (10,000 cycles) in both directions. Flanged valve ends shall be faced and drilled to conform to ANSI B16.1, Class 125 for diameter and drilling. Mechanical or push-on type rubber-gasketed joint ends shall conform to AWWA C111. Port areas for valves smaller than 20-inch shall be at least 80 percent of full pipe area. Port areas for valves 24-inch and larger shall be at least 70 percent of full pipe area.
- C. Materials and Construction:
1. Bodies shall be of ASTM A126, Class B cast iron.
 2. Valve plug shall be ASTM A126, Class B cast iron or ASTM A536 ductile iron. Resilient plug facing shall be synthetic rubber, neoprene or Buna N compound suitable for use with water and wastewater applications.
 3. Seats shall be a raised welded overlay of 90% pure nickel, a minimum of .125" thick and 0.50" wide, conforming to AWWA C504. When the plug is in the closed position, the resilient plug facing shall contact only nickel. Sprayed or plated mating seat surfaces are not acceptable for resilient plugs.
 4. Bearings shall be replaceable. Sleeve bearings in the upper and lower journals shall be permanently lubricated 316 stainless steel per ASTM A743 Grade CF-8M. Nonmetallic journal bearings shall not be acceptable. Thrust bearings shall be teflon.
 5. Shaft seals shall be self-adjusting chevron-type conforming to AWWA C504. Valve shall be designed so it can be repacked while the valve is in line and under pressure without removing the actuator. O-ring seals shall not be acceptable in valves larger than 3".
 6. All exposed fastening hardware shall be zinc plated or stainless steel. Provide stainless steel bolting on buried service valves.
- D. Manual Operators:
1. All valves shall open counterclockwise.
 2. Provide indicators to show position of plug except on buried operators.
 3. Actuators: Manual valves shall have lever or worm gear actuators with handwheels, chainwheels, tee wrenches, extension stems, floorstands, etc., as shown on the plans or as called for in the valve schedule. Lever actuators shall be furnished for valves 8" or smaller where the maximum shutoff pressure is 25 psi or less as indicated on the plans or in the valve schedule. Worm gear actuators shall be furnished for all valves 4" or larger where the maximum reverse shutoff pressure is greater than 25 psi. Worm gear actuators shall be sized for 150 psi. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. This adjustable stop shall be the only adjustment necessary to set the clearance between the

valve plug and the seat while the valve is in line and under pressure. Handwheel and chainwheel sizes for worm gear actuators shall be no smaller than 6" in diameter and no larger than twice the diameter of the actuator's gear sector. All exposed nuts, bolts, and washers shall be zinc plated.

Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs, and washers shall be stainless steel.

4. Handwheels shall be located for easy access on exposed valves.
5. Buried valves shall be operated by a 2" AWWA nut with valve box.

E. Electric Powered Operators:

1. Where shown on the plans, plug valves shall be operated by an electric powered valve operator. Operator shall be a quarter turn operator fully complying with AWWA C-540 as manufactured by E.I.M., Limatorque, or approved equal. The valve supplier shall be responsible for coordinating and supplying the complete valve assembly, including all controls and extension assemblies where required.
2. Electric motor and control enclosures shall be NEMA 4 rated and O-ring sealed. Seals shall be provided at all exit points to the gear case. Critical areas, subject to high wear, shall be double sealed.
3. The unit operator on 460 volt, 3-phase power and shall contain a reversing motor starter and control transformer. Motor shall have Class F insulation with a Class B temperature rise. Power shall be transferred through a removable splined bushing.
4. Unit shall be designed to operate against the line test pressure (Section 18160) applied in either direction. The fully open to fully closed operation time shall be approximately 200 seconds.
5. The unit shall be operated locally by OPEN-STOP-CLOSE signal. Operation shall be selected through a LOCAL-OFF-REMOTE switch. The valve position shall be shown on an indicator.
6. Four field adjustable limit switches shall be provided OPEN, CLOSED, or any intermediate point. Switch contacts shall be solid silver and have a minimum rating of 10 amps (break) inductive at 120 volts. Use of cams or set screws in securing switches is not acceptable.
7. Mechanical stops shall be provided to withstand maximum operator torque.
8. The service of a minimum of one day of field start-up time shall be provided to coordinate valve operation with the instrumentation supplier. One day shall also be provided to assure proper installation and operation of the operator and to instruct plant staff on proper operation and maintenance of the valve.

- F. Testing: Furnish certified copies of results of tests prior to shipment. All valves shall be subjected to an AWWA C504 procedure leak test at 150 psi against the face of the plug and a body hydrostatic test at 300 psi. Valves shall be capable of providing drip-tight shutoff up to the full leak test rating with pressure in either direction.

2.04 BALL VALVES

A. Acceptable Manufacturers:

Under 6"

1. Crane Co.
2. Nibco.
3. Or approved equal.

6" and Larger

1. Henry Pratt Co.
2. Von Roll Co.
3. Or approved equal.

B. Ball valves shall be standard port type with 3-piece body. Flanged valve ends shall be faced and drilled to conform to ANSI B16.1, Class 125 for thickness and drilling. Mechanical or push-on type rubber-gasket joint ends shall conform to AWWA C111.

C. Materials and Construction:

1. Ball valves 6" and larger shall conform to AWWA C507 with a minimum design operating pressure of 150 psig.
2. Bodies shall be of ASTM 126, Class B cast iron for 2-1/2" and larger. Smaller valves shall be bronze body.
3. Valve trim shall be bronze.

D. Manual Operators:

1. All valves shall open counterclockwise.
2. Exposed valves 3" and smaller shall be lever operated.
3. Provide indicators to show position of ball.
4. AWWA 2" size nut operators operated by enclosed worm gear operators shall be provided for buried valves.
5. Exposed valves over 3" diameter shall be handwheel operated through an enclosed worm gear.

2.05 CUSHIONED SWING CHECK VALVES

A. Acceptable Manufacturers:

1. Golden Anderson Valve Specialty Company.
2. Valve and Primer Corporation.
3. Or approved equal.

B. Operational Requirements:

1. Prevent reverse flow without shock or hammer.
2. Seat tightly with internal pipeline forces.

3. Cushioned in manner permitting adjustment of speed of closure.

C. Design:

1. Check valve shall conform to AWWA C508 except for addition of exterior cushion chamber.
2. Swing disc type with single stainless steel shaft and flanged body. Flanges shall be ANSI B16.1, Class 125.
3. Valve disc shall have external lever and adjustable counterweight to initiate closure.
4. Valves shall have a metal to composition seat.
5. Valve coatings shall conform to Division 9

2.6 COMBINATION PRESSURE REDUCING & PRESSURE SUSTAINING VALVES

A. Acceptable Manufacturers:

1. Cla-Val
2. Singer Valve, Inc.
3. Or approved equal.

- B. The combination pressure reducing & sustaining valve shall maintain a constant pressure downstream of the valve, regardless of changing flowrates and/or inlet pressures. When the upstream pressure becomes equal to a preset pressure, the valve shall throttle to maintain a constant inlet pressure.

C. Main valve:

1. The valve shall be a hydraulically, single diaphragm-actuated globe valve. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating the operating pressure from the line pressure. Packing glands and/or stuffing boxes are not permitted. There shall be no pistons operating the main valve or pilot valves.
2. The valve body and cover shall be cast from ASTM A536 Ductile Iron with integral flanges, faced and drilled per ANSI B16.42, Class 150. The valve shall be "full-ported" with a flow area through the valve no less than the area of its nominal pipe size.
3. The inner valve assembly shall be guided by top and bottom guided by easily replaceable top and bottom bearing bushings. The inner valve assembly shall be the only moving part and shall be securely mounted to a stainless steel stem.
4. The valve shall provide for smooth, frictionless motion with actuation by flat style EPDM or Buna-N diaphragm, constructed of nylon fabric bonded to synthetic rubber. The diaphragm shall not be utilized as the seating surface. No lip seals or packing glands shall be utilized to seal the actuator.
5. The valve bonnet shall be accurately attached to the valve body by locating pins or a machined locating lip located on the valve body and cover.

6. Valves 3" and larger shall have stainless seat rings and a resilient disc constructed of EPDM or Buna-N for normal service conditions
 7. All external fasteners shall be stainless steel complete with stainless steel washers.
 8. Each valve shall be supplied with valve position indicators, stainless steel strainer, opening speed control and 3 1/2" glycerin filled pressure gauges located on the inlet and outlet sides of the valve.
- D. Pilot System:
1. The pressure reducing pilot control shall be a normally open pilot of bronze construction with a spring to adjust the closing pressure setting. The pressure sustaining pilot control shall be a normally closed pilot of brass or bronze construction with a spring to adjust the opening pressure setting.
 2. The pilot seat, stem, yoke and inner valve shall be of brass or stainless steel construction.
 3. Controls shall include adjustable closing speed control, y-strainer and pilot isolating valves.
 4. The pressure reducing pilot control shall function to open when the controlled pressure (downstream) is less than the spring setting. The pressure sustaining pilot shall function to open with the upstream pressure exceeds the spring setting.
- E. Each valve shall be tested prior to being shipped to the site. Testing shall include pressure testing and testing of full valve functionality. Manufacturer shall provide written certification of valve conformance with written specification.
- F. The valves shall be covered by a minimum three (3) year warranty against defects in materials and workmanship.
- G. Valve manufacturer's representative shall be present for the installation and field testing of the valve. The manufacturer's representative shall provide training for the owner on operation of the pressure reducing/sustaining valve equipment.

2.07 ACCESSORIES

- A. Thrust Restraints: As specified in Section 330509 - Thrust Restraint for Utility Piping.
- B. Valve Box Aligner: High-strength plastic device designed to automatically center valve box base and to prevent it from shifting off center during backfilling.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 330506 – Pipe Installation and Testing: Requirements for installation examination.
- B. Determine exact location and size of valves from Drawings.
- C. Identify required lines, levels, contours, and datum locations.

- D. Verify that elevations of existing facilities prior to excavation and installation of valves and hydrants are as indicated on Drawings.

3.02 PREPARATION

- A. Section 330506 – Pipe Installation and Testing: Requirements for installation preparation.
- B. Locate, identify, and protect from damage utilities to remain.
- C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
 - 1. Notify Architect/Engineer not less than 2 days in advance of proposed utility interruption.
 - 2. Do not proceed without written permission from Architect/Engineer.

3.03 INSTALLATION

- A. Perform trench excavation, backfilling, and compaction as specified in Division 31.
- B. Install valves in conjunction with pipe laying.
- C. Provide buried valves with valve boxes installed flush with finished grade.
- D. Orientation:
 - 1. Set valves plumb.
- E. After main-line pressure testing, check for proper drainage.

3.04 FIELD QUALITY CONTROL

- A. Section 33 05 06 - Quality Requirements: Requirements for inspecting and testing.

END OF SECTION

SECTION 33 14 20

PIPE SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the design and installation of all pipe hangers, supports, restraints, guides, anchors and concrete inserts required to properly support new and modified piping systems.
- B. Furnish and install all hangers, supports guides and anchors required to support all piping systems.

1.02 REFERENCES

- A. Hangers and supports shall be designed and installed in accordance with the following codes and standards:
 - 1. ANSI/ASME B31 - Code for Pressure Piping.
 - 2. ASME Boiler and Pressure Vessel Code, Section III.
 - 3. ASTM A36, Standard Specification for Carbon Structural Steel.
 - 4. ASTM A276, Standard Specification for Steel bars, Carbon, Merchant Quality, M-Grades.
 - 5. ASTM A575, Standard Specification for Steel bars, Carbon, Hot-Wrought, Special Quality.
 - 6. ASTM A917, Standard Specification for Steel Sheet, Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface (General Requirements).
 - 7. ASTM A918, Standard Specification for Steel Sheet, Zinc-Nickel Alloy Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
 - 8. ASTM B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - 9. AWS D1.1, Structural Welding Code – Steel
 - 10. AWS D2.6, Structural Welding Code – Stainless Steel
 - 11. MSS SP-58 Pipe Hangers and Supports, Materials, Design and Manufacture.
 - 12. MSS SP-69 Pipe Hangers and Supports, Selection and Application.
 - 13. MSS SP-89 Pipe Hangers and Supports, Fabrication and Installation Practices.

1.03 COMPLIANCE SUBMITTAL

- A. Submit as specified in Division 1.
- B. Submit the following for acceptance:
 - 1. Acknowledgement that products submitted meet requirements of standards referenced.
 - 2. Manufacturer's installation instructions.
 - 3. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
 - 4. Scaled hanger and support assembly drawings.
 - 5. Scaled hanger and support location plan.

6. Bill of material for each hanger and support.
7. When required by the Contract Documents, provide detailed design calculations for the pipe support system. Calculations shall analyze each pipe system for all loads and forces on hangers and supports and their reaction forces to the structure to which they are fastened. Calculations shall be keyed to scaled drawings and sealed by a licensed professional engineer.

1.04 RESPONSIBILITY

- A. It is the Contractor's responsibility to design, furnish, and install all pipe hangers, supports, restraints, guides, anchors and concrete inserts required. At specific locations, Engineer has provided minimum design requirements for thrust restraint and pipe supports.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Each engineered hanger assembly will be individually bundled and tagged ready for installation.
- B. Hanger material for piping 2 inch and smaller shall be shipped loose.
- C. Handle all hanger material in a manner to insure that hangers and accessories will not be damaged.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. ANVIL International.
- B. ITT Grinnell.
- C. Unistrut
- D. B-Line Systems, Inc.
- E. Or approved equal.

2.02 DESIGN REQUIREMENTS

- A. Supports shall be capable of supporting the pipe for all service and testing conditions. Provide a factor of safety of five (5).
- B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from piping or attached equipment.
- C. Design supports and hangers to allow for proper pitch of piping.
- D. For chemical and waste piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
 1. ASME B31.3.
 2. MSS SP-58 and MSS SP-69
 3. Except where modified by this specification

- E. Check all physical clearances between piping, support system and structure. Provide for vertical adjustment after erection.
- F. Support vertical pipe runs in pipe chases at base of riser. Support pipes for lateral movement with clamps or brackets.
- G. Place hangers are to be installed on outside of pipe insulation.
 - 1. Use a pipe covering protection saddle for insulated pipe at support point.
 - 2. Insulated piping 1-1/2 IN and less, provide a 9 IN length of high-density perlite or high-density calcium silicate at saddle.
 - 3. Insulated piping over 1-1/2 IN, provide a 12 IN length of high-density perlite or high-density calcium silicate at saddle.
- F. Pipe Support Spacing.
 - 1. General.
 - a. Factor loads by specific weight of liquid conveyed if specific weight is greater than water.
 - b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise in the drawings
 - c. Provide at least one support for each length of pipe at each change of direction at each valve.
 - 2. Steel, stainless steel, cast-iron pipe support schedule.

Pipe Sizes, IN	Maximum Span, FT
1-1/2 and less	5.0
2 thru 4	10.0
5 thru 8	15.0
10 and greater	20.0

- 3. Copper pipe support schedule.

Pipe Sizes, IN	Maximum Span, FT
2-1/2 and less	5.0
3 thru 6	10.0
8 and greater	15.0

4. PVC pipe support schedule

Pipe Sizes, IN	Maximum Span, FT
1-1/4 and less	3.0
1-1/2 thru 3	4.0
4 and greater	5.0

5. Support each length and every fitting

- a. Bell and spigot piping shall have at least one hanger applied at the bell
- b. Mechanical couplings joints shall have hanger placed within 2 FT of each side of fittings to keep pipes in alignment.

6. Space supports for soil and waste pipe and other piping systems not included above every 5 FT.

7. Provide Unistrut Unicushion wrap of pipe, or equivalent, at each support.

2.03 MATERIALS

A. Galvanized components:

1. Electro-galvanized components:

- a. Bar, forged or cast fabrication: ASTM B633, SC4
- b. Rolled sheet fabrications: ASTM A917 and ASTM A918, 50N50NU

2. Hot-dipped galvanized components: See Division 5, Specification Section 05500.

2.02 HANGERS AND ACCESSORIES

A. Hanger rods shall be fabricated of ASTM A36 steel and have a minimum allowable tensile stress of 12,000 PSI at 650 DEG F per MS SP-58. Hanger rods shall be continuously threaded and electro-galvanized or cadmium plated after threads are cut

B. Hanger rods shall have the following load limits:

NOMINAL ROD DIAMETERS, IN	MAXIMUM SAFE LOADS (LBS)
3/8 (MIN)	610
1/2	1,130
5/8	1,810
3/4	2,710
7/8	3,770
1	4,960

- C. Hangers for use directly on copper pipe shall be copper or cadmium plated. All other hangers shall be cadmium plated or galvanized..
- D. Hangers 4 IN and less shall be ANVIL Figure 180 with Figure 114, or approved equal.
- E. Hangers over 4 IN shall be ANVIL Figure 590, or approved equal.
- F. Hangers for use in chemical storage areas and as indicated on the drawings for corrosion resistance shall be CorPro CP – Hanger, or approved equal.
- G. Concrete inserts for hanger rods shall be ANVIL Figure 281 or approved equal. For inserts with continuous slots, Unistrut #P1000 or approved equal.
- H. Beam clamps for hanger rods shall be ANVIL Figure 133, standard duty, or approved equal.
- I. Trapeze Hangers for suspended piping
 - 1. Construct with galvanized steel using angles, channels or other structural shapes. Provide curved roller surfaces at support point corresponding with the type of hanger required.:
 - 2. In chemical feed and storage areas, construct with FRP and support with fiberglass Unistrut channel or equal..

2.05 PIPE STANDS

- A. Provide pipe support saddles for pipe located 3 FT or less from floor elevations, except as otherwise indicated on the drawings. Pipe support saddle shall be ANVIL figure 264, or approved equal.
- J. Pipe support risers shall be galvanized, schedule 40 pipe, sized per manufacturer's recommendations.
- K. Pipe support base plate shall be 4 IN (MIN) larger than support. Provide a 3/16 IN collar thickness, circular in shape, and sleeve type connection to the pipe. Collar fitted over outside of support pipe and extended 2 IN from floor plate. Collar shall be welded to the floor plate. All edges shall be ground smooth. The pipe support base plate assembly shall be hot-dipped galvanized after fabrication.
- L. Pipe covering protection saddle for insulated pipe at point of support, provide ANVIL Figure 167, Type B or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hangers and supports at locations determined by weight balance calculations.
- B. Installation shall conform with manufacturer's recommendations.
- C. Furnish and install all necessary brackets, angles, and clips which are not a part of the building structure but which are required to properly support the piping system.

- D. Adjust hangers and supports as follows:
 - 1. Prior to putting the piping system into service, remove travel stops, adjust all spring hangers to the correct cold load, adjust all solid hangers to correct position, and remove all temporary hangers used in erection and testing.
- E. Furnish and install all concrete inserts required to properly support all piping systems.
- F. Field painting shall comply with Division 9, Specification Section 09910-Painting (Industrial)

3.02 INSPECTION

- A. Inspection for acceptance of hangers and hanger material will be conducted by the Engineer as soon as practical after arrival at the jobsite.
- B. Jobsite inspection takes precedence over any prior inspection.

END OF SECTION

SECTION 40 23 00

WATER PROCESS PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. The purpose and intent of this Section are to require that all necessary piping and related material shall be furnished and installed to provide complete and workable piping systems.
- B. Provide all pipe and fittings required to install all new piping systems specified in herein and as indicated on the drawings.
- C. This Section includes:
 - 1. Land Application Area Piping.
 - 2. WWTF Gravity piping.
 - 3. All small piping such as cooling or sealing water connections, vents, drains, control tubing, lubricating tubing, etc., required to complete the installation of each piece of mechanical equipment.
 - 4. Furnish and install piping connected to accessories which must vary from the drawings because of requirements peculiar to the particular equipment furnished, as required to make a complete and workable installation at no additional cost to the Owner. This requirement shall include changes required in the piping systems because of design changes made by the manufacturer between the time of design and the time of installation or because of equipment furnished of different manufacture than that specified.

1.02 REFERENCES

- A. Pipe and fittings shall be designed and tested in accordance with manufacturers' recommended procedures and the following codes and applicable standards:
 - 1. American National Standards Institute (ANSI):
 - A21.4 - Cement Mortar Lining for Ductile Iron Pipe and Fittings.
 - A21.10 - Ductile Iron and Gray-Iron Fittings, 3 in through 48 in, for Water.
 - A21.11 - Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
 - A21.15 - Flanged Ductile-Iron Pipe with Threaded Flanges.
 - A21.51 - Ductile Iron Pipe, Centrifugally Cast, for Water.
 - A312 - Seamless and Welded Austenitic Stainless Steel Pipe.
 - A403 - Wrought Austenitic Stainless Steel Piping Fittings.
 - B16.1 - Cast Iron Flanged Fittings
 - B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
 - B16.5 - Pipe Flanges and Flanged Fittings.

- B16.9 - Factory-Made Wrought Buttwelding Fittings.
- B16.11 - Forged Fittings, Socket Welding and Threaded.
- B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
- B16.21 - Nonmetallic Gaskets for Pipe Flanges.
- B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- B16.25 - Butt Welding Ends.

2. American Society of Mechanical Engineers (ASME):

- B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
- B16.5 - Pipe Flanges and Flanged Fittings.
- B16.9 - Factory-Made Wrought Buttwelding Fittings.
- B16.11 - Forged Fittings, Socket Welding and Threaded.
- B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
- B16.21 - Nonmetallic Gaskets for Pipe Flanges.
- B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- B16.25 - Butt Welding Ends.
- B31.1 - Code for Pressure Piping, Power Piping Section. ASME Boiler Code - Section 1.
- B36.10 - Welded and Seamless Wrought Steel Pipe.

3. American Society for Testing and Materials (ASTM):

- A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- A106 - Seamless Carbon Steel Pipe for High Temperature Service.
- A182 - Forged and Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service.
- A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- A307 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- A312 - Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- A403 - Wrought Austenitic Stainless Steel Pipe Fittings.
- A536 - Ductile Iron Castings.
- A674 - Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
- A746 - Ductile Iron Gravity Sewer Pipe.
- B75 - Seamless Copper Tube.
- B88 - Seamless Copper Water Tube.
- C150 - Portland Cement.
- D1248 - Polyethylene Plastics Extrusion Materials for Wire and Cable.
- D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (PVC) Compounds.
- D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- D2310 - Machine Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- D2997 - Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

- D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (4" through 15").
- D3139 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- D3350 - Polyethylene Plastics Pipe and Fitting Materials.
- F477 - Elastomeric Seals (Gaskets) For Joining Plastic Pipe.
- F679 - Type PSM Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings (18" through 27").
- F714 - Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.

4. American Water Works Association (AWWA):

- C104 - Cement-mortar Lining for Ductile-Iron Pipe and Fittings.
- C105 - Polyethylene Encasement for Ductile Iron Pipe Systems.
- C110 - Ductile-Iron and Gray-Iron Fittings.
- C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
- C150 - Thickness Design of Ductile Iron Pipe.
- C151 - Ductile Iron Pipe, Centrifugally Cast.
- C153 - Ductile Iron Compact Fittings.
- C222 - Polyurethane Coating for Interior and Exterior of Steel Water Pipe and Fittings
- C600 - Installation of Ductile Iron Mains and Their Appurtenances.
- C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In.
- C901 - Polyethylene (PE) pressure pipe and tubing, ¾ inch through 3 inch, for Water Service.
- C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In.
- C950 - Fiberglass Pressure Pipe.

5. National Bureau of Standards, Voluntary Products Standard (NBS):

- PS15-69 - Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment.

6. National Sanitation Foundation (NSF):

- 61 - Drinking Water System Components – Health Effects.

1.03 COMPLIANCE SUBMITTALS

- A. Submit as specified in Division 1.
- B. Submit the following for acceptance:
 - 1. Color code for random length pipe shipped to job site.
 - 2. Affidavits of compliance with applicable standards.

3. Test certificates.
 4. Special fitting detail.
 5. Joint details.
 6. Pressure rating and thrust restraint capacity for restrained joint systems.
 7. Test results or calculations for restrained joint assemblies.
 8. Butt welding end preparation details.
- C. Submit laying schedules with dimensioned plans or diagrams for all pipe.
1. Show pipe size and material.
 2. Show pipe class, thickness, or schedule.
 3. Show joint types for all pipes, valves and other equipment.
 4. Show all valves, equipment, and other accessories including restraint fittings.
 5. Provide definitions for abbreviations with all submittals.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Ship all random-length pipe to the job site marked with a continuous color stripe indicating material and schedule number.
- B. Handle all pipe and fittings in a manner to ensure that pipe and fittings will not be damaged.
- C. Do not drop or bump pipe or fittings.
- D. Use slings, lifting lugs, hooks or other devices designed to handle pipe.
- E. Store pipe and fittings with provisions to prevent movement or slipping into adjacent units.
- F. Ship all gaskets to the job site tagged with size, material and pressure rating.
- G. Ship spare gaskets separately packaged and tagged as spare parts.

1.05 JOB CONDITIONS

- A. Lines and grades shall be as indicated. Engineer will furnish a benchmark and a base line or other necessary horizontal control points to permit the Contractor to lay out, stake, and construct the work.

1.06 PIPING SYSTEM DESCRIPTIONS

- A. Piping is grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system

materials of construction. The table below identifies each piping classification, its utility designation and the system classification for each utility designation.

SYMBOL	SYSTEM	UTILITY DESIGNATOR	SIZE (IN)	PIPE MATERIAL	TEST PRESSURE (PSIG)
LEFF	10	Lagoon Effluent	3/4 - 3	PVC ⁽¹⁾	150
	9		3 - 54	PVC ⁽²⁾	25
SAN	9	Sanitary Sewer - Gravity	4 to 36	PVC	5

(1) Land application area pressure piping.

(2) lagoon gravity piping.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Ductile-Iron Pipe:
 - 1. American Cast Iron Pipe Co.
 - 2. U.S. Pipe Supply.
 - 3. Or approved equal.
- B. Plastic Pressure and Gravity Pipe (PVC):
 - 1. North American Specialty Products.
 - 2. Diamond Plastics.
 - 3. Or approved equal.
- C. Stainless Steel Pipe:
 - 1. Felker Bros. Corp.
 - 2. Marmon/Keystone.
 - 3. Or approved equal.
- D. Carbon Steel Pipe:
 - 1. Northwest Pipe Company
 - 2. American Piping
 - 3. Or approved equal.
- E. High Density Polyethylene Pipe:

1. Chevron-Philips.
2. ISCO Industries.
3. Or approved equal.

2.02 MATERIALS

- A. Pipes, fittings and appurtenances containing more than 0.25% lead calculated by weighted average shall not be used in potable water service.
- B. Ductile Iron Pipe and Fittings:
 1. Ductile iron pressure pipe shall conform to AWWA C115, C150, and C151 except as otherwise specified.
 2. Minimum thickness class for flanged pipe, AWWA C115, shall be class 53.
 3. Joints:
 - a. All buried gravity pipe shall have push-on joints conforming to AWWA C111 unless otherwise indicated or specified.
 - b. All interior and exposed exterior pipes shall be flanged unless otherwise indicated or specified. Contractor shall coordinate flange drilling and pressure class with connected valves, equipment and accessories supplied.
 - c. Pipe flanges shall be ductile iron, conforming to ANSI B16.1 and AWWA C115 and shall be drilled class 125 or class 250 where required for valves, equipment and accessories supplied.
 - d. Sleeved or coupled joints shall be provided where indicated. Furnish pipe ends suitable for installing style of sleeve or coupling indicated or specified. Provide anchor couplings or thrust blocks where restraint is required to withstand specified operating or hydraulic test pressure and where indicated.
 - e. Flexible Joints (Unrestrained), where indicated on the drawings for buried piping shall be one of the following:
 - 1) Mechanical joint.
 - 2) Sleeve Coupling.
 - a) Ford FC1.
 - b) Romac 501.
 - c) Smith Blair 411.
 - d) Or approved equal.
 - 3) Sleeve couplings shall be cast iron, ductile iron, or fusion-bonded epoxy coated steel. Bolts and nuts shall be Type 304 or 316 stainless steel.
 4. Restrained Joints:

- a. Furnish restrained joints, harnesses, anchors, or thrust blocks at all locations, unless otherwise noted. All bolts, nuts and tie rods shall be Type 304 or 316 stainless steel.
 - b. Proprietary restrained joints for push-on pipe shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Flex Ring, American Cast Iron Pipe.
 - 2) Tr-Flex, U.S. Pipe Co.
 - 3) Fast-Grip Gasket, American Cast Iron Pipe Co. (12-inch and smaller pipe only).
 - 4) Snap-LOK, Griffin Pipe Products
 - 5) Or approved equal
 - 6) Joint restraint systems consisting solely of wedge elements in rubber gaskets will not be acceptable for pipe greater than 12-inch diameter.
 - c. Restrained flexible joints shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Romac 400RG.
 - 2) Romac Alpha.
 - 3) EBAA Iron Mega Coupling Series 3800.
 - 4) Smith-Blair 470 Series.
 - 5) Or approved equal.
 - d. Restrained mechanical joints shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) EBAA Iron Mega-Lug.
 - 2) Stainless steel tie-rod assemblies. Tie rods shall connect no less than 50 percent of the bolts in the coupled glands.
 - 3) Or approved equal
 - e. Mechanical joint glands and field-assembled flanges using set screws bearing directly against the pipe for restraint will not be acceptable.
5. Fittings:
- a. Fittings shall conform to AWWA C110 or C153 and shall be ductile iron.
 - b. Fittings provided with buried pressure or flooded pipe shall have mechanical joints.
 - c. Fittings for gravity pipe with push-on joints shall be mechanical joints or push-on joints.
 - d. Provide all specials, taps and plugs as specified or indicated.
 - e. Flanged fittings shall be provided for flanged pipe.
 - f. Flange faces shall be coated with a rust-preventive compound.

6. Lining:
 - a. All pipe and fittings for potable water service shall be lined with cement mortar conforming to ANSI 21.4 and AWWA C 104, unless otherwise indicated.
 - b. All pipe and fittings for wastewater service shall be lined with cement mortar and coal tar epoxy with a minimum thickness of 24 mil applied to a surface prepared in accordance with manufacturer's recommendations unless otherwise indicated. Lining shall conform to ANSI A21.4/AWWA C104.
 - c. Where indicated, all pipe and fittings for wastewater service shall be lined with one of the following.
 - 1) Amine cured novalac epoxy containing at least 20 percent by volume of ceramic quartz pigment, Protecto 401, Permox-CTF or approved equal. The lining shall be a minimum of 40 mils nominal dry film thickness. Inside of socket shall be coated in accordance with manufacturer's recommendations.
 - d. Lining shall extend from edge of plain end to the gasket seat in the bell socket.
 - e. Lining application shall be in accordance with the manufacturer's recommendations.
7. All buried iron pipe and fittings shall be coated with manufacturer's standard exterior bituminous coating. All exposed pipe and fittings shall be exterior coated with the finish coatings as specified in Division 9.
8. Gaskets and Bolting Material:
 - a. Provide all gaskets, bolts, lubricants, and other accessories required to install pipe and fittings complete and ready for service.
 - b. Bolts and nuts for flanged and mechanical joints shall be Type 304 or 316 stainless steel.
 - c. Gaskets for flanged joints shall be 1/8" thick, full faced synthetic rubber.
 - d. Gaskets for flanged joints on air service shall be rated for 22° F minimum.
9. Polyethylene Encasement: Buried ductile iron piping shall be encased in polyethylene conforming to ASTM D 1248, Type 1, Class C, Grade E-1 when noted on the plans.
10. Flanged Coupling Adapters:
 - a. Flanged Coupling Adapters shall have restraining anchor studs and/or harnesses and shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:

- 1) Ford FCA.
 - 2) Smith-Blair 913.
 - 3) Or approved equal.
 - b. Couplings shall be coated per Division 9.
 - c. Type 304 or 316 stainless steel bolts, nuts and tie rods shall be used.
 - d. Gaskets, except for air piping, shall be neoprene rubber. Gaskets for air piping shall be suitable for operation at a temperature of 250° F.
11. Flanged Dismantling Joints:
 - a. Flanged Dismantling Joints shall have restraining tie rods and shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Ford FDJ.
 - 2) Smith-Blair 975.
 - 3) Or approved equal.
 - b. Couplings shall be coated per Division 9.
 - c. Type 304 or 316 stainless steel bolts, nuts and tie rods shall be used.
 - d. Gaskets, except for air piping, shall be neoprene rubber. Gaskets for air piping shall be suitable for operation at a temperature of 250° F.

C. Stainless Steel Pipe and Fittings:

1. Stainless steel pipe shall conform to ASTM A312, Type 304 or 304L.
2. All pipe 2" and larger shall be Schedule 10S.
3. All joints 2" and larger shall be butt welded except where flanges are indicated.
 - a. Flanges
 - 1) Pipe flanges shall be ASTM A182, Type 304 or 304L stainless steel fabricated in accordance with ANSI B16.5.
 - 2) Flanges shall be 150 pound, raised face, weld neck or socket weld unless otherwise indicated.
 - 3) Flange bolting material shall be Type 304 stainless steel.
 - b. Fittings:
 - 1) Fittings shall be ASTM A403, Type 304 or 304L stainless steel.
 - 2) Fittings 2" and larger shall be butt welded with full inert gas (Argon) purge.

- 3) Fittings shall be the same schedule as the pipe to which they attach.
- c. Welding:
 - 1) All fittings shall be factory welded to pipe with Gas Tungsten Arc (TIG) method with full inert gas (Argon) purge.
 - 2) Backing rings will not be permitted.
 - 3) Interior weld beads shall be smooth with an interior projection not exceeding 1/16 inch beyond the interior diameter. Outside welds shall be wire brushed with stainless steel brush.
 - 4) Weld quality and qualification of welders shall conform to ANSI B31.3.
- d. Gaskets:
 - 1) Gaskets shall be spiral wound Flexitalic style CG with nominal thickness of 0.175 and shall be of 316L stainless steel construction.
 - 2) Provide one complete set of spare gaskets of each size and pressure rating used for this installation.
4. Stainless steel pipe shall be pickled and neutralized after fabrication. Pipe shall be free from iron particles and other foreign matter.

D. Carbon Steel Pipe:

1. Carbon steel pipe shall conform to:
 - a. ASTM A53 Grade B.
 - b. ASTM A106 Grade B for 450 psig steam.
2. Pipe Rating:
 - a. 2 1/2" and larger shall be standard weight.
 - b. 2" and smaller shall be Schedule 80.
3. Pipe Joints:
 - a. 2 1/2" and larger shall be butt-weld with split commercial backing rings except where flanges are required.
 - b. 2" and smaller shall be socket welded unless otherwise indicated.
4. Fittings:
 - a. Fittings 2 1/2" and larger shall be butt-weld forged or wrought steel and shall conform to ANSI B16.9.

- b. Fittings 2" and smaller shall be socket weld conforming to ANSI B16.11.
 - c. Fittings shall be of the same schedule and material as the pipe to which they attach.
 - d. Screwed fitting 2" and smaller shall be 300-pound malleable iron conforming to ANSI B16.3 or 2000-pound forged steel threaded fittings conforming to ANSI B16.11. Galvanized when used with galvanized pipe. Used only on piping systems where screwed fittings are indicated.
 - e. Malleable iron unions 2" and smaller shall be 300-pound design with a ground joint of bronze to iron, screwed fitting shall be used only on systems where threaded joints are indicated.
5. Coatings:
- a. All buried shall be given a protective coating consisting of not less than two spirally applied wrappings of polyethylene or PVC tape, over a suitable prime coat, to a minimum system thickness of not less than 40 mils. Each wrapping shall be lapped not less than 1/2 inch. A single wrap lapped 50 percent or more shall not be acceptable.
 - b. The first wrapping shall consist of 1 or 2 plies of self-adhesive polyethylene or PVC tape to a total thickness of approximately 20 mils, Polyken 900 or 920; Plicoflex No. 340; or equal.
 - c. The finish wrapping shall consist of a self-adhesive protective overwrap of approximately 25 mils thickness, Polyken 955-25, Plicoflex Rockshield, or equal, or a protective adherent felt coating acceptable to the Engineer.
 - d. In wrapping welded joints, the sharp edges of weld spatter, slag, etc., at the welded joint shall be removed with a file or ball-peen hammer. A single thickness of tape shall first be applied around the weld. Then the wrapping shall be started 4 inches back on the pipe wrap, and the tape shall be spiral wrapped over the joint, holding the proper tension and overlap, and finished 4 inches back on the pipe wrap on the other side of the joint. The second wrapping shall then be applied.
 - e. Fittings, valves, and other odd-shaped components in the pipeline shall be wrapped with not less than 2 thicknesses of conformable polyethylene or PVC tape over a suitable prime coat, Polyken joint wrap tape No. 930 over primer No. 927 or 935; Plicoflex Molding tape over No. 105 primer; or equal.
6. Flanges:
- a. Steel pipe flanges shall conform to ANSI B16.5 and shall be of the same material as the pipe to which they attach. Slip-on or weld neck flanges may be used for class 150 and 300 pound. Only weld neck flanges shall be used for 400 pound class and greater.

- b. Steel flanges connecting to 125-pound cast iron flanged valve or fitting shall have a flat face. All others shall have raised face. The flange surface finish shall be in accordance with MSS SP-6.
- 7. Flange Bolts:
 - a. Bolting materials shall be Type 304 or 316 stainless steel bolts and hexagon nuts.
- 8. Gaskets:
 - a. Heavy-duty Buna-N shall be 1/16" thick full faced for pipe sizes 10" and smaller, and 1/8" thick full faced for pipe sizes 12" and larger.
 - b. One complete set of spare gaskets shall be provided consisting of at least one gasket of each size, material and pressure rating used for this installation.

E. Plastic Pressure Pipe and Fittings (PVC)

- 1. The materials of this pipe shall be uniformly blended with unplasticized polyvinyl chloride. Nothing used in its manufacture shall be injurious to humans or animals, nor shall it impart taste or odor to domestic water or in any manner alter the chemical content of waters flowing through the pipe. It shall consist of all new materials, and the manufacturer shall furnish a sworn statement that no reused or materials known as "mill shorts" were used in the manufacture of the pipe or fittings. All pipe shall have superior high-tensile strength. Pipe shall conform to all requirements of commercial standards and ANSI, as specified on the drawings and/or in the Piping Schedule in Section 40 23 00.1.05.A. The PVC pipe shall conform to the following standard specifications:
 - a. ASTM D2241, 200 psi, SDR 21.
- 2. All plastic pipe shall be approved by and bear the National Sanitation Foundation seal of approval and will comply with the requirements for Class 12454-A or Class 12454-B virgin components as defined in ASTM D1784 with an estimated hydrostatic design basis (HDB) rating of 4000 psi (27.58 MPa) for liquid at 73.4°F (23°C). Pipe and fittings with elastomeric seal joints shall meet the requirements of ASTM D3139.
- 3. Certificates of conformance with the foregoing specifications shall be furnished with each lot of pipe supplied.
- 4. PVC Pipe. Pipe shall be joined by means of a rubber ring slip joint, by means of a bell joint which shall be an integral and homogeneous part of the pipe barrel.
 - a. At no point in the pipe bell, including the recess groove for rubber rings, shall the wall thickness be less than that for the pipe barrel.
 - b. Samples of pipe shall be submitted to the Engineer for acceptance.
 - c. Maximum laying length of pipe shall be 20 feet.

- d. All pipe shall have a guide mark on the spigot end to enable checking of adequate seating into bell.
 - e. The manufacturer shall provide a factory representative skilled in the installation of the type of pipe purchased to instruct the Contractor's personnel in the proper procedures for connecting and laying the pipe. This instruction is to be given at the beginning of pipe laying operations.
5. Fittings for Pipe. Fittings for plastic pipe shall be ductile iron as specified. Ductile iron fittings for plastic pipe shall have a pressure rating not less than the pipe.
6. Restrained Joints:
- a. Furnish harnesses, anchors, and/or thrust blocks where called for on the drawings and at all locations where required to prevent separation of joints under operating and specified test hydraulic test pressures. All bolts, nuts and tie rods shall be Type 304 or 316 stainless steel.
 - b. Restrained flexible joints shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) Romac Alpha.
 - 2) EBAA Iron Mega Coupling Series 3800.
 - 3) Smith-Blair 470 Series.
 - 4) Or approved equal.
 - c. Restrained mechanical joints shall be rated for the greater of 150 psi minimum working pressure and the specified hydraulic test pressure:
 - 1) EBAA Iron Mega-Lug.
 - 2) Or approved equal.
 - 3) Stainless steel tie-rod assemblies. Tie rods shall connect no less than 50 percent of the bolts in the coupled glands.
 - d. Mechanical joint glands and field-assembled flanges using set screws bearing directly against the pipe for restraint will not be acceptable.

F. Polyvinyl Chloride (PVC) Gravity Pipe and Fittings:

- 1. PVC sewer pipe and fittings, sizes 4-inch through 15-inch, shall conform to ASTM D-3034, SDR 35. PVC sewer pipe and fittings, sizes 18-inch through 36-inch, shall conform to ASTM F-679.
- 2. All PVC sewer pipe and fittings shall be made of PVC plastic having a cell classification of 12454-B or 12454-C, as defined by ASTM D1784.
- 3. Joints shall be of the bell and spigot type. The bell shall contain a factory-installed elastomeric gasket which is positively retained. Joint shall be in conformance with ASTM D3212.

4. The gasket shall be molded or extruded and spliced from a high-grade, properly vulcanized elastomeric compound, consisting of a synthetic rubber and shall meet the low head requirements of ASTM F477.
 5. Molded fittings shall be supplied with factory-installed gaskets and shall be suitable for use with SDR-35 gravity sewer pipe. Fittings shall not deflect more than pipe when loaded and bedded in the same manner.
 6. All 90° bends shall be accomplished by using two 45° bends.
 7. Flexible Joints (Unrestrained), where indicated on the drawings for buried piping shall be one of the following:
 - a. Mechanical joint.
 - b. Sleeve Coupling:
 - 1) Ford FC1.
 - 2) Romac 501.
 - 3) Smith Blair 411.
 - 4) Or approved equal
 - c. Sleeve couplings shall be cast iron, ductile iron, or fusion-bonded epoxy coated steel. Bolts and nuts shall be Type 304 or 316 stainless steel.
- G. High Density Polyethylene Pipe (HDPE) and Fittings: Pipe and fittings shall conform to ASTM F714.
1. General: Furnish maximum pipe lengths normally produced by the manufacturer, except for fittings, closures, and specials. Only solid wall HDPE pipe in accordance with ASTM F714 will be accepted. HDPE profile wall pipe and fittings will not be accepted. Pipe shall have green stripe for wastewater service and blue stripe for water service.
 2. Materials: The pipe shall be high performance, high molecular weight, high density polyethylene pipe, Driscoplex 4000/4100 by CP Chem Performance Pipe, a division of Chevron Phillips Chemical Company, Plano, Texas, or approved equal. Pipe shall conform to ASTM D3350, Material grade PE4710. Minimum cell classification shall be 445574 C as referenced in ASTM D 3350.
 3. Design: Pipe supplied under this specification shall have a nominal DIPS (Ductile Iron Pipe Size) OD unless otherwise specified. The SDR (Standard Dimension Ratio) of the pipe shall be SDR 11, 200 psi, unless otherwise noted.
 4. Joints: Low pressure flow systems shall be joined by use of the heat fusion technique of butt fusion resulting in a monolithic pipe. All joints shall be fully restrained and as strong as the pipe in both tension and hydrostatic loading. The joining of pipes of dissimilar materials shall be made using approved transition coupling, and shall provide a permanent and watertight connection which will withstand the hydrostatic test pressure.

5. Fittings: The fittings for low pressure systems shall be molded from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe or shall be manufactured using a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe supplied under this specification. All fittings supplied under this specification shall be of the same manufacturer as the pipe being supplied. Minimum cell classification shall be 445574 C as referenced in ASTM D3350.

H. Clear-Braid Reinforced (CBR) PVC Hose

1. CBR PVC Hose shall consist of an open mesh polyester braiding permanently encapsulated in the wall of clear, flexible PVC tubing.
2. CBR PVC Hose shall be certified by the National Sanitation Foundation for food equipment materials (NSF-51) and potable water (NSF-61). All material components of the hose shall conform to USP Class VI and applicable FDA standards.
3. CBR PVC Hose shall have, at a minimum, the following physical properties:

Hardness, Shore A \pm 5:	80
Tensile Strength, psi:	2,500
Elongation at Break, %:	300
Maximum Operating Temperature, °F:	175

4. CBR PVC Hose shall have the following minimum working pressure ratings:

O.D. (Inch)	I.D. (Inch)	WALL (Inch)	WORKING PRESSURE (PSI @ 70°F)
3/8	3/16	3/32	250
1/2	1/4	1/8	250
17/32	5/16	7/64	225
5/8	3/8	1/8	225
3/4	1/2	1/8	200
7/8	5/8	1/8	175
1	3/4	1/8	150
1-3/8	1	3/16	125
1-3/4	1-1/4	1/4	100
2	1-1/2	1/4	75
2-5/8	2	1/4	70

5. Connections to CBR PVC Hose shall be by glass-fiber reinforced Nylon cam operated couplings conforming to dimensional requirements of the MIL-C-27487 standards. The hose shall be attached to the connector via hose bar and fastened with a worm gear operated hose clamp. Gaskets shall be EPDM. All hardware (handle, pin, hose clamp, etc.) shall be stainless steel. Nylon cam operated couplings shall have the following working pressure rating:

Diameter Range (Inches)	Working Pressure (psi)
1/2" to 1"	175.0
1-1/4" to 2"	150.0

3"	100.0
4"	50.0

- I. Copper Tube and Fittings:
 - 1. Copper tube shall conform to ASTM B88 - Type L for above ground installations. Buried pipe may be type K or L.
 - 2. Fittings shall be wrought copper with solder joints in accordance with ANSI B16.22.
- J. Stainless Steel Tube and Fittings:
 - 1. Tubing and fittings shall be 304 stainless steel conforming to ASTM A269.
 - 2. Fitting shall be flared.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install pipe in accordance with Section 33 05 06 of Division 33.

3.02 INSPECTION

- A. Inspection for acceptance of pipe will be conducted by the Engineer as soon as practical after arrival of pipe and fittings at the job site.
- B. Job site inspection takes precedence over any prior inspection.

3.03 ACCEPTANCE

- A. Pipe will be inspected by Engineer for acceptance by owner at the construction site. Acceptance at the job site shall be paramount. Prior approval or payment for pipe rejected at the job site shall be null and void. Acceptance by Engineer at a point in the sequence of manufacture, delivery and installation will not relieve the Contractor of his responsibilities as set forth in the Contract Documents. Manufacturing defects that prohibit installed pipe from successfully passing leakage tests shall constitute rejection of the defective pipe.

3.04 PIPING SYSTEM SCHEDULES

- A. SYSTEM 9 – Sanitary Sewer – Gravity Service
 - 1. Test requirements: Sanitary Sewer – Gravity Service – see Section 1.6 and Division 33, Specification Section 33 05 06
 - 2. Gaskets and O-rings:
 - a. O-rings: Neoprene or rubber
 - b. Push-on (PVC): Ruber, AWWA/ANSI D3212

- c. Elastomeric gaskets with water tight seal conforming to ASTM D3139, ASTM D3212 and ASTM F477 (PVC).
3. Pipe, Buried Service, 4 to 15 IN:
 - a. Material: PVC, SDR-35 (ASTM D3034)
 - b. Lining: None.
 - c. Coating: None
 - d. Fittings: N/A
 - e. Joints: Unrestrained
 4. Pipe, Buried Services, 18 to 36 IN:
 - a. Materials: PVC, ASTM F679
 - b. Lining: None.
 - c. Coating: None.
 - d. Fitting: N/A
 - e. Joints: Unrestrained.

B. SYSTEM 10 – Lagoon Effluent

1. Test requirements: Lagoon Effluent– see Section 1.6 and Division 33, Specification Section 33 05 06
2. Gaskets and O-rings:
 - a. O-rings: Neoprene or rubber
 - b. Mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11
 - c. Elastomeric gaskets with water tight seal conforming to ASTM D3139, ASTM D3212 and ASTM F477 (PVC).
3. Pipe, Buried Service, 3/4 to 3 IN:
 - a. Material: ASTM D2243, SDR-21 PVC
 - b. Lining: None.
 - c. Coating: None.
 - d. Fittings: Compression, restrained.
 - e. Joints: Restrain joints per detail
 - f. Tracer wire per Division 33, Specification Section 33 05 06

4. Pipe, Buried Service, 3 to 36 IN:
 - a. Material: ASTM D2243, SDR-21 PVC
 - b. Lining: None.
 - c. Coating: None.
 - d. Fittings: AWWA/ANSI C110/A21.10 ductile iron restrained or AWWA/ANSI C153/A21.53 ductile iron compact fittings restrained. Polyethylene Encasement per AWWA C105.
 - e. Joints: Restrain joint per detail.
 - f. Tracer wire per Division 33, Specification Section 33 05 06

END OF SECTION

SECTION 40 61 13
PROCESS CONTROL SYSTEMS GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY AND DESCRIPTION OF WORK

- A. This Section includes control panels and equipment controls as specified in this and other Divisions and as indicated on construction plans.
- B. Types of control panel work specified include fabrications, installation, startup, and testing of all facility control panels and enclosures, to include, but not limited to:
 - 1. Outdoor new and/or indoor equipment rack and/or wall mounted process equipment control systems.
 - 2. Indoor & outdoor individual new equipment processes' PLC based control systems.
 - 3. Indoor and/or outdoor equipment rack & wall mounted remote alarming and monitoring system.
 - 4. Indoor and/or Outdoor equipment rack mounted and indoor process instrumentation measurement systems.
 - 5. Final system control (HAND, AUTO, LOCAL) operational requirements shall be determined (based on available operating alternatives, scenarios, set points, speed adjustments, operator interfacing, and configurations) during an operational controls workshop to be conducted after contract has been awarded to the successful bidder and prior to the submittal/shop drawing process with the Owner, Engineer, Contractor, selected equipment Manufacturer's representative and the supplier's controls system designer. When the controls are designed by the Manufacturer, the Manufacturer's representative may represent the Manufacturer at the workshop. Workshop shall be based on actual process equipment and control system selected for this installation.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 40 basic instrumentation and control systems, materials and methods section, and is part of each Division 40 section and other divisions making reference to control panels specified herein.
- C. Division 43 – Process Gas and Liquid Handling, Purification, and Storage Equipment.
- D. Division 46 – Water and Wastewater Equipment

1.03 QUALITY ASSURANCE

- A. **Standards:**
 - 1. American National Standards Institute (ANSI): Z55.1 - Gray Finishes for Industrial Apparatus and Equipment.
 - 2. National Electrical Manufacturers Association (NEMA): ICS - Industrial Controls and Systems.
 - 3. Institute of Electrical and Electronic Engineers (IEEE)

4. National Electric Code (NEC), NFPA 70

1.04 SUBMITTALS

- A. Submit compliance submittals in accordance with Division 1.
- B. Submit manufactures' data including specifications, installation instructions, and system operational instructions.
- C. Submittals shall include as a minimum:
 1. Written Operational Description.
 2. Detailed bill of materials.
 3. Panel, electrical, control, and instrumentation weights and dimensions
 4. Complete panel components and devices bill-of-materials listing, type, model, ratings, and specifications data sheets, to include catalog numbers and part numbers.
 5. Components and device manufacturer, type, model, ratings, and specifications
 6. Field sensors
 7. Transmitters
 8. Power supplies including UPS/backup up battery systems
 9. Surge protection equipment
 10. Enclosures
 11. Enclosures' space heating and ventilation equipment and controls.
 12. Enclosure Heating and Air Conditioning sizing calculations as/if required by equipment manufacturer, for this equipment & system to be mounted outdoors in continuous direct sunlight
 13. Motor starters and drive units
 14. Overcurrent and instantaneous protection devices
 15. Controls components
 16. Operator interface units
 17. Motor winding heater components, branch circuits, and controls
 18. CPUs and I/O modules and power supplies
 19. UPS/battery back up system components
 20. Communications equipment to include radios, antennas, modems, etc.

21. Communications software
22. Wiring diagrams (on 11"x17" sheets)
23. Loop diagrams (on 11"x17" sheets)
24. Instrumentation
25. MMI/HMI and PLC programming software
26. Control cabinet(s) layout drawings showing accurately scaled equipment sections, including, but not limited to: PLCs, controllers, device panels, and circuit breakers. Show spatial relationships of components to proximate electrical equipment. Clearly differentiate on wiring diagrams those conductors, which are factory installed and those which are field installed. Preliminary and final electronic and hard copies of all programming software inputs, ladder logic and functions shall be submitted.
27. Overcurrent characteristics; time-current curves (TCCs) for all panel installed fusing, circuit breakers, motor protectors, and motor overload relays; and details of motor control.
28. Example and proposed copies of Operator Interface Unit Man Machine Interface (MMI) system display windows/screens for Owner approval.
29. Operations and Maintenance Manual (minimum two (2) bound hardcopy sets and one (1) electronic copy on USB drive), in conformance with Division 1 specifications. Include the following data:
 - System supplier and integrator points of contact and business information.
 - Table of contents.
 - Product data sheets.
 - Alignment, adjustment and repair instructions.
 - Manufacturer's installation and operational instructions.
 - System initial startup/programming set points and timing delay settings based on specific equipment installation and operational requirements.
 - Assembly diagrams, interconnection drawings and shop drawings.
 - Guide to troubleshooting.
 - Lubrication instructions.
 - Recommended spare parts lists and predicted life of parts subject to wear.
 - Final start-up, testing, and commissioning test reports after Owner acceptance.

Operations and Maintenance Manual shall also include an electronic file of "As-Built/As-Initially Programmed" programming ladder logic; and per requirements of Division 1, one (1) electronic copy or hard copy, minimum, for Owner and Engineer acceptance and approval

A waterproof reduced copy of the master "As-built" control panel diagrams shall be laminated in clear plastic and permanently fastened to the inside of the control panel door.
30. Manufacturer's installation instructions and certifications. Installation manuals shall incorporate instructions for off-loading, storage, assembly, installation, maintenance and operation of the system and all its components. Installation data/instructions/drawings to include, but not limited to: Equipment/material mounting,

alignment, anchoring, attachments, accessories, wiring diagrams, connections, electrical power and control terminations diagrams, and programming/system setup

31. List of spare parts to be furnished to Owner after equipment operational acceptance.

32. Testing data and reports to show full compliance with these specifications.

33. Process & controls warranty and/or guarantee.

1.05 FABRICATOR QUALIFICATION

A. Fabrication shall be by a manufacturer or a particular division of a manufacturing firm specializing in control panel construction.

B. Fabricators shall have at least 5 years' experience in the manufacture of control panels.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Control Panels and Enclosures:

1. Boss Manufacturing
2. Hoffman Engineering Company (Hoffman)
3. Hennessy Products, Inc.
4. Saginaw
5. Or approved equal

B. Wire:

1. Alpha Wire Corporation (Alpha)
2. Belden Corporation (Belden)
3. Coleman/CCI
4. Carol Cable Company (Carol)
5. General Electric Company (General Electric)
6. Southwire
7. Or approved equal

C. Wire Ducts:

1. Panduit
2. ABB
3. Or approved equal

D. Wire Markers:

1. Brady
2. Electrovert
3. Thomas & Betts
4. ABB
5. Or approved equal

E. Din Rails:

1. IBOCO
2. Or approved equal

F. Equipment Connections:

1. Amp, Inc.

2. Thomas and Betts
3. Or approved equal

G. Terminal/Distribution Blocks:

1. Ferraz
2. Buchanan
3. ERICO
4. Marathon Special Products
5. Multi-amp Corporation, The States Division (States)
6. Or approved equal

H. Circuit Breakers:

1. Eaton
2. Schneider Electric/Square D
3. General Electric Company
4. Allen-Bradley
5. ABB
6. Or approved equal.

I. Fuses:

1. Bussman
2. Littlefuse
3. Ferrazshawmut
4. Or approved equal

J. NEMA Contactors, Motor Starters, & Overload Relays:

1. Eaton

K. Relays & Power Monitors:

1. Diversified
2. Agastat
3. SymCom
4. IDEC
5. ISSC
6. ATC
7. Sigma
8. Timemark
9. Or approved equal

L. Event Counters & Runtime/Elapsed Time meters

1. Eaton/Cutler Hammer
2. General Electric Company
3. Schneider Electric/Square D
4. ABB
5. Allen-Bradley
6. ECC
7. Or approved equal

M. Panel Control Switches and Lights:

1. Eaton/Cutler Hammer
2. General Electric Company
3. Micro Switch Division of Honeywell
4. Schneider Electric/Square D
5. Federal Signal

6. IDEC
7. Or approved equal

N. Transient Surge Protection (required on all control panels and instrumentation)

1. Schneider Electric/Square D
2. Ditek
3. Leviton
4. Amber Industries, Inc.
5. Eaton/Cutler-Hammer
6. Innovative Technology, Inc.
7. Phoenix
8. Emerson
9. Or approved equal

O. Panel Mounted Alarm Devices

1. Allen-Bradley/Rockwell
2. ABB
3. Floyd Bell
4. Ingram
5. Federal
6. Or approved equal

P. Space Heaters

1. Watlow
2. Hoffman
3. Stego
4. Or approved equal

2.02 MATERIALS

A. CONTROL PANELS

1. General and Floor Mounted:
 - a. A control system shall be provided which includes process equipment control/monitoring, structure/tank/channel level control/monitoring, local alarm systems and remote station alarming and status monitoring.
 - b. Process system control systems shall be configured for local and future remote monitoring alarming.
 - c. The respective motor starter auxiliary contacts shall activate each equipment runtime meter, event counter, and "RUN" pilot indicator light for a "True Run" condition.
 - d. Provide intrinsically safe relays for all externally installed field devices. Intrinsically safe relays shall be mounted within control panels and adjacent to the control devices/controllers and equipment motor starters. Intrinsically safe circuits shall be isolated from other control panel circuits/devices as required per NEC Article 504.
 - e. Control panels and related enclosures shall be identified with appropriate markings and safety warning signs, to include, but not limited to, those required by Article 409 of the National Electric Code (NEC NFPA-70).
 - f. A waterproof reduced copy of the master "As-built" control panel diagrams shall be laminated in clear plastic and permanently fastened to the inside of the control panel door.

- g. The control panel shall meet U.L. requirements and shall be U.L. 508A listed as a complete assembly. The control panel shall be completely pre-wired and factory tested prior to shipment.
 - h. All conduit penetrations shall be from the bottom of enclosure with all field terminations in lower enclosure sections
 - i. Panel Construction by locations (Unless otherwise indicated):
 - 1) Interior, dry locations: NEMA 1
 - 2) Exterior, non-corrosive areas: NEMA 3R- with dead front exterior front door and a full-size interior swing panel(s) for mounting controls, indicating devices, and monitoring devices.
 - 3) Exterior and Process areas: NEMA 4X Stainless Steel Type 316L or polycarbonate (as indicated), with dead front exterior front door and a full size interior swing panel(s) for mounting controls, indicating devices, and monitoring devices. Located at or near corrosive areas or potential corrosive areas to include, but not limited to: water and wastewater.
 - a) Equipment and Piping vaults
 - b) Pump stations, clarifiers
 - c) Process equipment
 - d) storage basins and lagoons
 - e) Open channels
 - j. Padlockable front door.
 - k. Shall be fabricated in a manner as detailed in the construction drawings.
 - l. Bracings, gussets and stiffeners as required forming a rigid, uniform structure.
 - m. Front face shall be a smooth, continuous surface, free from warps, blemishes or marks.
 - n. Frame work constructed using minimum of 12-gauge steel.
 - o. All welded construction with welds ground smooth.
 - p. Suitable for mounting directly on a concrete floor.
 - q. Interior brackets and hinged equipment racks or panels for mounting components.
 - r. Interior support shelves shall be supported from side sub-panels of the panel with rigid strut system. Threaded rod hangers are not applicable.
 - s. Painting (NEMA 1 and 3R): Manufacturer's standard method with a minimum of one coat of primer and two coats of finish paint (unless otherwise required). Finish color to match adjacent surfaces.
2. **Wall-Mounted (Rack and Rail mounted similar) Design Requirements:**
- a. Panel Construction by locations (Unless otherwise indicated):
 - 1) Interior, dry locations – NEMA 1
 - 2) Exterior, non-corrosive areas – NEMA 3R with dead front exterior front door and a full size interior swing panel(s) for mounting controls, indicating devices, and monitoring devices.
 - 3) Exterior and Process areas NEMA 4X Stainless Steel Type 316L, with dead front exterior front door and a full size interior swing panel(s) for mounting controls, indicating devices, and monitoring devices. Located at or near corrosive areas or potential corrosive areas to include, but not limited to: water and wastewater

- a) Equipment and Piping vaults
 - b) Pump stations, clarifiers
 - c) Process equipment
 - d) Storage basins and lagoons
 - e) Open channels
- b. Totally enclosed cabinet with front door and continuous hinge with stainless steel hinge pin. Door shall be removable by pulling the hinge pin. Door shall have high impact thermoplastic data pocket.
 - c. Formed and welded construction, 14-gauge minimum steel.
 - d. Interior 12-gauge minimum steel mounting panel.
 - e. Sized to house all equipment and devices indicated and specified.
 - f. Padlock hasp and screw type door clamps.
 - g. NEMA Type 1 and 3R Painting: Manufacturer's standard method and color (as selected by Engineer) with one coat of primer and two coats of finish paint minimum.
 - h. Manufactured by Hoffman Engineering Company, Hennessy, Boss Mfg., or approved equal.

B. NAMEPLATES

- 1. Fabricated from laminated melamine sheeting with colored core and satin finish melamine overlay.
- 2. Color: Black with white engraved letters unless indicated otherwise.
- 3. Thickness: 1/16-inch nominal.
- 4. Attached to panels and instruments with contact cement or approved double-faced tape.
- 5. Edges beveled to expose core on perimeter.
- 6. Legend engraved through overlay to expose core.
- 7. Provide for each device on the panel interior so device can be identified when viewed from rear of panel. Provide on panel face as indicated.

C. ELECTRICAL SYSTEM

- 1. Wiring:
 - a. Alpha, Belden, or Carol 600-volt, 105-degree C, UL style 1015 MTW wire or General Electric SI-57275, SIS Vulkene insulated switchboard wire, or approved equal.
 - b. Analog/transmitter/transducer/sensor signal cable:
 - 1) Shielded, two pair & three conductor cables, 16 Gauge & 18-gauge cable
 - a) Conductors- tinned copper twisted pair
 - b) Insulation – Polyethylene
 - c) Construction - conductors cabled
 - d) Shield – Aluminum foil, 100 % coverage
 - e) 20 Gauge (18 Gauge for Beldon 8719) stranded tinned copper drain wire
 - f) Jacket – chrome gray PVC
 - g) 300V- 60 Deg. C. for Beldon 8760, 600V, 80 Deg. C for Beldon 8719
 - h) Belden 8670, Belden 8719, or equal
 - 2) Transducer coaxial cabling (as required per equipment manufacturer)
 - a) RG-62/U type, NEC CMP, CEC CMP
 - b) Conductors- 22 gauge (solid), .025 bare copper covered steel
 - c) Insulation – FEP
 - d) Shield – bare copper braid 94% shield coverage

- e) Jacket – fluorocopolymer gray
 - f) 75 Deg. C.
 - g) Belden 82269 or equal
- c. Wire Sizes:
- 1) No. 12 AWG, 19-strand, for all convenience outlets, interior lighting and other similar loads.
 - 2) No. 14 AWG, 16- to 41-strand, for low-power loads of 115 volts or lower voltage.
- d. Wire Markers:
- 1) Slip-on Type - Hot-stamped spaghetti-type, Brady Ty-grip, Brady BT or DAT, Electrovert Type Z, or approved equal.
 - 2) Sleeve or Wrap Type - Brady or T & B computer printed markers, either sleeve or wrap type, with clear wrap over markings. Hand printed type is not acceptable.
 - 3) Identify both ends of wire with the same unique wire number.
 - 4) Markers to apply to only one electrical point in panel circuiting.
 - 5) Wire numbers shall be assigned where specific designations are not indicated.
- e. Wiring Methods:
- 1) Main groups of wires routed in plastic nonflammable wiring duct.
 - 2) Smaller groups of wire cabled and secured with nylon cable clamps and ties or plastic spiral wraps.
 - 3) Instrument dc signal wiring shall be routed in separate ducts or groups from ac power and control wiring. Signal and control conductors shall be installed in separate conduits than branch circuit equipment power conductors. Transducer coaxial and sensor conductors shall be installed in grounded metal conduits (unless otherwise noted by instrumentation equipment manufacturer) separate from control and power conductors.
 - 4) Equipment and Terminal Block Connections:
 - 5) All connections made with insulated locking spade lug terminals except where devices specified are available only with solder type terminals.
 - 6) Terminals installed with tool as recommended by manufacturer to apply required amount of pressure correctly.
 - 7) Provide terminal blocks for all external connections
- f. Surge Protection: All control panels shall have transient surge protection on all incoming electrical service at rated voltage.
2. Terminal Blocks:
- a. Sectional-type medium-duty blocks for instrument and control circuits.
 - b. 600 Volt sectional type heavy-duty blocks for power circuits above 250 volts ac.
 - c. Tubular screw clamp type contacts.
 - d. Include white marking strip for terminal identification.
 - e. Provide a minimum of 10 percent spare terminals.
 - f. Use for internal and external panel connections.

- g. Buchanan type 525 for 300 Volt blocks and Buchanan type 223 or GE type EB-25 for 600 Volt blocks or approved equal.
3. Panel Fuses:
- a. Fuse clip of similar type construction as terminal blocks.
 - b. Fuse rating as indicated or recommended by manufacturer of equipment being protected.
 - c. Necessary space on panel for a minimum of three future fuse blocks.
 - d. Vinyl handle for disconnecting fuse and removal.
 - e. Mounted on a panel inside control panel in a readily accessible location.
 - f. Buchanan type 352 or equal.
4. Push Buttons and Selector Switches:
- a. Heavy-duty oil tight units with contacts rated 10 amps continuous at 120 volts ac, micro switch type CMC.
 - b. Provide the number of contacts and contact development as indicated.
 - c. "Start" or "ON" push buttons shall have a black operator.
 - d. Stop or Off push buttons shall have a red operator.
5. General-Purpose Control Relays:
- a. Eaton, Schneider Electric, IDEC Type RR, or approved equal.
 - b. Provide with coil voltage as indicated with a neon coil energization indicator on 120-volt ac coils.
 - c. Number of contacts required rated at 10 amps at 120 volts ac.
 - d. Provide plug-in relay with socket.
6. Time Delay Relays:
- a. Agastat SSC Series or equivalent ISSC unit.
 - b. Solid-state timing relay, plug-in type with matching socket.
 - c. Time range and voltage as indicated.
 - d. Contact rating of 10 amps at 120 volts ac.
 - e. Contact action as indicated.
7. Pilot Lights:
- a. Heavy-duty oiltight units, 30.5 mm LED type.
 - b. Full voltage transformer type.
 - c. Color lens as indicated.
 - d. Push to test type.

8. Mounting of Relays and Control Devices:
 - a. Complete accessibility to all terminals, relay sockets, and other devices without dismantling of panel equipment.
 - b. Do not block access to any instruments or control devices mounted on face sheet.
 - c. Installed on swing-out panels if necessary.
 - d. Mount all diodes, resistors and similar equipment between terminal points on terminal blocks.
9. Transient Surge Protection (see Division 260000 for 480V rated equipment)
 - a. 120 VAC, 60 Hz, single phase
 - b. Response time less than one (1) nanosecond
 - c. Temperature Range:
 - 1) -25 C to +70 C operating
 - 2) -40 C to +85 C storage
 - d. Installed after AC line ON/OFF switch and fuse
 - e. EMI/RFI Attenuation:
 - 1) up to 50 dB (Normal mode)
 - 2) Up to 44 dB (Common Mode)
 - f. Protection modes:
 - 1) L-N (Normal Mode – 25,000 Amps)
 - 2) N-G, L-G (Common Mode – 19,500 Amps)
10. Space Heaters
 - a. Protection control panel interior from condensation, corrosion, and low temperatures. Units shall be thermostatically controlled fan-driven heater units to maintain a stable temperature within the enclosure.
 - b. Anodized Aluminum housing.
 - c. Thermostat adjustable from 0 degrees F to 100 degrees F.
 - d. Fan shall draw cool air from bottom of enclosure and pass air across the thermostat and heating elements before being released into enclosure cavity.
 - e. Required in all outdoor, damp, corrosive, and piping/process vault areas.

PART 3 EXECUTION

3.01 SPECIFIC OPERATIONS

A. General

1. Local control panels shall be installed as indicated on construction plans and per these specifications. Control panel fabrication, installation, testing, programming, calibration, start-up and Owner training is Contractor responsibility. Contractor shall determine and delegate control panel responsibilities (based on process equipment specifications and equipment manufacturer's operational requirements) as necessary to insure a complete and operational process system.

2. The control panels' 120V AC control power source shall be as indicated.
3. All control/instrumentation panels and enclosures shall be sized per NEC, NEMA rated as indicated, and wall or/equipment rack mounted w/stainless steel brackets, supports, anchors, and related hardware. Enclosures shall include: TVSS protection; fused or circuit breaker circuit disconnect means; auxiliary receptacles and lighting (interior and external) as indicated; and thermostat controlled space heaters. Operator interface/recording devices shall be mounted on panel interior swing door.
4. Each equipment motor starter unit shall be installed at indicated equipment control panel and/or combination motor starter/disconnect locations. Individual motor starter units shall include:
 - a. Control power and auxiliary circuits as required.
 - b. Control and instrumentation surge protection.
 - c. Equipment/pump HAND/OFF/AUTO (HOA) selector switches with normally opened contact blocks for remote switch position monitoring
 - d. RUN, STOP, FAIL(overload) push to test type pilot lights
 - e. Equipment and/or pump protection modules with SEAL FAIL, and Motor OVERTEMP push to test type pilot lights
 - f. Motor and pump protection system reset push buttons
 - g. Individual equipment run time meters, event counters, and indicator lights shall activate during "True Run" conditions.
 - h. Auxiliary relay dry contacts (RUN, FAIL, and other process status/alarm conditions, as indicated) wired to distribution/termination blocks for remote alarming and monitoring.
5. The pump control float switches and control sections shall include: controller/alternator; intrinsically safe relays; control power ON/OFF switch; wet well HIGH-LEVEL pilot light (if required); and indicated alarming devices.

3.02 INSTALLATION:

- A. As specified in this Division and per manufacturer's installation requirements.
- B. All conduit penetrations shall be from the bottom of enclosure with all field terminations in lower enclosure sections.
- C. Enclosure shall be a wall/rack mounted or free-standing unit. Free standing units shall have the bottom of the interior of panel a minimum of 12 inches above finished floor/concrete pad. Enclosure shall be concrete pad anchored with stainless steel fasteners & anchors.

3.03 FIELD PERFORMANCE TESTS

- A. The equipment installation shall be inspected, tested and placed in operation by a Certified Equipment Manufacturer's Representative. Equipment shall be tested for proper operating conditions following installation, and shall be operated for a suitable period through all control system operational sequences to demonstrate that the units and the control system perform as specified. All tests shall be witnessed by the Engineer. Tests and checks shall include, but not be limited to, the following:
 1. Megger equipment motor stators and power cables/circuits

2. Check power supply voltage to control panel, all motors, and devices before and during equipment operations.
 3. Check motors for proper rotation
 4. Measure motors' operating load and no load currents
 5. Test all solenoid valve operations
 6. Check level & process control operation and sequence and alarming
 7. Check performance of all components as a functioning unit.
 8. Check for equipment and spray systems leaks.
 9. Check vibration and alignment of each unit and make necessary adjustments such that equipment vibration velocity is less than the maximum value set by the Hydraulic Institute Standards.
- B. The contractor shall be responsible for any adjustments and corrective work determined during performance testing as necessary to provide a fully functional equipment package as specified.
- C. Inspection, testing and initial operational checkouts shall be recorded on test reports. The contractor shall submit two (2) copies of the written start-up testing report showing operations performed and results obtained for each unit to the Owner and Engineer for review and approval.

3.04 MANUFACTURER'S FIELD SERVICES

- A. As specified in Division 1, Division 43, Division 46, and as specified herein.
- B. On-site start-up and testing service by a qualified representative of the Supplier shall be furnished from the initiation of process/controls start-up. The representative shall be on site for no less than one (1) day, including travel expenses, and shall have complete knowledge of the proper installation, operation and maintenance of the equipment. All units shall be checked for proper mechanical operation as described above.
- C. A qualified representative of the Supplier shall conduct a one (1) day training seminar for the plant operators and Owner after the control and process system is operational. The training shall include proper operation and maintenance procedures of the entire equipment supplied.
1. Instruction shall be specific to the models of equipment provided and shall include both classroom and field sessions.
 2. All training materials and visual aids to be provided by the equipment manufacturer shall be based on the approved O&M manual.
 3. Provide Owner with required O & M manuals & final test reports as indicated above and in section 1.01 of this specification.

3.05 SPARE PARTS

Provide the following:

Control panel(s) spare indicator pilot light bulbs and control fusing (minimum six (6) each type and size.

END OF SECTION 40 61 13

SECTION 40 91 16

FLOW INSTRUMENTATION

PART 1 GENERAL

1.01 SUMMARY AND DISCRIPTION OF WORK

- A. The extent of the Instrumentation work is indicated on drawings and by provisions of this section. All equipment, installation inspection, calibration, testing, start-up, and Owner training shall be provided by equipment and controls suppliers and installed by Contractor.
- B. Instrumentation work to include, but not limited to, following:
 - 1. Submersible Magnetic Flowmeters to include sending elements, Signal Converter, Remote Transmitter Assembly, mounting brackets, and related hardware.
- C. All similar configuration and mode of operation shall be supplied from one manufacturer

1.02 RELATED DOCUMENTS

- 1. Division 01 - General Requirements.
- 2. Division 11 - Process Control Systems General Requirements.
- 3. Division 26 – Electrical
- 4. Division 40 – Instrumentation testing

1.03 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.5, Pipe Flanges and Flanged Fittings.
 - 2. ASTM International (ASTM):
 - a. A106, Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service.
 - 3. American National Standards Institute (ANSI).
 - 4. Instrument Society of America
 - 5. National Electrical manufacturers Association

1.04 SUBMITTALS

- A. Submittals shall include as a minimum:
 - 1. Panel internal and external layout diagrams.
 - 2. Operational description, logic, and detailed interconnection diagrams.
 - 3. Panel equipment data sheets to include over protection device time current curves.
 - 4. Itemized bill of materials by nomenclature, quantity, part numbers, and description.

5. Interface connection requirements for all external instrumentation and equipment connections.
 6. The panel manufacturer shall indicate its UL follow-up service procedure file number on all submittals.
- B. Equipment operation and maintenance (O&M) manuals shall be provided with each assembly shipped and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.
 - C. Operation and maintenance manuals. Submit operations and maintenance manual and parts list (as outlined in Division 1) for each system component, including "trouble-shooting" maintenance guide. An overall system O&M Manual shall include: equipment supplier and manufacturer's technical support services, point of contact and business information; table of contents; installed equipment & all devices bill of materials; product data sheets; interconnection drawings and shop drawings; final schematics and (as-installed) drawings; incorporate all changes and device settings made during the installation; warranties; factory and field testing reports; and electronic file of any "As-Built" programming device settings; and per requirements of Division 1. Submit one (1) initial electronic copy or hard copy, minimum, for Owner and Engineer acceptance and approval. Upon Owner & Engineer acceptance and approval, submit Two (2) hardcopies bound in 3-ring binder and one (1) electronic copy on "thumb" (USB) drive for final.
 - D. Spare Parts list.
 - E. Equipment warranty, as specified herein.

1.05 SYSTEM DESCRIPTION

- A. The instruments specified in this Specification Section are the primary element components for the control loops shown on the "PID" series Drawings and specified in Divisions 40, 43 and 46.
- B. These instruments are integrated with other control system components specified under Divisions 43 and 46 to produce the functional control defined in the Contract Documents.

PART 2 PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.
- B. Submit request for substitution in accordance with Section 01 25 13.
- C. Propeller Flow Meters
 1. McCrometer
 2. Mueller Systems
 3. Or approved equal
- D. Submersible Magnetic Flow meters
 1. Toshiba
 2. ABB
 3. Foxboro-Siemens
 4. Fischer-Porter

5. Rosemont 8000 series
6. Or approved equal

2.02 GENERAL

- A. Exterior/outdoor mounted instrumentation shall be installed in enclosures with NEMA rating for specific environmental conditions. Installations shall include thermostat controlled space heaters. All instrumentation, enclosures, conduit, and fittings installed within potential high water and flood stage levels shall be water tight installations and submersible (NEMA 6) rated.
- B. Transmitters shall have a dc signal current of 4 mA to 20 mA, into a minimum load range of 0 1000 ohms at 24V dc. All supplied instrumentation shall include required power supplies, surge protection, signal converters, digital indicators, and cabling.
- C. Evenly graduated scales on all indicating and recording receivers.
- D. All panel mounted instruments with bezel colors of manufacturer's standard.
- E. Provide mounting brackets, anchors, and pipe stands as required to install all field mounted instruments. Include any mechanical piping fittings, valve and piping tap materials, isolation valves, tubing, etc. for a complete and operational system. All materials shall be stainless steel.
- F. Signal and float switch installations shall be provided with intrinsically safe relays.
- G. Provide all power supplies, enclosures, & accessories required for complete and working system.
- H. All instrumentation shall be provided with surge protection rated for installed conditions.

2.03 HORIZONTAL TURBINE METERS

- A. Meter shall be manufactured and tested to meet all performance and accuracy standards established in AWWA C701, Class I, for installation in a horizontal configuration.
- B. Size: as indicated on the project plans, ANSI Class 150 flanges
- C. Accuracy:
- D. Maximum working pressure: 175 PSI
- E. Operating temperature range: 33 DEG F to 100 DEG F water temperature
- F. Materials:
 1. Body maincase: bronze or painted steel
 2. Casing bolts: Stainless Steel
 3. Measuring elements: thermoplastic with inlet/outlet straightening vanes.
 4. Rotor thrust bearings: Tungsten carbide
 5. Rotor bearing pivots: stainless steel ANSI B18, rare earth ceramic

6. Register box and lid: bronze or painted steel.

G. Register

1. Permanently sealed magnetic drive with heat-treated glass to eliminate dirt, moisture infiltration, lens fogging, etc.
2. Provide an integral, tamperproof locking mechanism which seals the register to prevent tampering.
3. Totalizing register shall have a straight-reading odometer type display with a 360 degree test circle with a center sweep hand and low flow detector.

2.04 SUBMERSIBLE MAGNETIC FLOW METERING EQUIPMENT

A. Body:

1. Magnetic flow meters shall be of the DC field design and shall produce a flow signal output directly proportional to the liquid velocity.
2. The magnetic flow meters shall use field replaceable 316 stainless steel or zirconium electrodes with specified meter size and EPDM liner.
3. The electronics enclosure shall be NEMA 6P (IEC529 IP67) designed for continuous submergence in water up to 30 feet. Electronic components shall be protected from condensation and corrosion.
4. Unit shall be supplied with a minimum of 300 ft. of manufacturer's required cabling from flow meter to remote signal converter/flow transmitter.
5. Install between 150 Class, ANSI, O.D. and drilling only. Steel raised-face flange drilling to conform to pattern for cast-iron flange ANSI B16.1 or with flanged ends.
6. System accurate within ± 1 percent of full scale through magnetic meter and signal converter over 10:1 range.
7. Operate from 115 volt, 60-Hertz source.
8. Stainless steel grounding rings (if required by manufacturer) on the inlet and outlet and pipe-bonding jumpers as required for proper operation.
9. Minimum one complete set of spare gaskets shall be provided.

B. Signal Converter/Transmitter:

1. This unit shall supply pulsed DC to the magnet coils of the magnetic flow meter.
2. Data entry shall be by means of push-button type keypad input. All configuration information is to be stored in EEPROM memory and shall be secured from loss without the need for battery backup.
3. The signal converter shall include an empty pipe detection circuit, which shall automatically drive the output signals to zero when the electrodes become uncovered.
4. This unit shall be designed for input power supply of 120 VAC.
5. Unit shall include analog 4-20mA output and programmable pulsed output. All cabling shall be provided by manufacturer with minimum 300 ft lengths each.
6. The signal converter shall include a LCD display that shall be programmable to display date, flow rate (gallons per minute), and totalized flow (gallons).
7. Minimum flow range shall be from 0-3,000 gallons per minute.

8. Outdoor rated enclosure, NEMA 4X, thermostat controlled space heating, and wall or rack mounted.
9. Installation/equipment package shall include manufacturer's transmitters enclosure wall bracket.

2.05 ACCESSORIES

- A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.
 1. Materials, unless otherwise specified, shall be as follows:
 - a. Bolts, nuts, washers, expansion anchors: 316 stainless steel.
 - b. Mounting brackets:
 1. Standard: 316 stainless steel.
 2. Highly corrosive areas: Aluminum.
 - c. Mounting plates, angles:
 1. Standard: Carbon steel.
 2. Corrosive areas: Aluminum..
 - d. Instrument pipe stands:
 1. Standard: Hot-dip galvanized 2 IN schedule 40, ASTM A106, Grade B carbon steel.
 2. Corrosive areas: Aluminum.
- B. Provide handheld communicator compatible for all intelligent transmitters furnished:
 1. Hand held communicator shall provide capability to check calibration, change transmitter range, and provide diagnostics.
 2. If these features are provided with the intelligent transmitter that is accessible, the hand held communicator is not required.
- C. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as shown on the Drawings.

PART 3 PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install Instrumentation per manufacturer's instructions. All mounting equipment and materials shall be supplied by manufacturer.
- B. Instrument dc signal wiring shall be routed in separate ducts or groups from ac power and control wiring. Signal and control conductors shall be installed in separate conduits than branch circuit equipment power conductors. Transducer coaxial and sensor conductors shall be installed in grounded metal conduits (unless otherwise noted by instrumentation equipment manufacturer) separate from control and power conductors.
- C. Instrument Valves:
 1. Orient stems for proper operation.
 2. Install arrays orderly and neat in appearance with true horizontal and vertical lines.

3. Provide a minimum of 2 IN clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.
 4. Valves shall have bonnets and any soft seals removed during welding or soldering into the line. When cool, reassemble the valves.
 5. Support each valve individually.
 6. The tubing system does not qualify as support for the valve. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment. Keep foreign matter out of the system. Remove all oil on piping and tubing with solvent before piping and tubing installation. Plug all open ends and connections to keep out contaminants:
- D. Threaded Connection Seals: Use Tite-Seal or acceptable alternate. Use of lead base pipe dope or Teflon tape is not acceptable. Do not apply Tite-Seal to tubing threads of compression fittings.
- E. Instrument Mounting: Mount all instruments where they will be accessible from fixed ladders, platforms, or grade. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight. Mount instruments level, plumb, and support rigidly. Mount to provide: Protect from heat, shock, and vibrations, maintenance and interference with piping, conduit and equipment.

3.02 FIELD QUALITY CONTROL

- A. Manufacturers Field Services:
1. Contractor and Manufacturer shall be responsible for all final field installation setting, adjustments, and calibration for complete and operational system. Contractor shall be responsible for all costs related to system programming, calibration, testing, startup, and Owner training.
 2. A qualified manufacturer representative shall schedule a minimum of two (2) separate four (4) hour day visits for installation, programming, calibration, adjustments, testing, startup, and Owner training.
 3. Owner training shall be executed after final process demonstration and acceptance by Owner. Training shall be scheduled on separate date than that of any testing, startup, and calibrations. Submit written request for scheduling training to Owner and Engineer a minimum of 2 weeks in advance.
 4. In addition to the above, provide as specified in Division 1 and this Division.
- B. Field Testing:
1. Provide as specified in Division 26 and this Division 40.
 2. Submit final test reports (minimum of two copies) to include all system parameters and programming set points/settings. Submit as indicated above in PART 1 and per Division

END OF SECTION

SECTION 40 91 19

PRESSURE INSTRUMENTATION

PART 1 GENERAL

1.01 SUMMARY AND DISCRIPTION OF WORK

- A. The extent of the Instrumentation work is indicated on drawings and by provisions of this section. All equipment, installation inspection, calibration, testing, start-up, and Owner training shall be provided by equipment and controls suppliers and installed by Contractor.
- B. Instrumentation work to include, but not limited to, following:
 - 1. Pressure switch, mounting brackets, and related hardware.
- C. All similar configuration and mode of operation shall be supplied from one manufacturer

1.02 RELATED DOCUMENTS

- 1. Division 01 - General Requirements.
- 2. Division 11 - Process Control Systems General Requirements.
- 3. Division 26 – Electrical
- 4. Division 40 – Instrumentation testing

1.03 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.5, Pipe Flanges and Flanged Fittings.
 - 2. ASTM International (ASTM):
 - a. A106, Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service.
 - 3. American National Standards Institute (ANSI).
 - 4. Instrument Society of America
 - 5. National Electrical manufacturers Association

1.04 SUBMITTALS

- A. Submittals shall include as a minimum:
 - 1. Panel internal and external layout diagrams.
 - 2. Operational description, logic, and detailed interconnection diagrams.
 - 3. Panel equipment data sheets to include over protection device time current curves.
 - 4. Itemized bill of materials by nomenclature, quantity, part numbers, and description.

5. Interface connection requirements for all external instrumentation and equipment connections.
 6. The panel manufacturer shall indicate its UL follow-up service procedure file number on all submittals.
- B. Equipment operation and maintenance (O&M) manuals shall be provided with each assembly shipped and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.
 - C. Operation and maintenance manuals. Submit operations and maintenance manual and parts list (as outlined in Division 1) for each system component, including "trouble-shooting" maintenance guide. An overall system O&M Manual shall include: equipment supplier and manufacturer's technical support services, point of contact and business information; table of contents; installed equipment & all devices bill of materials; product data sheets; interconnection drawings and shop drawings; final schematics and (as-installed) drawings; incorporate all changes and device settings made during the installation; warranties; factory and field testing reports; and electronic file of any "As-Built" programming device settings; and per requirements of Division 1. Submit one (1) initial electronic copy or hard copy, minimum, for Owner and Engineer acceptance and approval. Upon Owner & Engineer acceptance and approval, submit Two (2) hardcopies bound in 3-ring binder and one (1) electronic copy on "thumb" (USB) drive for final.
 - D. Spare Parts list.
 - E. Equipment warranty, as specified herein.

1.05 SYSTEM DESCRIPTION

- A. The instruments specified in this Specification Section are the primary element components for the control loops shown on the "PID" series Drawings and specified in Divisions 40, 43 and 46.
- B. These instruments are integrated with other control system components specified under Division 43 and Division 46 to produce the functional control defined in the Contract Documents.

PART 2 PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.
- B. Submit request for substitution in accordance with Section 01 25 13.
- C. Pressure switch
 1. Allen-Bradley
 2. Emerson/ASCO
 3. Or approved equal

2.02 GENERAL

- A. Exterior/outdoor mounted instrumentation shall be installed in enclosures with NEMA rating for specific environmental conditions. Installations shall include thermostat controlled space heaters. All instrumentation, enclosures, conduit, and fittings installed within potential high water and flood stage levels shall be water tight installations and submersible (NEMA 6)

rated.

- B. Transmitters shall have a dc signal current of 4 mA to 20 mA, into a minimum load range of 0 1000 ohms at 24V dc. All supplied instrumentation shall include required power supplies, surge protection, signal converters, digital indicators, and cabling.
- C. Evenly graduated scales on all indicating and recording receivers.
- D. All panel mounted instruments with bezel colors of manufacturer's standard.
- E. Provide mounting brackets, anchors, and pipe stands as required to install all field mounted instruments. Include any mechanical piping fittings, valve and piping tap materials, isolation valves, tubing, etc. for a complete and operational system. All materials shall be stainless steel.
- F. Provide all power supplies, enclosures, & accessories required for complete and working system.
- G. All instrumentation shall be provided with surge protection rated for installed conditions.

2.03 PRESSURE SENSOR/SWITCH

- A. Pressure sensor shall be wafer type, designed to fit between standard ANSi B16.1 Class 125/ANSI B16.5 Class 150 pipe flanges. Face-to-face of the entire sensor shall be no longer than specification MSS-SP67 configuration.
- B. Sensor shall be flow through design with flexible elastomer sensing ring around the full circumference. The elastomer sensing ring shall be rigidly clamped between metal end cover flanges, and no part of the elastomeric sensing ring shall be exposed to the external face of the sensor. There shall be no dead ends or crevices, and flow passage shall make the sensor self-cleaning.
- C. The pressure-sensing ring shall measure pressure for 360° around the full inside circumference of the pipeline. Flexible sensing ring shall have a cavity behind the ring filled with fluid to transfer pressure to the gauge.
- D. Line pressure pushes against an elastomer ring inside the sensor. The deflection of the ring displaces a fluid fill inside the body of the sensor, forcing the fluid into a pressure-measuring device
- E. Accuracy: +/- 1 PCT of full scale.
- F. Provide ethylene glycol for the fluid fill in the pressure sensing ring cavity.
- G. Provide pressure gage, 0-10 psi; pressure switch and appurtenant hardware including fittings and isolation valves for a complete and operable system:
 - 1. Ametek/USauge, Ashcroft, or approved equal
 - 2. Materials:
 - a. Bourdon tube, socket, connecting tube: 316 Stainless steel
 - b. Case: Phenolic
 - c. Pressure snubber:
 - 1. Filter Disc: 316 Stainless Steel

- 2. Housing: 316 Stainless Steel
- d. Accessories:
 - 1. Utilize pressure snubber with porous metal discs to provide pulsation dampening on gauge applications.
- 3. Accuracy: +/-1 PCT of full scale
- H. Provide ball valve to isolate pressure switch from source.
- I. Provide pressure snubber with porous metal discs to provide pulsation damping on the pressure switch.
- J. Function of the pressure sensor is to activate/deactivate the well pump to maintain distribution system pressure at appropriate set point.

2.04 ACCESSORIES

- A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.
 - 1. Materials, unless otherwise specified, shall be as follows:
 - a. Bolts, nuts, washers, expansion anchors: 316 stainless steel.
 - b. Mounting brackets:
 - 1. Standard: 316 stainless steel.
 - 2. Highly corrosive areas: Aluminum.
 - c. Mounting plates, angles:
 - 1. Standard: Carbon steel.
 - 2. Corrosive areas: Aluminum..
 - d. Instrument pipe stands:
 - 1. Standard: Hot-dip galvanized 2 IN schedule 40, ASTM A106, Grade B carbon steel.
 - 2. Corrosive areas: Aluminum.
- B. Provide handheld communicator compatible for all intelligent transmitters furnished:
 - 1. Hand held communicator shall provide capability to check calibration, change transmitter range, and provide diagnostics.
 - 2. If these features are provided with the intelligent transmitter that is accessible, the hand held communicator is not required.
- C. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as shown on the Drawings.

PART 3 PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install Instrumentation per manufacturer's instructions. All mounting equipment and materials shall be supplied by manufacturer.

- B. Instrument dc signal wiring shall be routed in separate ducts or groups from ac power and control wiring. Signal and control conductors shall be installed in separate conduits than branch circuit equipment power conductors. Transducer coaxial and sensor conductors shall be installed in grounded metal conduits (unless otherwise noted by instrumentation equipment manufacturer) separate from control and power conductors.
- C. Instrument Valves:
 - 1. Orient stems for proper operation.
 - 2. Install arrays orderly and neat in appearance with true horizontal and vertical lines.
 - 3. Provide a minimum of 2 IN clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.
 - 4. Valves shall have bonnets and any soft seals removed during welding or soldering into the line. When cool, reassemble the valves.
 - 5. Support each valve individually.
 - 6. The tubing system does not qualify as support for the valve. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment. Keep foreign matter out of the system. Remove all oil on piping and tubing with solvent before piping and tubing installation. Plug all open ends and connections to keep out contaminants:
- D. Threaded Connection Seals: Use Tite-Seal or acceptable alternate. Use of lead base pipe dope or Teflon tape is not acceptable. Do not apply Tite-Seal to tubing threads of compression fittings.
- E. Instrument Mounting: Mount all instruments where they will be accessible from fixed ladders, platforms, or grade. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight. Mount instruments level, plumb, and support rigidly. Mount to provide: Protect from heat, shock, and vibrations, maintenance and interference with piping, conduit and equipment.

3.02 FIELD QUALITY CONTROL

- A. Manufacturers Field Services:
 - 1. Contractor and Manufacturer shall be responsible for all final field installation setting, adjustments, and calibration for complete and operational system. Contractor shall be responsible for all costs related to system programming, calibration, testing, startup, and Owner training.
 - 2. A qualified manufacturer representative shall schedule a minimum of two (2) separate four (4) hour day visits for installation, programming, calibration, adjustments, testing, startup, and Owner training.
 - 3. Owner training shall be executed after final process demonstration and acceptance by Owner. Training shall be scheduled on separate date than that of any testing, startup, and calibrations. Submit written request for scheduling training to Owner and Engineer a minimum of 2 weeks in advance.
 - 4. In addition to the above, provide as specified in Division 1 and this Division.
- B. Field Testing:
 - 1. Provide as specified in Division 26 and this Division 40.
 - 2. Submit final test reports (minimum of two copies) to include all system parameters and programming set points/settings. Submit as indicated above in PART 1 and per Division

END OF SECTION

SECTION 43 25 16

CHEMICAL FEED EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. The contractor shall design, fabricate, deliver to the site, start-up and warranty of chemical metering skids for chemical feed to groundwater. Each chemical metering skid shall be shipped as a prefabricated, preassembled unit composed of, but not limited to, the following discrete components:
1. Mounting skid and back panel
 2. Chemical metering pumps
 3. Calibration column
 4. Y-strainer
 5. Pressure relief valve.
 6. Pulsation damper.
 7. Diaphragm seal pressure gauge and switch.
 8. Vacuum breaker assembly.
 9. Flushing inlet/outlet
 10. Check valves.
 11. Piping shall include vented isolation ball valves and unions for all serviceable components.
 12. The discharge piping shall allow for each pump to serve individual loads or a common load with backup.
 13. NEMA 4X stainless steel terminal box and local control panel.
- B. Final system control (HAND, AUTO, LOCAL) operational requirements shall be determined (based on available operating alternatives, scenarios, set points, speed adjustments, operator input, and configurations) during an Operations Controls Workshop with the Owner, Engineer, Contractor, selected equipment supplier, and the suppliers controls system designer. The Operations Controls Workshop shall be conducted after contract has been awarded to the successful bidder and after the submittal/shop drawing process has yielded an "Approved as Noted" submittal package. Workshop shall be based on actual pump equipment and control system selected for this installation.

1.02 QUALITY ASSURANCE

- A. All pumps and tubing to be the product of one manufacturer. The manufacturer shall supply fifteen (10) separate references with contact names and phone numbers, where substantially similar installations for the equipment as specified has been in satisfactory operation for a minimum of two (2) years.

- B. System supplier shall have a local authorized service center in their territory to provide service and support to the package system. The service center shall have and maintain factory-authorized service technicians for installation, maintenance and repair as necessary and specified.

1.03 COMPLIANCE SUBMITTALS

- A. Submit in accordance with Division 1.
- B. Documentation of all materials and equipment required to establish compliance with these specifications shall be submitted by the equipment manufacturer for Engineer review and acceptance prior to the commencement of fabrication. Submittal shall include, but not be limited to the following:
 - 1. A complete and thorough description of the equipment provided to permit a comparison with the specification.
 - 2. A certification indicating compliance with project plans and specifications or complete list of all deviations
 - 3. Certified shop drawings showing all important details and materials of construction, dimensions, loads on supporting structures, anchor bolt locations, installation requirements, fabrication and erection, etc.
 - 4. Manufacturer's specifications.
 - 5. Descriptive literature, bulletins, and/or catalogs of equipment.
 - 6. Motors:
 - Name of manufacturer.
 - Type and model.
 - Type of bearings and lubrication.
 - Bearing Life Data
 - Rated size of motor hp.
 - Temperature rating.
 - Full load rotative speed.
 - Efficiency at full, $\frac{3}{4}$, and $\frac{1}{2}$ load.
 - Full load current.
 - Locked rotor current.
 - NEMA Code rating
 - Weight.
 - Enclosure type.
 - Frame size.
 - Winding insulation class.
 - 7. Control Panel and components.
 - Submittals, as outlined above, will be required for the following:
 - Detailed control system operational description. Include: operator interface procedures; emergency procedures; and system troubleshooting.
 - Bill materials
 - Panel, electrical, control, and instrumentation weights and dimensions.
 - Complete panel components and devices bill-of-materials listing, type, model, ratings, and specifications data sheets, to include catalog numbers and part numbers.
 - Components and device manufacturer, type, model, ratings, and

specifications.

Field sensors

Transmitters

Level switches

Power supplies including UPS/backup battery systems

Surge protection equipment

Enclosure interior and exterior layout drawings

Enclosures space heating and ventilating equipment and controls.

Enclosures heating and ventilation sizing calculations as/if required by equipment manufacturer, for this equipment and system to be mounted outdoors in continuous direct sunlight.

Motor starters and drive units

Overcurrent and instantaneous protection devices

Controls components

Operator interface units

Motor winding heater components, branch circuits, and controls.

Wiring diagrams (on 11"x17" sheets)

Loop diagrams (on 11"x17" sheets)

Instrumentation

Complete panel components and devices bill-of-materials listing.

All panel & field devices, components and device Manufacturer, type, model, ratings, and specifications data sheets, to include specific catalog numbers and part numbers.

Submit control cabinet(s) layout drawings showing accurately scaled equipment sections, including, but not limited to: controllers, device panels, and circuit breakers. Show spatial relationships of components to proximate electrical equipment. Clearly differentiate on wiring diagrams those conductors, which are factory installed and those which are field installed.

Time-Current Curves (TCCs) for all panel installed fusing, circuit breakers, motor protectors, and motor overload relays.

Overcurrent characteristics, time-current curves, and details of motor control.

8. Shop painting systems, including manufacturer's descriptive technical catalog literature and specifications.
9. External utility requirements for air, water, power, drain, etc., as applicable for each component.
10. List of spare parts to be furnished to Owner after equipment operational acceptance and predicted life of parts subject to wear.
11. Training course outlines.
12. Testing data and reports to show full compliance with these Specifications.
13. Process warranty and/or guarantee based on Specifications contained herein.
14. Reports and certifications:
 - a. Testing data and reports to show full compliance with these Specifications.
 - b. Written factory test report of inspection.
 - c. Manufacturer's Certificate of Compliance of factory-applied coating system.
 - d. Manufacturer's Certificate of Proper Installation.

- e. Field functional test reports.
 - f. UL LLC (UL) Certification.
15. Statements on Qualification:
 - a. Installation list demonstrating compliance with required manufacturer's qualifications.
 - b. List of field service capabilities, service facility locations, contact information and after-hours availability.
 16. Special shipping, storage and protection, and handling instructions.
 17. Manufacturer's installation instructions. Installation manuals shall incorporate instructions for off-loading, storage, assembly, installation, maintenance and operation of the system and all its components. Installation data/instructions/drawings to include, but not limited to: Equipment/material mounting, alignment, anchoring, attachments, accessories, wiring diagrams, connections, electrical power and control terminations diagrams, and programming/system setup.
 18. Operation and Maintenance Manual (minimum three (3) bound hardcopy sets and one (1) electronic copy on USB drive), in conformance to Division 1 Specifications. Include the following data:

System Supplier and integrator points of contact and business information.
 Table of contents.
 Product data sheets.
 Alignment, adjustment and repair instructions.
 Manufacture's installation and operational instructions.
 System initial startup/programming set points and timing delay settings based on specific equipment installation and operational requirements.
 Assembly diagrams, interconnection drawings and Shop Drawings.
 Guide to troubleshooting.
 Lubrication instructions.
 Recommended spare parts lists and predicted life of parts subject to wear.
 Final start-up, testing, and commissioning test reports after Owner acceptance.

Per minimum requirements of Division 1, provide: One (1) electronic copy of hardcopy, minimum, for Owner and Engineer review and approval; two (2) bound hardcopies and one electronic copy on USB drive for final. A waterproof reduced copy of the mast "As-Built" control panel diagram shall be laminated in clear plastic and permanently fastened to the inside of the control panel door.

Operations and Maintenance Manual shall also include an electronic file of "As-Built/As-Initially Programmed" programming ladder logic; and per requirements of Division 1, one (1) electronic copy or hard copy, minimum, for Owner and Engineer Acceptance and approval

1.04 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Ship the complete skid package, including the pump, drive, piping, valves and accessories, assembled complete. Ship tubing elements separately for field installation and process line connection by Contractor.

2. Pack all additional spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
 3. Deliver spare parts at the same time as pertaining equipment. Deliver to Owner after completion of work.
- B. Receiving:
1. Contractor to inspect and inventory items upon delivery to site.
 2. Contractor to store and safeguard equipment, material, instructions, and spare parts in accordance with manufacturer's written instructions.

1.05 WARRANTY

- A. The equipment furnished under this Section shall be free of defects in materials and workmanship for a period of twelve (12) months from start-up and delivery of a complete operations and maintenance manual, as specified in Division 1, or eighteen (18) months from the delivery of the equipment to the site.
- B. Drive and pumpheads shall have a two (2) year manufacturer's warranty from date of shipment.

1.06 SERVICE CONDITIONS

- A. Chemical Name: Sodium Hypochlorite
1. Physical State: Liquid Solution
 2. Concentration: 5.25 percent
 3. Specific Gravity: 1.10
 4. Maximum Temperature: 110 degrees Fahrenheit

PART 2 - PRODUCTS

2.01 GENERAL

- A. All equipment specified under this section shall be furnished by an equipment supplier who shall be responsible for the adequacy and compatibility of all components. All components shall be designed, fabricated, tested and installed by factory-authorized representatives experienced in the design, manufacture and installation of said equipment.
- B. The arrangement shown on the drawings is based on best information available to the Engineer at the time of design and is not intended to show exact dimensions particular to any specific equipment, unless otherwise noted or shown. Therefore, it may be anticipated that structural supports, process piping, valving, process equipment configurations, etc., shown in part or in whole, may be changed to accommodate equipment furnished.
- C. The chemical feed equipment package shall be designed for installation in a concrete masonry unit building having a controlled environment. The equipment shall be appropriately designed for operation in the full range of anticipated environmental conditions.

2.02 ACCEPTABLE MANUFACTURERS

- A. Chemical Feed Pumps
1. Prominent
 2. Verder Ltd.

3. Watson-Marlow, Inc.
4. Approved equal.

2.03 CHEMICAL METERING SKIDS

- A. The chemical metering skid shall be completely self-contained and designed to safely feed metered amounts of all chemicals as specified herein. Each chemical metering skid shall include chemical metering pumps, accessories, controls and as indicated in the Process Pump Schedule listed in Subsection 2.04. All equipment shall be of materials selected specifically for use with all chemicals listed in Subsection 1.06 – Service Conditions.
- B. Pumps shall be positive displacement peristaltic type complete with spring-loaded pumphead, self-contained variable speed drive, and flexible extruded tube element, and fittings as specified.
- C. Pumps shall be supplied mounted on skids, complete with all necessary process piping, valves and accessories necessary for proper operation after direct connection to chlorine feed supply line and discharge lines.
- D. The chemical metering skids shall be constructed with white CPVC or HDPE sheet with a minimum trade thickness of 0.50-inches. The design of the skid shall include gussets and supports as required for all components and shall be self-supporting. All components of the chemical metering system shall be contained within the footprint of the skid. The skids shall be manufactured utilizing a continuous welding technology. Bolted construction is not acceptable. Two (2) pedestals shall be provided to elevate the metering pumps above the skid base. The skid should have approximate length and width dimensions of 3-ft by 2-ft, respectively. Skid shall be designed to accommodate mounting on either the floor or wall.
- E. Assembly of all piping shall be performed in a controlled shop environment by the skid manufacturer. All pipe shall be squarely cut on precision equipment and the ends chamfered and deburred. All socket welded connections shall follow the guidelines set by the pipe/fitting manufacturer for proper cleaning, priming and gluing procedures. A heavy bodied solvent, suitable for use with all chemicals as listed in the subsection 1.06 – Service Conditions, shall be used. All threaded connections will utilize Teflon tape, a suitable thread sealant or a combination of both. Threaded connections shall utilize stainless steel reinforcement rings where applicable to reduce the risk of cracking.
- F. The piping shall be attached to the chemical metering skid with a non-metallic corrosion resistant support system. All support channel shall be welded to the chemical metering skid. Bolted or screwed connections are not acceptable. All support straps shall be removable and reusable to allow for servicing of the system. All inlet and outlet connections, valves and pump accessories shall be clearly labeled on the skid.
- G. The chemical metering skids shall be completely assembled and tested by the manufacturer prior to delivery to the job site. Each skid shall include Hastelloy C-276 mounting brackets.
- H. Chemical Metering Skid Accessories
 1. Calibration Columns
 - a. A clear calibration column shall be provided in the chemical supply piping of each system. The piping shall be designed for the calibration column to be used with any of the metering pumps. The top of the calibration column shall provide for connection of rigid piping for “vent” return to chemical storage tank. Calibration columns shall be used as degassing chambers. All materials shall be compatible with chemicals as listed Subsection 1.06 – Service Conditions.
 2. Pressure Relief Valves

- a. Pressure relief valves shall be provided in the discharge piping of each metering pump, prior to any valves, to eliminate the buildup of excess pressure in the system. The pressure relief valves shall be fully adjustable, from 0 to 60-psi, with bodies compatible with the chemicals as listed in subsection 1.06 – Service Conditions. The pressure relief valves shall have Teflon diaphragms and have no metal parts in contact with the chemical. Output of the pressure relief valves shall return to the chemical storage tank.
3. Pulsation Dampers
 - a. Gas charged pulsation dampers shall be provided and sized for a minimum of 90 percent dampening. Pulsation dampers shall include gas charged fittings and a pressure gauge. The dampers shall be installed in the discharge piping of each metering pump, as close to the metering pump discharge as possible. All materials shall be compatible with the chemicals listed in Subsection 1.06 – Service Conditions.
 4. Diaphragm Protected Pressure Gauges
 - a. Pressure gauges shall be 2-inch, liquid filled gauges with isolators. Pressure gauges shall provide for the indication of system pressure in the discharge piping of each metering pump. Industrial quality, Type 316 Stainless Steel gauges shall be utilized. The isolators shall have housings compatible with the chemicals as listed in Subsection 1.06 – Service Conditions, with a Teflon diaphragm and suitable liquid fill.
 5. Back Pressure Valves
 - a. Back pressure valves shall be provided in the discharge piping of each metering pump to provide a constant back pressure at the chemical metering pump discharge. The back pressure valves shall be fully adjustable from 0 to 60-psi, with bodies compatible with chemicals as listed in Subsection 1.06 – Service Conditions, and Teflon diaphragm. No metal parts shall be in contact with the chemicals.

2.04 PROCESS PUMP SCHEDULE

A. Sodium Hypochlorite

Quantity	1 (*)
Capacity	
Max, gph	0.14
Min, gph	0.00
Max. Pump Speed	220 RPM
Max. Discharge Pressure (PSI)	30.0 PSI
Tubing Element	1/16 IN bore x 1/16 IN wall thickness (MIN)
Tubing Material	Marprene, Norprene, Viton, or approved equal
Fittings	1/4 IN Male Cam & Groove Fittings, polypropylene
Power (VAC, Frequency, Phase)	115VAC, 60Hz, 1 Phase

(*) Provide one firm pump now; one standby pump to be installed in the future.

2.05 PERSTALTIC PUMP CONSTRUCTION

A. General:

1. Peristaltic pumping action is created by the compression of the flexible tube between the pumphead rollers and track, induced forward fluid displacement within the tube by the rotation of the pump rotor, and subsequent vacuum-creating restitution of the tube.
2. Pumps shall be dry self-priming, capable of being run dry without damaging effects to the pump or tube, and shall have a maximum suction lift capability of up to 30' vertical water column. Max pressure rating: 30 psi.
3. Pump shall use no check valves or diaphragms and shall require no dynamic seals in contact with the pumpage. Process fluid shall be contained within pump tubing and shall not directly contact any rotary or metallic components.
4. Flow shall be in the direction of the rotor rotation, which can be reversed and shall be proportional to rotor speed.
5. Pump shall be capable of operating dry for 30 minutes without damage to any component.
6. Pump shall have a repeatable accuracy of 1.0% of the maximum output (MIN).
7. Pump shall have a nameplate showing the chemical, capacity in GPH and pressure rating in PSI
8. Pump shall be UL listed for chemical use.
9. Pump shall be designed to prevent backflow.

B. Pumphead:

1. Pumphead shall consist of a spring-loaded track/pumphead cover with safety interlock, element-type tube retainer mechanism, and gear driven roller rotor assembly. The safety interlock shall render the drive inoperable when the pump cover is open.
2. Rotor assembly shall be equipped with four geared self-lubricating compression rollers drive by a 4:1 reduction planetary gear reducer. Compression rollers shall be located 90 DEG apart for compression of the tube against the track four times per revolution. One roller shall at all times be fully engaged with the tubing providing complete compression to prevent backflow or siphoning. Hose occlusion shall be adjustable by the adjustment of two hex head nuts with springs to set the force with which the cover compresses the tubing. Hex nuts shall be fitted with setscrews to limit compression and shall come factory-set to accommodate 1/16 IN wall thickness tubing.
3. The rotor assembly shall be mounted on roller bearings to a drive shaft supported between roller bearings mounted in the pump housing. The assembly will engage the drive shaft by means of gear which shall directly drive each roller independently. The drive shaft shall engage the drive motor through a timing bolt and pulley system. The pumphead shall be secured to the drive via four Allen head screws and be self-locating.
4. Material of Construction:
 - a. Track: Polyamide 6/Nylon 6 or glass fiber impregnated polyphenylene sulfide.
 - b. Rotor: stainless steel, Nylatron or glass fiber impregnated polyphenylene sulfide roller.

C. Tubing:

1. Pump shall be supplied with tubing element with molded fittings which shall be self-locating when fitted into the pumphead. Tube element shall be in contact with the

inside diameter of the track (housing) through an angle of 90 degrees and be held in place on the suction and discharge by the element fittings. The tubing shall be replaceable with no disassembly of the pumphead.

2. Material of Construction: provide tubing elements comprised of materials listed in 2.04 herein. Tubing shall have a minimum 64 Shore A durometer. If required for chemical compatibility, pump manufacturer shall recommend an alternate tubing material.
3. Molded Fittings: Polypropylene, 3/8" male cam and groove.
4. Supply four (4) tube elements of the specified size per pump.
5. Supply four (4), 1.25 meter reinforced transparent PVC flexible hose for connection of pump to suction and discharge process lines to metering skid process piping. Flexible hose shall have a polypropylene female cam and groove fitting for mounting to pump and 3/8" male cam and groove fitting for mounting to process piping.

D. Drive:

1. Rating: Continuous 24-hour operation, 40° C ambient.
2. Supply: 1 10-120V 50/60 Hz and 220-240V 50/60 Hz, 1-phase field switchable. Supply six-foot-length mains power cord with standard 120V three-prong plug. Max drive power consumption: 200VA.
3. Enclosure: TENV with IP66 / NEMA 4X ingress protection rating.
4. Housing: Pressure cast aluminum polyester powder coat, glass fiber impregnated polyphenylene ether or approved equal.
5. Hardware: Stainless steel.
6. Operator membrane keypad:
 - a. Increase/Decrease Speed.
 - b. Forward/Reverse.
 - c. Non-maintained rapid prime.
 - d. Start/Stop.
 - e. Auto/Manual selector.
 - f. Programmable keypad disable to prevent changes from incidental contact.
 - g. Programmable automatic restarting for resumed pumping after recovery from power interruption.
 - h. Two-position On/Off switch.
 - i. LED display of RPM.
7. Remote Features:
 - a. Analog input of 0-32mA or 0-30VDC for speed control in Auto mode. Signal response may be scaled over any part of the drive speed range. Contractor to ensure analog signals being sent to the pump for automatic speed control from other devices are isolated signals.
 - b. Dry contact closure or TTL input for remote start/stop – functional in both the Auto and Manual modes.
 - c. Contact closure or TTL input for forward/reverse keypad override.

- d. Provisions for accessory potentiometer for remote speed control.
 - e. TTL output run status.
 - f. Tachometer output selectable as either 0-5VDC analog or 5V square wave frequency output.
8. Drive motor shall be permanent magnet DC with integral gearbox. Circuitry shall be microprocessor controlled PWM type with closed loop speed control. Drive speed shall be infinitely variable between 0.1 and 220 rpm (1000:1 turndown, MIN).
 9. Mounting: Drive shall be self-supporting and shall not require anchoring.

2.06 PIPING

A. Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC)

1. All fittings and pipe shall be heavy duty, Schedule 80 PVC or CPVC. All fittings shall be injection molded, with PVC having a cell classification of 12454-B and CPVC having a cell classification of 23447-B, as indicated in ASTM D-1784 – Standard Specification for Rigid Poly (Vinylchloride) Compounds and Chlorinated Poly (Vinylchloride) Compounds.
2. All pipe and fittings for potable water supply shall be listed for such applications by the National Sanitation Foundation Laboratories, Inc. (NSF).
3. All molded threads, internal or external shall be “blunt-start” threads. All threads shall conform to the thread standard ANSI/ASME B1.20.1 for tapered pipe threads. Threads shall measure not more than 1 1/2 threads large or small when checked with a plug gauge or ring gauge.
4. Dimensions and tolerances of sockets shall conform to PVC IPS Schedule 40/80 socket dimensions. All reducer bushing shall be designed so as to provide for a positive and sufficient grip for cementing bushings in place. Waterways shall be smooth and commercially free of flash and irregularities. On tees and 90 degree bends, bond lines shall not coincide with the maximum stress area (crotch).
5. All pipe shall be squarely cut on precision equipment and the ends chamfered and deburred. All socket welded connections shall follow the guidelines set by the pipe/fitting manufacturer for proper cleaning, priming and gluing procedures. A heavy bodied solvent, suitable for use with all chemicals as listed in the subsection 1.06 – Design Summary, shall be used. All threaded connections will utilize Teflon tape, a suitable thread sealant or a combination of both. Threaded connections shall utilize stainless steel reinforcement rings where applicable to reduce the risk of cracking.
6. All piping shall be clearly identified and labeled per Specifications Section 331300.

2.07 VALVES

A. Ball Valves

1. Ball Valves, Sizes 0.5-inches to 4-inches, shall be of true union design, with two-way blocking capability. All o-rings shall be EPDM or FKM with PTFE seats. PTFE seats shall have an elastomeric backing cushion of the same material as the valve seals. The stem shall have double O-rings and be of blowout-proof design. The valve handle shall double as carrier removal and tightening tool. ISO mounting pad shall be integrally molded to the valve body for actuation. The ball valves shall have a pressure rating of 230-psi for sized 0.5-inches to 3-inches and 150-psi for 4-inches, at 70 degrees Fahrenheit. Ball Valves must carry a two year warranty. All valves for hypochlorite service must be vented.

2.08 INJECTION QUILL

- A. Provide a high corrosion resistance retractable injection quill with integral 1 IN ball valve, 1 IN check valve, and 1/2 IN solution tube with elastomeric (EPDM or FKM) duckbill tip for sodium hypochlorite chemical application. Valve body shall be comprised of CPVC or Brass. O-rings and seats shall be EPDM or FKM. Solution tube material shall be CPVC. Quill insertion length shall be 10 IN. Assembly shall be rated for 100 psi working pressure.

2.09 ELECTRICAL DEVICES AND CONTROLS

- A. All electrical power, devices and control enclosures, shall be mounted within the Chemical Feed Building in such a manner to allow ease of operator access. All necessary electrical wiring for power supply and control of chemical feed equipment shall be supplied and installed by the contractor. All electrical materials and installations shall meet the requirements of the current edition of the National Electric Code (NEC) and any local ordinances.
 - 1. A 25-point NEMA 4X terminal box shall be provided for each pump on the skid back panel for termination of all wiring. The inside cover of the terminal box shall include a wiring diagram detailing the function of all terminals. The contractor shall supply shielded signal wiring for wiring of the required remote input and output to the terminal box.
 - 2. A simplex outlet with a weatherproof cover shall be provided for each metering pump (firm, standby and future pumps).
- B. Local electrical service nominal rating shall be 120V, 1 PH, 60 Hz
- C. Sequence of operation:
 - 1. Sodium Hypochlorite Chemical Feed.
 - a. When REMOTE mode is selected by the Operator: Chemical feed pump shall be interlocked with the well pump. It shall actuate and dose chemical at the volumetric flowrate necessary to achieve Operator selected chemical concentration in the pump discharge. Initial chemical concentration set-point shall be 2.0 mg L⁻¹:
 - b. When LOCAL mode is selected by the Operator, the chemical feed pump operations shall be controlled at the keypad/operator terminal located on the chemical feed pump.
 - c. When a Pump Fail, Pump Leak, or High Discharge Pressure condition are observed for the chemical feed pump, the pump shall be shutdown, a local alarm shall be initiated. A manual reset function shall be required to return the chemical feed pump to an operating condition.
 - d. Presence of fluid in the chemical feed skid containment pan shall initiate a local alarm.
 - e. The presence of a Low Chemical Storage Tank Level and a High Chemical Storage Tank Level shall be indicated locally, cause a local alarm to initiate.
- D. Control Functions
 - 1. Provide local keypad on NEMA 4X rated enclosure. Keypad shall provide the following Operator control functions, feedback, inputs/outputs, etc.
 - a. Operator Control Functions:

Control Power ON/OFF

Pump Motor	LOCAL / OFF / REMOTE
Pump Motor - LOCAL	START/STOP
Pump FAIL	RESET
Pump Speed	0 to 100%

- b. Control Panel Indication - Push-to-test indicator lights shall be provided on the inner swing panel of the enclosure. At a minimum, provide the following indicators:

Pump Run	GREEN
Pump Leakage	RED
Pump FAIL	RED
High Discharge Pressure	RED
Flow Present	GREEN

- c. Control Panel Indication – Analog indication. At a minimum, provide the following indicators:

Pump Speed, 0 to 100%

- d. Interface Requirements:

- 1) Inputs – provide the following analog (4 to 20 mA) inputs for process control.
- 2) Inputs – provide the following discrete inputs (i.e. contact closure) for process control

- e. Outputs (discrete contact closure for remote status and alarm monitoring).

Pump Fail

- f. Local Alarm Indications. When the alarm condition is met, a local horn shall sound and a local alarm lamp shall energize.

Pump Fail

2.10 SPARE PARTS

- A. Provide the following spare parts to the OWNER for each chemical metering skid upon delivery of the pump skid. Spare parts shall include all parts required for two (2) years of normal maintenance of all components of the chemical metering system. All parts shall be in one box labeled with the Skid ID information.

1. One (1) maintenance kit for each chemical metering pump. Maintenance kits shall include but not be limited to four (4) tubing elements and three (3) 8-meter reinforced PVC flexible hose lines.
2. One (1) maintenance kit for a pressure relief valve.
3. One (1) maintenance kit for a back pressure valve.
4. One (1) spare pulsation dampener bladder.
5. Two (2) spare valves.

6. One (1) Parts list for all serviceable components.
7. One spare pumphead assembly and rotor.
8. Four (4) $\frac{3}{4}$ " female Cam and Groove fittings per skid for connection to pump ports.
9. One (1) spare injection quill.

PART 3 - EXECUTION

3.01 INSTALLATION (BY CONTRACTOR)

- A. Contractor shall install items in accordance with manufacturer's printed instructions and as indicated and specified.
- B. Pump is supplied with a 25-point terminal strip for signal input and output wiring. Contractor shall supply shielded signal wiring for wiring of the required remote input and output to the terminal strip. The contractor shall be responsible for the supply and installation of all necessary wire, conduit, fittings, etc, necessary to complete signal input and output wiring. All electrical wiring, conduit, panels, etc, shall be installed per the most current edition of the National Electric Code (NEC) and any pertinent local ordinances.

3.02 INSTALLATION ACCESSORIES

- A. Leak Detector:
 1. Pump manufacturer shall supply a float-type leak sensor mounted to the drain port of the pumphead for leak detection and pump shutdown in the event of a tube failure.
- B. Adapter to Process Piping:
 1. Pump manufacturer shall supply $\frac{3}{4}$ " female Cam and Groove to $\frac{1}{2}$ " male NPT adapter for connection to process piping. Provide two adapters per pump: one for suction, one for discharge.

3.03 INSPECTION AND TESTING

- A. Upon completion of installation, a full operating test shall be performed in the presence of the Engineer, a qualified manufacturer's representative and the owner. The contractor shall furnish all labor, materials and equipment required for such a test and shall correct any deficiencies noted.

3.04 MANUFACTURER'S SERVICES

- A. The manufacturer shall provide the following services:
 1. Provide 8-hours of mechanical start-up services, including two separate round-trips to the job site and any other ancillary costs associate the mechanical start-up
 2. Provide eight (8) hours of process start-up services, including two separate round-trips to the site and any other ancillary costs associate the process start-up.
 3. Provide eight (8) hours of operating training, including two separate round trips to the site and any other ancillary costs associate with training.
- B. Operation and Maintenance Manuals
 1. The manufacturer shall supply operation and maintenance manuals prepared specifically for the project. The manuals shall include all procedures, drawings, parts lists, etc., required to instruct personnel unfamiliar with the equipment supplied. Operation and Maintenance manuals shall be prepared in accordance with the project

specifications. At a minimum, two copies of the operation and maintenance manuals must be supplied to the owner. The operation and maintenance manuals shall be bound in a 3-ring binder with the title of the document clearly indicated on the binder cover and binding. The manufacturer's service department contact information shall also be included on each manual cover.

END OF SECTION

SECTION 46 51 13
FLOATING AERATORS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The Contractor shall furnish and install floating aeration equipment in the aerobic digester and sludge storage basins as indicated on the drawings and specified herein. Floating aeration equipment package shall include, but not be limited to:
1. Electric motor rated for environmental and service duty classifications;
 2. Stainless steel discharge cone;
 3. Closed cell polyurethane float system encapsulated in a fiberglass shell;
 4. Stainless steel propeller, volute and discharge cone;
 5. Three point cable mooring system, including mooring cable, thimbles, u-bolt clips, extension springs, snap hooks, eye bolts and all ancillary anchorage hardware necessary for a complete and functional installation. All components of the mooring system shall be stainless steel, unless otherwise noted.
 6. Power cable;
 7. Integration with existing controls package.
- B. All parts and components shall be designed and proportioned for ample strength, stability and stiffness for their intended purpose. Ample space and access shall be provided for inspection, repairs, and adjustment.
- C. Final system control (HAND, AUTO, LOCAL) operational requirements shall be determined (based on available operating alternatives, scenarios, set points, speed adjustments, operator input, and configurations) during an Operational Controls Workshop with the Owner, Engineer, Contractor, selected equipment supplier, and the supplier's controls system designer. The Operational Controls Workshop shall be conducted after contract has been awarded to the successful bidder and after the submittal/shop drawing process has yielded an "Approved as Noted" submittal package. Workshop shall be based on actual equipment and control system selected for this installation.
- D. The Owner has purchased process, control and instrumentation equipment contained in this Specification for installation by the Contractor under this Phase 2 – Final Installation Plans contract. The equipment scope of supply is available in Specification 00016 Information Available to Bidders. The Contractor shall be responsible for any and all process equipment, instrumentation, and ancillary appurtenances not provided within the scopes of supply along with all labor and material necessary for a complete and functional installation of the process, control and instrumentation equipment packages, as detailed herein.

1.02 RELATED DOCUMENTS

- A. Division 1 – General Requirements
- B. Section 030000 – Concrete
- C. Section 05100 – Structural Metal Framing
- D. Section 055000 – Metal Fabrications
- E. Section 099100 – Painting
- F. Division 26 – Electrical
- G. Division 32 – Earthwork
- H. Division 40 - Instrumentation

1.03 COMPLIANCE SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Documentation of all materials and equipment required to establish compliance with these specifications shall be submitted for review. Submittal shall include, but not be limited to the following:
 - 1. A complete and thorough description of the equipment provided to permit a comparison with the specification.
 - 2. A certification indicating compliance with project plans and specifications or complete list of all deviations.
 - 3. Equipment layout and installation requirements complete with: detailed, dimensioned drawings; equipment weights; anticipated structure loading, anchor bolt locations, installation requirements, fabrication and erection, etc.
 - 4. Manufacturer's specifications.
 - 5. Complete bill of material and descriptive information including catalog cut sheets and specifications for all components, including, but not limited to, floating aerator, mooring system, controls, etc.
 - 6. Process equipment calculations for oxygen transfer rate, complete mixing, etc., demonstrating conformance to the requirements of this specification. Calculations shall be based on the final installed equipment configuration.
 - 7. Process equipment buoyancy calculations showing conformance to requirements of this specification. Calculations shall be based on the final installed equipment configuration.
 - 8. Motors:
 - Name of manufacturer.
 - Type and model.

Type of bearings and lubrication.
Bearing Life Data
Rated size of motor hp.
Temperature rating.
Full load rotative speed.
Efficiency at full, $\frac{3}{4}$, and $\frac{1}{2}$ load.
Full load current.
Locked rotor current.
NEMA Code rating
Weight.
Enclosure type.
Frame size.
Winding insulation class.

9. Control Panel and components.

Submittals, as outlined above, will be required for the following:

Detailed control system operational description. Include: operator interface procedures; emergency procedures; and system troubleshooting.

Bill materials

Panel, electrical, control, and instrumentation weights and dimensions.

Complete panel components and devices bill-of-materials listing, type, model, ratings, and specifications data sheets, to include catalog numbers and part numbers.

Components and device manufacturer, type, model, ratings, and specifications.

Field sensors

Transmitters

Level switches

Power supplies including UPS/backup battery systems.

Surge protection equipment

Enclosure interior and exterior layout drawings

Enclosures' space heating and ventilating equipment and controls.

Enclosure heating and ventilation sizing calculations as/if required by equipment manufacturer, for this equipment and system to be mounted outdoors in continuous direct sunlight.

Motor starters and drive units

Overcurrent and instantaneous protection devices

Controls components

Operator interface units

Motor winding heater components, branch circuits and controls.

Wiring diagrams (on 11"x17" sheets)

Loop diagrams (on 11"x17" sheets)

Instrumentation

Complete panel components and devices bill-of-materials listing.

All panel & field devices, components and device Manufacturer, type, model, ratings, and specifications data sheets, to include specific catalog numbers and part numbers.

Submit control cabinet(s) layout drawings showing accurately scaled equipment sections, including, but not limited to: controllers, device panels, and circuit breakers. Show spatial relationships of components to proximate electrical

equipment. Clearly differentiate on wiring diagrams those conductors, which are factory installed and those which are field installed.

Time-Current Curves (TCCs) for all panel installed fusing, circuit breakers, motor protectors, and motor overload relays.

Overcurrent characteristics, time-current curves, and details of motor control.

10. Shop painting systems, including manufacturer's descriptive technical catalog literature and specifications.
11. External utility requirements for air, water, power, drain, etc., as applicable for each component.
12. List of spare parts to be furnished to Owner after equipment operational acceptance and predicted life of parts subject to wear.
13. Training course outlines.
14. Testing data and reports to show full compliance with these Specifications.
15. Process warranty and/or guarantee based on Specifications contained herein.
16. Reports and certifications:
 - a. Testing data and reports to show full compliance with these Specifications.
 - b. Written factory test report of inspection.
 - c. Manufacturer's Certificate of Compliance of factory-applied coating system.
 - d. Manufacturer's Certificate of Proper Installation.
 - e. Field functional test reports.
 - f. UL LLC (UL) Certification.
 - g. AWS welding inspector certifications.
17. Statements on Qualification:
 - a. Installation list demonstrating compliance with required manufacturer's qualifications.
 - b. List of field service capabilities, service facility locations, contact information and after hours availability.
18. Special shipping, storage and protection, and handling instructions.
19. Manufacturer's installation instructions. Installation manuals shall incorporate instructions for off-loading, storage, assembly, installation, maintenance and operation of the system and all its components. Installation data/instructions/drawings to include, but not limited to: Equipment/material

mounting, alignment, anchoring, attachments, accessories, wiring diagrams, connections, electrical power and control terminations diagrams, and programming/system setup.

20. Operation and Maintenance Manual (minimum three (3) bound hardcopy sets and one (1) electronic copy on USB drive), in conformance to Division 1 Specifications. Include the following data:

System Supplier and integrator points of contact and business information.
Table of contents.
Product data sheets.
Alignment, adjustment and repair instructions.
Manufacture's installation and operational instructions.
System initial startup/programming set points and timing delay settings based on specific equipment installation and operational requirements.
Assembly diagrams, interconnection drawings and Shop Drawings.
Guide to troubleshooting.
Lubrication instructions.
Recommended spare parts lists and predicted life of parts subject to wear.
Final start-up, testing, and commissioning test reports after Owner acceptance.

Per minimum requirements of Division 1, provide: One (1) electronic copy of hardcopy, minimum, for Owner and Engineer review and approval; two (2) bound hardcopies and one electronic copy on USB drive for final. A waterproof reduced copy of the mast "As-Built" control panel diagram shall be laminated in clear plastic and permanently fastened to the inside of the control panel door.

Operations and Maintenance Manual shall also include an electronic file of "As-Built/As-Initially Programmed" programming ladder logic; and per requirements of Division 1, one (1) electronic copy or hard copy, minimum, for Owner and Engineer Acceptance and approval

1.05 QUALITY ASSURANCE

A. Standards:

1. American Society for Testing and Materials (ASTM).
2. American National Standards Institute (ANSI): PS 15-69.
3. American Society of Civil Engineers (ASCE): "Measurement of Oxygen Transfer in Clean Water," latest edition.
4. Hydraulic Institute Manufacturer's Association.
5. National Electrical Manufacturer's Association (NEMA).
6. Institute of Electrical and Electronic Engineers (IEEE).
7. National Electric Code (NEC).
8. National Fire Protection Association (NFPA):

- 9. NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Shall be as specified in General Conditions and Division 01.

1.07 WARRANTY

- A. For a period of one (1) year from date of successful start-up and the delivery of a complete O&M Manual in conformance with Division 1 specifications, or eighteen (18) months from the receipt of the equipment at the site, the manufacturer shall repair or replace any portion of the equipment package which has been found defective in materials or workmanship under normal conditions of use and maintenance. Successful start-up is considered to have been achieved upon satisfactory completion of specified performance testing.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Refer to Contract drawings for basin configuration, dimensions, flow schematic, and elevations.
- B. The arrangement shown on the Drawings is based upon the information supplied during the design phase of the project. The specified and indicated components shall be supplied as a minimum. The Supplier shall be responsible for the design and final selection of all the specific components as well as any additional components required to provide a complete and operational system. The basins, structural supports, foundations, connected piping, valves, and electrical components shown, in part or in whole, may require modification to accommodate the equipment furnished.

2.02 MANUFACTURER

- 1. Aqua-Aerobics Systems, Inc.
- 2. Evoqua Water Technologies, LLC

2.03 DESIGN CRITERIA

- A. Furnish and install floating aerator units complete with pivotal mooring systems in the aerobic digester and sludge storage basins as shown on the project drawings. The aerator units shall consist of a motor, direct-drive impeller driven at a constant speed, impeller volute, an integral flotation unit, pivotal mooring system (pivotal mooring arm, mooring cable, mounting hardware, anchorage and all ancillary components necessary for complete and functional mooring system), and power cable.
- B. Each aerator shall be capable of meeting the following design criteria.

Design Criteria	PC-AER01
Influent Characteristics	Raw Wastewater, 0.05 % Solids
Basin Geometry	Circular

Basin Volume, GAL	1,370,000
Basin SWD, ft	
Minimum	5.0
Maximum	6.0
Design Temperatures, °C	
Winter	12.0
Summer	26.0
Site Grade	660.0
WSE, Max	658.0
α	0.65 (maximum)
β	0.95 (maximum)
Operating DO, mg L ⁻¹	2.0
AOTR, lbs O ₂ d ⁻¹	
Winter	4.0
"On-Season"	52.0

- C. The maximum allowable motor size shall be 1.0 Hp.
- D. Equipment Environment Application Rating:
1. Inside basin, extending to top of basin elevation: Class 1, Division 2.
 2. Envelope from top of basin to elevation 18 IN above top of channel and 10 FT wide: Class 1, Div 2.

2.04 MATERIALS AND FABRICATION

- A. Aerator Drive Motor:
1. The motor shall operate at a nominal speed of 1800 RPM (maximum) and shall be wired for 240 volts, 60 Hz, 1 phase service.
 2. The motor shall be rated for Class I, Division 2 environments, severe chemical duty, and shall have a 1.15 service factor.
 3. The motor windings shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F".
 4. A condensate drain shall be located at the lowest point in the lower end-bell housing.
 5. A labyrinth seal shall be provided below the bottom bearing to prevent moisture from penetrating around the motor shaft.
 6. All motor frame parting surfaces shall be deep registered and Permatex sealed, or equivalent.
 7. All through bolts, nuts, and screws shall be of type 18-8 stainless steel.
 8. A stainless steel nameplate shall be provided with each motor and shall be securely fastened thereto. The voltage, speed, insulation class, amperage, service factor, wiring diagram, motor serial number, and the manufacturer's name and address shall be steel stamped or otherwise permanently marked.

9. Motor frames shall be cast iron construction, with a cast iron or Type 304 stainless steel rain shield.
 10. Winding heaters shall be provided for outdoor installations. Branch circuit design shall be by the equipment manufacturer/supplier.
- B. Motor Shaft:
1. The motor shaft shall have a one-piece motor shaft continuous from the top motor bearing, through the lower bearing and down to and through the propeller.
 2. The one-piece shaft shall have a minimum diameter of 0.875 IN and be manufactured from 17-4 PH stainless steel, or comparable stainless steel having a minimum yield strength of 100,000 PSI.
 3. The one-piece shaft shall be machined to a tolerance of plus or minus 0.006 IN total indicated run out.
- C. Motor Bearings:
1. Motor bearings shall be regreasable. Sealed bearings are not acceptable.
 2. The top and bottom motor bearings shall be of the combined radial and axial thrust type and shall be packed at the factory with CHEVRON Black Pearl grease (or an approved equivalent waterproof grease).
 3. Top motor bearing shall be shielded on the bottom side only. The bottom motor bearing shall be open.
 4. The lower motor bearing inner race shall be locked to the motor shaft via a special washer and locker nut arrangement. The shaft shall be threaded just below the lower bearing and shall have a keyway cut into the motor shaft. This key shall accept a tab from the I.D. of the locking washer, and the locking nut shall have recesses to accept a tab from the O.D. of the locking washer to prevent the nut from backing off. Snap ring type retainers will not be acceptable
- D. Discharge Cone:
1. The discharge cone casting shall act as a base for the aerator motor, and alignment of the motor to this base shall be controlled by machined index fittings that engage the base of the motor. All discharge cone hardware shall be 304 stainless steel and safety wired.
 2. The discharge cone casting shall act as a thrust block to deflect the high velocity, pumped volume of the aerator from a vertical to the horizontal direction. Provide discharge cone casting with adequate mass to minimize vibration, and to provide adequate strength. The bottom side of this casting shall have a 90° radiused transition to effect the hydraulic change in direction with a minimum of head loss.
 3. The discharge cone shall absorb all normal and shock loads encountered by the propeller, and transmitted to the diffuser head via the motor shaft and lower motor end bell. The discharge cone shall distribute these forces into the float via webs that terminate in a flange or ring that is an integral part of the discharge cone. This flange shall mate with a similar flange that is an integral part of the float to spread the stresses generated by the propeller uniformly around the float so that no point loading of the float is allowed. These flanges shall be machined flat to provide proper bearing surfaces. The alignment of the discharge cone to the float shall be by use of a 360-degree pilot; and, bolt holes only shall not be acceptable. Diffuser head designs that employ studs and spacers, shoulder bolts or fiberglass are not acceptable. Load bearing flange-to- flange connections shall be required.

4. The discharge cone shall contain an anti-deflection journal insert or deflector bearing to limit the radial deflection of the motor shaft. The anti-deflection journal insert, when supplied, shall be located in the lower extremity of the discharge cone, approximately one-half the distance between the motor base and the lower end of the shaft. A journal insert shall be machined from Delrin and shall be a minimum of 0.060 IN diameter or larger through the bore than the diameter of the motor shaft. Units featuring one-piece unsupported shaft shall not be acceptable.
5. There shall be a fluid deflector located on the motor shaft immediately below the anti-deflection journal insert and the lower portion of the discharge cone. The fluid deflector shall be machined from Delrin or molded black neoprene and attached to the motor shaft by recessed allen head stainless steel set screws or molded from black neoprene and press fit onto motor shaft.
6. The design of the discharge cone shall be such that the liquid spray will discharge at an angle of 90 degrees to the motor shaft, and over a 360-degree spray pattern in the horizontal plane.
7. The discharge cone shall be a monolithic casting of Type 304 stainless steel.
8. A high-density polyethylene splash deflector ring shall be placed on top of the discharge cone to lower the aerator spray pattern. The size and placement of the ring shall be as recommended by the aerator manufacturer.

E. Flotation:

1. Each aerator shall have at a reserve buoyancy factor of safety of 2.0 to ensure stability and to provide support flotation required during aerator servicing.
2. Floats shall be one piece. No segmented floats shall be acceptable.
3. Flotation stability shall be mandatory. Under no circumstances shall unstable flotation designs requiring counter balancing, ballast of liquid, solid mass, or submerged major fabricated assemblies to stabilize the operation of the aerator be allowed. Only aerators demonstrating stable operational characteristics, without rocking or oscillating and causing mooring stress, shall be acceptable.
4. The float shall be manufactured of polyester fiberglass resins and shall have a resin/glass content of 70% resin and 30% glass. A minimum of 0.014 IN thick gel coat shall cover the entire outer float shell. A moisture inhibitor, such as N.P.G. (neopenthal glycol) or equal, and an ultraviolet inhibitor, such as UV9 or equal, shall be used to protect the float from moisture and sunlight damage. The construction of the float shall be such that no under-water joints shall be used.
5. Joints used to connect the top coverlid shall be overlapped a minimum of 1-1/2 IN, both parts of all joints shall be ground to glass fiber and a resin/glass adhesive shall be applied to complete a 100% monolithic glass-to-glass bond.
6. The float construction shall be such that the volute will distribute the load of the entire motor, drive, discharge cone, and volute static load, plus the entire dynamic load from the propeller thrust and radial forces by spreading these forces uniformly around the full 360-degree circumference of the float's central core.
7. Point connected joints or point stressed connections shall not be acceptable.
8. The minimum flexural strength of the fiberglass materials shall be 28,000 psi and the minimum tensile strength shall be 11,000 psi
9. The float shall be a minimum of 46.5 IN in diameter and 7.5 IN thick, and shall be fabricated of approved fiberglass construction or low density polyethylene as later described herein. The float shall be constructed so that all stress imposed from wave action and mooring line tension shall be transmitted from each mooring line to another by pulling across the float in such a manner as not to flex the structure. All

floats shall be constructed so that the internal void can be filled full of closed cell polyurethane foam having a minimum 2.0 lbs/ft³ density and shall be completely sealed water tight.

10. Floats shall have six (min) mooring points, spaced for 3- or 4-point mooring around the outer circumference. No mooring connections shall be allowed as embedments in the upper or lower float covers. Only tension-type connections perpendicular to the outer sidewall will be approved. All mooring connections shall be stainless steel.

F. Propeller:

1. The propeller shall be a two- or three-blade, marine-type precision casting specifically designed for the application intended and will be manufactured of Type 316 stainless steel.
2. The propeller shall have a diameter of 11.0 IN (min)
3. The blade design shall be anti-fouling with dual sweptback leading edges so that it shall not accumulate fibers, rags, stringy materials, etc.
4. The propeller shall have a diameter not allowing a greater clearance with the volute of 0.25".
5. Each propeller blade shall be pitched so that the pitch angle and rake angle are within ± 2 percent of the other blade(s).
6. The propeller shall be pitched so that the drive motor is loaded between 88% and 94% of full-load nameplate horsepower. Data confirming the pitch, diameter, and rake shall be supplied with the submittals.
7. The propeller shall be keyed to mate to the keyed shaft for ease of maintenance and assembly.
8. The propeller shall be secured to the shaft by a locking nut and/or hardened stainless steel pin and set screw.
9. Propellers that are pinned and require gluing to the shaft shall not be acceptable.
10. Aerators using inclined screw impellers shall not be acceptable.

G. Volute:

1. The propeller shall operate in a volute made of 304 stainless steel and shall be a minimum of 12 IN.
2. The volute shall be round and true so that propeller blade tip clearance is uniform within the volute as it rotates.
3. The volute shall have minimum of 3/16-inch wall thickness, and a minimum of four full-length stainless steel gussets shall be welded on 90° spacing around the circumference of the volute between the top and bottom flanges.
4. The volute shall have a large flange at its top extremity that completely encircles the volute. This flange shall match a similar flange on the bottom of the discharge cone to provide for a bolted, machined flange-to-flange fit to provide uniform distribution of the dynamic loads generated by the propeller and the static weight of the motor module.
5. There shall be a 360 degree machined index in the upper flange that shall provide concentric alignment of the propeller in the volute by engaging the inside diameter of the mating flange on the discharge cone. Bolt holes alone shall not be acceptable to locate the alignment of the propeller.

6. Fiberglass volutes, carbon steel volutes, or fiberglass or stainless steel lined volutes are not acceptable.
- H. Intake Cone:
1. The intake cone shall be fabricated from Type 304 stainless steel, 0.105 IN thickness and having a gradually expanding opening outward to the intake end.
 2. The length and inlet diameter shall be sufficient to provide uniform inlet hydraulics so that no increase in vibration is caused due to its shape or size.
 3. The stainless steel used to fabricate the intake cone shall be structurally sufficient to support the weight of the entire aerator assembly and cover when the aerator is free-standing on dry ground.
 4. For maximum in-depth mixing efficiency, the intake cone shall be designed so that the suction lift from the aerator propeller is vertical from the liquid depth below the aerator.
 5. Side or angle entry suction inlets shall not be approved.
 6. Fiberglass intake cones are not allowed.
- I. Balancing:
1. The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced to within 2.0 mils peak-to-peak measured at the upper and lower motor bearing.
 2. Measurements shall be taken at a frequency equivalent to 1800 PM and at 3600 RPM.
 3. Measurements shall be taken with the motor in a vertical, shaft down position, with the entire motor module mounted on resilient pads.
 4. Certified copies of the balance inspection shall be supplied with each aerator.
- J. Mooring:
1. A three-point cable mooring system with maintenance loops shall be supplied for each floating aerator unit, consisting of a stainless steel cable, and required thimbles, clips and disconnects
 2. The cables shall be attached to mooring new concrete filled mooring posts and shall maintain the surface aerator in position at the center of the lagoon cell.
 3. The mooring system shall be installed as recommended by the manufacturer so the aerator shall be permitted to rise and fall with anticipated water level variations, but will have a minimum of lateral movement.
 4. The operating water surface elevations or indicated on the project plans.
 5. Mooring cable shall be 7 x 19-strand construction, Type 304 stainless steel and 3/16" in diameter.
 6. Mooring hardware, consisting of thimbles, clips, snap hooks, shackles, etc, shall be of Type 316 stainless steel.
 7. Galvanized hardware is not acceptable.
- K. Electrical Service Cable:
1. Each aerator shall be furnished with the required length of AWG #12 four- conductor, continuous length (non-spliced) underwater electric service cable no less than 400 ft in length for termination at Control Panel. Contractor shall confirm cable length prior to ordering aerator.

2. The aerator manufacturer shall furnish the cable, with the motor and sealed into the motor terminal box, and wired for 240 volt service. The aerator manufacturer shall be responsible for this watertight seal and electrical connection.
3. The cable shall have three power conductors and a ground conductor.
4. The conductors shall be flexible type annealed copper stranded.
5. Each conductor, including the ground conductor, shall be insulated. Cables containing an uninsulated ground conductor will not be acceptable.
6. The insulated conductors shall be assembled together with a non-hygroscopic filler material.
7. The outer jacket shall be high quality CPE, PVC, TPE, or equal, and shall be rated at a conductor operating temperature of not less than 90 degrees centigrade.
8. The cable shall be rated for hard outdoor service and shall be resistant to oil, sunlight, ozone, grease, acids, water, abrasion and impact.
9. Insulation tensile strength shall be 2600 psi nominal.
10. Dielectric withstand shall be 3,000 volts AC.
11. Spark test shall be 7,000 volts AC.
12. Color codes of the insulation for the cables shall be black, white, red, and green.
13. Jacket tensile strength shall be 2300 psi nominal.
14. The cable shall be provided and installed with proper size stainless steel strain relief grips and cable holders to protect the cable from physical damage.

2.05 CONTROLS

- A. Local electrical service nominal rating shall be 240V, 1 PH, 60 Hz
- B. All electrical power, devices, and controls enclosures, except for field devices, shall be mounted on local stainless steel equipment rack, constructed on elevated walkway at top of each structure.
- C. Terminate surface aerator cable at existing Effluent Pump Station Control Panel. Terminate cable conductor at the existing surface aerator motor power circuit. Adjust motor overload protection settings accordingly to accommodate for motor load.

PART 3 EXECUTION

3.01 GENERAL

- A. Installation of equipment shall be in strict accordance with recommendations of the Aeration Equipment Supplier.
- B. Aeration Equipment Supplier shall notify Contractor and Engineer of anything in the installation which is contrary to the requirements of the Supplier.

3.02 INSTALLATION

- A. Installation of the equipment shall be in strict accordance with the manufacturer's recommendations.

3.03 FIELD PERFORMANCE TESTING

- A. The Supplier shall perform field tests of all equipment in the presence of the Engineer to demonstrate that equipment supplied performs in accordance with design conditions. The proposed equipment installation shall be inspected, tested and placed into operation by a Certified Equipment Manufacturer's Representative. Demonstration of equipment performance following initial installation and startup shall be provided through all control system operational sequences as necessary to show that the equipment performs as specified herein. All tests shall be witnessed by the Engineer. Tests and checks shall include, but not be limited to, the following:
 - 1. Megger equipment motor starters and power cables/circuits.
 - 2. Check power supply voltage to control panel, all motors, and devices before and during equipment operations.
 - 3. Check motors for proper rotation.
 - 4. Measure motors' operating load and no load currents.
 - 5. Check level control operation and sequence and alarming.
 - 6. Check performance of all components as a functioning unit.
 - 7. Check for equipment and spray systems leaks.
- B. The contractor shall be responsible for any adjustments and corrective work determined during performance testing as to provide a fully functional equipment package as specified.
- C. Inspection, testing and initial operational check-outs shall be recorded on certified test reports, which shall be submitted to the Owner and Engineer for review and approval.
- D. The equipment supplier/manufacturer shall notify the Engineer 10 days in advance of all field performance testing so that the Engineer can be present for all tests.
- E. Upon completion of the installation, testing and startup of the equipment, the Equipment Manufacturer shall provide data to confirm the equipment provided will meet the oxygen transfer efficiency specified.

3.04 INSPECTION. START-UP AND TRAINING

- A. On-site start-up and testing service by a qualified representative of the Supplier shall be furnished from the initiation of plant start-up. The representative shall be on site for no less than one (1) days, including travel expenses, and shall have complete knowledge of the proper installation, operation and maintenance of the equipment. All units shall be checked for proper mechanical operation.
- B. A qualified representative of the equipment Supplier shall conduct a one (1) day training seminar, including travel expenses, for the plant operators and Owner after the facility is operational. The training shall include proper operation and maintenance procedures of the entire equipment.

3.06 SPARE PARTS

- A. Provide the following:

1. One-year supply of all lubricants.

END OF SECTION