

PROJECT MANUAL

Wastewater System Improvements

Roaring River State Park

Cassville, Missouri

Designed By: Great River Engineering
2826 S. Ingram Mill Road
Springfield, MO, 65804

Date Issued: June 21, 2024

Project No.: X2323-03

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION
Facilities Management, Design & Construction

SECTION 00 01 07 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: X2323-03

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:

Connie M. Walden
PE#: PE-2022008888
Sheets: G-001, G-002, G-003, G-004, G-005,
G-006, C-501, C-101, C-102, C-103, C-104,
C-502, C-301, C-105, C-201, C-106, C-107,
C-302, C-108, C-109
Specifications: 024100, 025370, 033100,
055000, 071113, 072000, 079200, 310000,
311000, 312300, 321216, 321313, 323113,
328000, 329200, 330523.13, 331133,
333200, 333216.13, 333300, 462183



Craig Keith Brewster
PE#: E-2000150002
Sheets: E-101
Specifications: Division 26



END OF SECTION 00 01 07.

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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 provides a comprehensive list of the drawings that comprise the Bid Documents for this project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 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 G-001	06/21/24	5309-09065_G-001
2.	Abbreviations	Sheet G-002	06/21/24	5309-09065_G-002
3.	General Notes and Legend	Sheet G-003	06/21/24	5309-09065_G-003
4.	Site Plan	Sheet G-004	06/21/24	5309-09065_G-004
5.	Site Access and Laydown Area	Sheet G-005	06/21/24	5309-09065_G-005
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8.	LS 8 Force Main Plan and Profile	Sheet C-101	06/21/24	5309-09065_C-101
9.	Lagoon Fence Plan	Sheet C-102	06/21/24	5309-09065_C-102
10.	Irrigation Sprayers Plan	Sheet C-103	06/21/24	5309-09065_C-103
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21.	Electrical Site Plan	Sheet E-101	06/21/24	5309-09065_E-101

END OF SECTION 00 01 15.

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. Wastewater System Improvements
Roaring River State Park
Cassville, Missouri
Project No.: X2323-03

3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, August 8, 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 providing improvements for the water distribution system at Roaring River State Park which include the completion of proposed wellhouse improvements, distribution system improvements, and standpipe improvements.
- 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, July 23, 2024, at 12716 Farm Road 2239 Cassville, MO 65625
- 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: Great River Engineering, Connie Walden, 816-436-4440, email: cwalden@greatriv.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.

IMPORTANT REMINDER REGARDING REQUIREMENT FOR OEO CERTIFICATION

A. SECTION 002113 – INSTRUCTIONS TO
BIDDERS: Article 15.0, Section D1:

As of July 1, 2020, all MBE, WBE, and MBE/WBE contractors, subcontractors, and suppliers must be certified by the State of Missouri, Office of Equal Opportunity. No certifications from other Missouri certifying agencies will be accepted.

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://o eo .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.

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: **Wastewater System Improvements
Roaring River State Park
Cassville, Missouri**

Project Number: **X2323-03**

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 **240 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. Unit Prices (Section 004322)
 - iii. Proposed Contractors Form (Section 004336)
 - iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)

- v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
- vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
- vii. Missouri Service Disabled Veteran Business Form (Section 004340)
- viii. Affidavit of Work Authorization (Section 004541)
- ix. 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
NOTARY PUBLIC SIGNATURE

YEAR
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
LOCATION	DATE INSTALLED

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)
\$

THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: \$

SELECT MBE, WBE, SDVE	ORIGINAL CONTRACT PARTICIPATION AMOUNT	PARTICIPATION AMOUNT PAID-TO-DATE (includes approved contract changes)	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	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	

INSTRUCTIONS FOR MBE/WBE/SDVE PROGRESS REPORT

CONTRACTOR OR CONSULTANT TO FILL OUT AND REMIT WITH EACH PAY APPLICATION:

The MBE/WBE/SDVE Progress Report for the project is issued with the contract comprising values reported in the consultant's Proposal or on the successful contractor's Section 004337 Compliance Evaluation Forms.

At Initial Pay Application fill in the following:

1. Pay App No. Start with 1.
2. Fill in the Project Number and Date.
3. Enter Project Title, Project Location, and Firm.
4. Fill in the "Original Contract Sum" and "Total Contract Sum To Date" (Reference applicable Line Items on Form A of Application for Payment).
5. Indicate the Total Participation Dollar Amount from the Original Contract.
6. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier.
7. Enter the "Total Amount of Subcontract", "\$ Amount (Paid-To-Date)", and Company Name.

For all subsequent Pay Applications fill in the following:

1. Pay App No.
2. If Final Pay App, check box.
3. Fill in the Project Number and Date.
4. Enter Project Title, Project Location, and Firm
5. At each Pay App fill in the "Original Contract Sum" and "Total Contract Sum To Date" (reference applicable Line Items on Form A of Application for Payment).
6. Indicate the Total Participation Dollar Amount from the Original Contract.
7. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier
8. Enter the "Total Amount of Subcontract", "\$ Amount (Paid-To-Date)", and Company Name.



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:

Connie Walden
Great River Engineering
2826 S. Ingram Mill Road
Springfield, MO 65804
Telephone: 816-436-4440
Email: cwalden@greatriv.com

Construction Representative:

David Burkett
Division of Facilities Management, Design and Construction
703 S. Wall Street
Joplin, Missouri 64801
Telephone: 573-644-2442
Email: David.Burkett@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:

Mandy Roberson
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: 573-522-0074
Email: Mandy.Roberson@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
108	2.3	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

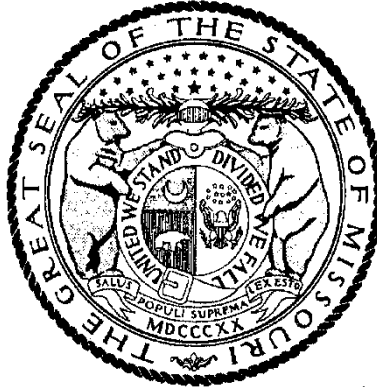
telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. For purposes of this prohibition, “covered telecommunications equipment or services” has the meaning as set forth at Sec. 889(f)(3) of Pub. L. No. 115-232. *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 005
BARRY 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
BARRY County

Section 005

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$24.19
Boilermaker	\$26.07*
Bricklayer-Stone Mason	\$55.74
Carpenter	\$49.55
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$26.07*
Plasterer	
Communication Technician	\$26.07*
Electrician (Inside Wireman)	\$48.67
Electrician Outside Lineman	\$26.07*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$26.07*
Glazier	\$26.07*
Ironworker	\$65.08
Laborer	\$31.74
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$26.07*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$26.07*
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$40.59
Plumber	\$55.58
Pipe Fitter	
Roofer	\$26.07*
Sheet Metal Worker	\$55.87
Sprinkler Fitter	\$26.07*
Truck Driver	\$26.07*
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
BARRY County

Section 005

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$26.07*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$26.07*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$26.07*
General Laborer	
Skilled Laborer	
Operating Engineer	\$26.07*
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$26.07*
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

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of wastewater system improvements at Roaring River State Park.
 - 1. Project Location: 12716 Farm Road 2239, Cassville, MO 65625
 - 2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.
- B. The Work consists of providing improvements for the wastewater system at Roaring River State Park. This includes construction of lift station updates and improvements, force main improvements, and WWTF safety and mechanical improvements.
 - 1. The Work includes:
 - a. Providing new mechanical equipment and controls for all eight (8) small lift stations at the facility and complete rehabilitation of the regional Lift Station 8 serving the entire park.
 - b. Providing lift station 8 improvements including the addition of a manual septage receiving station with a screen to facilitate discharge or vector waste after lift station cleaning activities and structural improvements to the existing concrete wet well.
 - c. Replacement of the existing Lift Station 8 force main from the pump station to the south side of Roaring River including trenchless construction underneath Roaring River.
 - d. Providing updates to the wastewater treatment facility including a new fence around the lagoon cells and pump house, an effluent discharge pump replacement, and replacement/repair of multiple sprinkler heads in the irrigation field west of the WWTF.
- C. The Work will be constructed under a single prime contract.

1.3 WORK SEQUENCE

- A. Modifications to the existing lift stations shall be performed one at a time, starting at lift station 8, the most downstream station, and working upstream through the system, unless otherwise directed by the Owner. All damaged sprayers shall be replaced prior to the installation of the new Effluent Pump No. 1. All other work shall be done in tandem with these activities until complete.

1.4 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the designated premises for construction operations, including use of the site.
- 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.

1.5 OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: The Owner will occupy the site 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.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01 10 00.

SECTION 01 21 00 – 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. Section 1 26 00 – Contract Modification Procedures for procedures for submitting and handling Change Orders for allowances.

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, designation 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.

1.7 LUMP SUM ALLOWANCES

- A. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

PART 2 - PRODUCTS (NOT APPLICABLE)

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, fifteen (15) “bad weather” days.

END OF SECTION 01 21 00.

SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

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 specifies administrative and procedural requirements for handling and processing Contract Modifications.
- B. Related Sections include the following:
 - 1. Section 01 21 00 - Allowances for procedural requirements for handling and processing Allowances.
 - 2. Section 01 31 15 - Project Management Communications for administrative requirements for communications.
 - 3. Section 00 72 13, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
 - 4. Division 00, Section 00 72 13, Article 4.0 "Changes in the Work" for Change Order requirements.

1.3 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.

1.4 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).

1.5 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.

1.6 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 APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01 26 00.

SECTION 01 31 00 – COORDINATION

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 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. Section 01 32 00 - Schedules for preparing and submitting Contractor's Construction Schedule.
 - 2. Articles 1.8.B and 1.8.C of Section 00 72 13 "General Conditions" for coordinating meetings onsite.
 - 3. Article 5.4.H of Section 00 72 13 "General Conditions" for coordinating Closeout of the Contract.

1.3 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.

1.4 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.

1.5 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 00 72 13 "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.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01 31 00.

SECTION 01 31 15 - PROJECT MANAGEMENT COMMUNICATIONS

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.
- B. Section 01 33 00 - Submittals
- C. Section 01 26 00 - Contract Modification Procedures

1.2 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.
- a. 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.
 - b. 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.
 - c. 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 01 31 15.

SECTION 01 32 00 – SCHEDULES

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 a Bar Chart Schedule for the project construction activities, schedule of submittals, and schedule for testing.

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 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.

3.2 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 01 21 00 - 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. Structural completion.
 - b. Permanent space enclosure
 - c. Completion of mechanical installation
 - d. Completion of the electrical portion of the Work
 - e. Substantial Completion

3.3 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 01 33 00 - 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.

3.4 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 01 32 00.

SECTION 01 33 00 – SUBMITTALS

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 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.

1.3 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

1.4 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".

1.5 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.

1.6 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.

1.7 QUALITY ASSURANCE DOCUMENTS

- A. The Contractor shall comply with the General Conditions.
- 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.

1.8 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 and Supplementary Conditions along with this and other Sections of the Contract Documents.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

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

SPEC SECTION	TITLE	CATEGORY
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013200	Schedules	List of Subcontractors
013200	Schedules	Major Material Suppliers
015000	Construction Facilities and Temporary Controls	Product Data
015713	Temporary Erosion Control	Product Data
025370	Installation of Trace Wire	Product Data
033000	Cast-In-Place Concrete	Product Data
055000	Metal Fabrications	Shop Drawings
072000	Protective Coating for New Concrete Sanitary Sewer Structures	Product Data
079200	Joint Sealants	Product Data
310000	Earthwork	Test Report
312300	Controlled Low Strength Material (CLSM)	Product Data
321100	Granular Paving	Product Data
321216	Hot-Mix Asphalt Paving	Product Data
321313	Portland Cement Concrete Paving	Product Data
323113	Chain Link Fences and Gates	Product Data
328000	Irrigation Sprayer System	Product Data
329200	Lawns and Grasses	Product Data
330523.13	Horizontal Directional Drilling	Product Data
331133	Vertical Turbine Pumps	Product Data
333200	Sewage Pumping Stations	Product Data
333216.13	Submersible Sewage Pumps	Product Data
333300	Sanitary Sewage	Product Data
462183	Septage Receiving Bar Screen	Product Data

END OF SECTION 01 33 00.

SECTION 013513.31 - 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 013513.31

SECTION 01 50 00 – 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:
 - 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:
 - 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 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: The Owner will provide use of existing electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc. Contractor shall be responsible for providing portable power through portable generators where necessary to complete the work herein.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heating: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
 - 1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel-oil heaters with individual space thermostatic control.
 - 2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- F. 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.

- G. Provide cell phone service throughout the construction period for all personnel engaged in construction activities.
 - 1. At project office and at each construction area, post a list of important and emergency telephone numbers.
- H. 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.
- I. 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.
- J. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.
 - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45°F to 55°F (7°C to 13°C).
- K. 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.

- C. Storage Facilities: Limited areas for storage of building materials are available onsite. Available storage areas are shown on the drawings. The Contractor shall provide his own security. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction 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. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 2. 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.
 3. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 4. 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. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
 2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.
 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

- H. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.
- I. 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.
- J. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- K. 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.
- L. 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. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”.
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.

4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project complete installation of the permanent fire-protection facility including connected services and place into operation and use. Instruct key personnel on use of facilities.
 - D. 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.
 - E. 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.
 2. Provide plywood fence, 8' (2.5m) high, framed with (4) 2"x4" (50mm x 100mm) rails, and preservative-treated wood posts spaced not more than 8' (2.5m) apart.
 - F. Covered Walkway: Erect a structurally adequate, protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
 1. Construct covered walkways using scaffold or shoring framing. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage. Extend the back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and the Designer.
 - G. 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.
 - H. 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. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. 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 01 50 00.

SECTION 017400 – CLEANING

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 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

2.1 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

3.1 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 two times each month, 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.

3.2 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.
1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner's property.

END OF SECTION 017400

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.

3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 - Coordination. Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Engineer.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

- a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
- a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 00 72 13 – General Conditions.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 3. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner with at least seven days' advance notice.

- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
 - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
 - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00.

SECTION 02 41 00 - DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Cutting or modifying of existing and new work.
 - 2. Partial demolition of structures.
 - 3. In-place abandonment of pipe.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. A10.6 - Safety and Health Program Requirements for Demolition Operations.
- B. International Concrete Repair Institute (ICRI):
 - 1. Guideline No. 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
 - 2. Guideline No. 310.3R - Guide for the Preparation of Concrete Surfaces for Repair Using Hydrodemolition Methods.

1.3 DEFINITIONS

- A. Chipping hammer: A hand-operated electrical or pneumatic demolition device for removal of hardened concrete or masonry materials having a weight of less than 15 pounds and an impact frequency of greater than 2,000 blows/minute.
- B. Concrete breaker: A hand-operated electrical or pneumatic demolition device for removal of hardened concrete or masonry materials having a weight greater or impact frequency less than the limits defined for a chipping hammer.
- C. Coring equipment: Non-impact rotary drill with diamond cutting edges.
- D. Heavy abrasive blast: Cleaning procedure by which various abrasives materials, or steel shot, are forcibly propelled by high pressure against a surface to remove loose material and produce a concrete surface roughened to ICRI Surface Profile CSP-7, or higher, as specified in ICRI 301.3R.

1.4 DESCRIPTION OF WORK

- A. The work includes partial demolition, cutting, and modifying of existing facilities, utilities, and/or structures.

- B. These facilities may be occupied and/or operational. Satisfactory completion of the work will require that the Contractor plan activities carefully to work around unavoidable obstacles and to maintain overall stability of structures and structural elements. It will further require restoration of existing facilities, utilities, and structures that are to remain in place and that are damaged by demolition or removal operations.

1.5 SUBMITTALS

- A. General:
 - 1. Submit as specified in 00 72 13 - General Conditions and 01 33 00 - Submittals.
- B. Shop drawings: Include:
 - 1. The location of all embedded items shall be documented using diagrams and/or other media that clearly show dimensions and locations of existing structural elements, existing embedded items and any new embedded items and their relationship to each other.
- C. Submittals for information only:
 - 1. Permits and notices authorizing demolition.
 - 2. Certificates of severance of utility services.
 - 3. Permit for transport and disposal of debris.
 - 4. Selective Demolition Plan.
 - 5. Pipe Abandonment Plan.
- D. Quality assurance submittals:
 - 1. Qualifications of non-destructive testing agency/agencies.
- E. Project record documents.
- F. Drawings and/or other media documenting locations of service lines and capped utilities

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Assign relocation, removal, cutting, coring and patching to trades and workers qualified to perform the Work in manner that causes the least damage and that provides means of returning surfaces to an appearance at least equal to that of the surrounding areas unaffected by the Work.
 - 2. Non-destructive testing agencies: Minimum of 5 years' experience performing non-destructive testing for location of steel reinforcement in existing concrete under conditions similar to that required for this Work.

1.7 SEQUENCING

- A. If the facility or utility to be modified cannot be removed from service, perform the Work while

the facility is in operation using procedures and equipment that do not jeopardize operation or materially reduce the efficiency of that facility.

- B. Coordinate the Work with operation of the facility:
 - 1. Do not begin alterations of designated portions of the Work until specific permission for activities in each area has been granted by the Owner in writing.
 - 2. Complete Work as quickly and with as little delay as possible.
- C. Operational functions of the facility that are required to be performed to facilitate the Work will be performed by facility personnel only.
- D. The Owner will cooperate in every way practicable to assist in expediting the Work.
- E. When necessary for the proper operation or maintenance of portions of the facility, reschedule operations so the Work will not conflict with required operations or maintenance.

1.8 REGULATORY REQUIREMENTS

- A. Dispose of debris in accordance with governing regulatory agencies.
- B. Comply with applicable air pollution control regulations.
- C. Obtain permits for building demolition, transportation of debris to disposal site and dust control.

1.9 PREPARATION

- A. Non-destructive evaluation of existing concrete:
 - 1. Prior to cutting, drilling, coring, and/or any other procedure that penetrates existing concrete, retain and pay for the services of a qualified non-destructive testing agency to perform investigations to determine the location of existing steel reinforcement, plumbing, conduit, and/or other embedments in the concrete.
 - 2. Submit documentation of the investigations to the Engineer for review before any work involving penetration of existing concrete is initiated.

1.10 PROJECT CONDITIONS

- A. Do not interfere with use of adjacent structures and elements of the facility not subject to the Work described in this Section. Maintain free and safe passage to and from such facilities.
- B. Provide, erect, and maintain barricades, lighting, guardrails, and protective devices as required to protect building occupants, general public, workers, and adjoining property:
 - 1. Do not close or obstruct roadways without permits.
 - 2. Conduct operations with minimum interference to public or private roadways.
- C. Prevent movement, settlement, or collapse of structures:

1. Provide and place bracing or shoring.
 2. Cease operations and notify Engineer immediately when safety of structures appears to be endangered. Take precautions to properly support structure. Do not resume operations until safety is restored.
 3. Assume liability for movement, settlement, or collapse. Promptly repair damage.
- D. Arrange and pay for capping and plugging utility services. Disconnect and stub off.
1. Notify affected utility company in advance and obtain approval before starting demolition.
 2. Place markers to indicate location of disconnected services.
- E. Unknown conditions:
1. The drawings may not represent all conditions at the site and adjoining areas. Compare actual conditions with drawings before commencement of Work.
 2. Existing utilities and drainage systems below grade are located from existing documents and from surface facilities such as manholes, valve boxes, area drains, and other surface fixtures.
 3. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to ensure that the service provided is not interrupted, and do not proceed with the Work until written instructions are received from the Engineer.

PART 2 - PRODUCTS

2.1 SALVAGE MATERIALS

- A. Salvage materials: Materials removed from existing facility.
- B. Materials designated for salvage:
1. Air compressor system from the Maintenance Building.
- C. Handling and storage:
1. Prevent damage to salvaged materials during removal, handling, and transportation of salvaged materials.
 2. Prepare salvaged materials for storage and hand over to Owner.
 3. Pay costs associated with salvaging materials, including handling, transporting, and storage

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to beginning selective demolition operations, perform a thorough inspection of the facility and site, and report to the Engineer defects and structural damage to or deterioration of existing

construction to remain.

- B. Examine areas affected by the Work and verify the following conditions prior to commencing demolition:
 - 1. Disconnection of utilities as required.
 - 2. That utilities serving occupied or active portions of surrounding facilities will not be disturbed, except as otherwise indicated.
- C. If unsatisfactory conditions exist, notify the Engineer, and do not begin demolition operations until such conditions have been corrected.

3.2 PREPARATION

- A. Selective Demolition Plan:
 - 1. Prepare and submit a comprehensive selective demolition plan for the Work including the following elements, at a minimum:
 - a. Proposed sequence, methods, temporary support, and equipment for demolition, removal, and disposal of portions of structure(s).
 - b. Provisions and procedures for salvage and delivery to the Owner of salvaged items, if required.
 - 2. Submit plan a minimum 7 days before demolition is scheduled to begin.
- B. Pipe Abandonment Plan:
 - 1. Prepare and submit a comprehensive Pipe Abandonment Plan for the Work to demonstrate and verify with camera inspection that all solids have been removed and pipe is free of residual.
 - 2. At a minimum, define the following elements:
 - a. Proposed sequence, methods, cleaning procedures, or demolition, removal, and disposal of contents of the piping.
 - b. Method of verification of final pipe condition.
 - c. Detailed drawings showing treatment of pipe ends.
 - 3. Submit plan a minimum 7 days before abandonment is scheduled to begin.
- C. Protection:
 - 1. Erect weatherproof closures to protect the interior of facilities and elements or equipment that are not designed for exposure to the weather. Provide temporary heat, cooling, and humidity control as necessary to prevent damage to existing and new construction. Maintain existing exiting paths and/or provide new paths in compliance with Building Code requirements.
 - 2. Erect and maintain dustproof partitions as required to prevent spread of dust, to other parts of building. Maintain negative pressure in the area where the Work is being performed to prevent the accidental spread of dust and to minimize the spread of fumes

- related to the Work.
3. Upon completion of Work, remove weatherproof closures and dustproof partitions, and repair damaged surfaces to match adjacent surfaces.
 4. Provide and maintain protective devices to prevent injury from falling objects.
 5. Locate guardrails in stairwells and around open shafts to protect workers. Post clearly visible warning signs.
 6. Cause as little inconvenience to adjacent building areas as possible.
 7. Protect landscaping, benchmarks, and existing construction to remain from damage or displacement.
 8. Carefully remove designated materials and equipment to be salvaged by the Owner or reinstalled.
 9. Store and protect materials and equipment to be reinstalled.

D. Layout:

1. The limits of selective demolition are indicated on the Drawings. Confine demolition operations within the limits indicated on the Drawings.
2. Lay out demolition and removal work at the site and coordinate with related Work for which demolition and removal is required. Clearly mark the extent of structural elements to be removed on the actual surfaces that will be removed.
3. Arrange for Engineer's inspection of the lay out extents.
4. Do not begin demolition/removal operations until the lay out markings have been reviewed by the Engineer.

3.3 DEMOLITION

A. General:

1. Perform demolition work in accordance with ANSI A10.6.
2. Demolish designated portions of structures and appurtenances in orderly and careful manner in accordance with the Selective Demolition Plan.
3. Conduct demolition and removal work in a manner that will minimize dust and flying particles.
 - a. Use water or dust palliative when necessary to prevent airborne dust.
 - b. Provide and maintain hoses and connections to water main or hydrant.
4. Demolish concrete and masonry in small sections. Perform demolition with small tools as much as possible. Blasting with explosive charges is not permitted.
5. Sawcut concrete to establish the edges of demolition, wherever possible.
 - a. Do not use a concrete breaker within 6 inches of reinforcing or structural metals that are designated to remain.
 - b. At edges that are not sawcut, remove the final 6 inches of material with a chipping hammer as defined herein. At surfaces where material is removed with a chipping hammer, follow with a heavy abrasive blast to remove all loose material and microcracking.
 - c. Alternate techniques to remove concrete may be used if acceptable to the Engineer; however, techniques other than those deemed by ICRI Guideline No. 310.2R to provide a low risk of introducing microcracking will require a subsequent

- procedure to remove loose material.
 - d. Provide final surface preparation for repairs as specified.
 - 6. At locations indicated on the Drawings that the existing reinforcing is to be preserved, remove concrete using methods that do not damage the reinforcing. Use one of the following techniques:
 - a. Hydrodemolition techniques as outlined in ICRI Guideline No. 310.3R.
 - b. Chipping hammer, as defined herein, followed by heavy abrasive blast to remove all loose material and microcracking at remaining surfaces impacted by the chipping hammer.
 - c. Alternate methods may be used, only if acceptable to the Engineer.
 - d. For all methods, provide a small completed area for Engineer's review and acceptance. If the proposed method, in the opinion of the Engineer, damages the reinforcing, revise the removal method to remove the concrete with a less aggressive technique to protect the reinforcing.
 - 7. Remove materials carefully, to the extent indicated and as required.
 - a. Provide neat and orderly junctions between existing and new materials.
 - b. Use methods that terminate surfaces in straight lines at natural points of division.
 - 8. Do not remove anything beyond the limits of Work indicated without prior written authorization of the Engineer. If in doubt about whether to remove an item, obtain written authorization of the Engineer prior to proceeding.
 - 9. Perform work so as to provide the least interference and most protection to existing facilities to remain.
 - 10. Assume possession of demolished materials, unless otherwise indicated on the Drawings or specified.
 - a. Remove demolished materials from site at least weekly and dispose of in accordance with Laws and Regulations.
 - b. Do not burn materials on site.
- B. In-place Abandonment of Pipe:
- 1. Abandoned pipe in-place as indicated on the Drawings.
 - 2. Clean buried or exposed solids service piping to a condition free of residual.
 - a. Solids service piping includes: raw wastewater (RAW WW) or other similar solids service subject to biological degradation, etc.
 - 3. Provide closure of abandoned pipe cut ends as indicated on the Drawings using one of the following methods:
 - a. Leave one end open.
 - b. Install cap.
 - c. Install plug.
 - d. Install drain valves, pressure relief valves, vents, etc.
 - e. Fill abandoned pipe as specified in Section 31 23 00- Controlled Low Strength Materials (CLSM).

- C. Sizing of openings in existing concrete or masonry:
 - 1. Make openings large enough to permit final alignment of pipe and fittings without deflections, but without oversizing.
 - 2. Allow adequate space for packing around pipes and conduit to ensure watertightness.
 - 3. If the Engineer deems the opening to be insufficient in size to accomplish this criteria, remove additional material using the procedures outlined in this Section.

- D. Cutting openings in existing concrete or masonry:
 - 1. Do not allow saw cuts to extend beyond limits of openings.
 - 2. Create openings by the following method or other means acceptable to the Engineer that prevents over-cutting of member at corners:
 - a. Core-drill through slab or wall at corners, being careful not to damage materials beyond the area to be removed.
 - b. Saw cut completely through the member, between the core holes at the corners.
 - c. As an alternate to sawcutting through the member, score the edges of the opening with a saw to a 1-inch depth on both surfaces (when accessible).
 - 1) Remove concrete or masonry to within 6 inches of material to remain with a concrete breaker.
 - 2) Remove the remaining material with a chipping hammer.
 - d. Remove the remaining material at the corners left by the core-drilling with a chipping hammer.
 - 3. Prevent debris from falling into adjacent tanks or channels in service or from damaging existing equipment and other facilities.

- E. Immediately upon discovery, remove and dispose of contaminated, vermin infested, or dangerous materials using safe means that will not endanger health of workers and public.

- F. Backfill open pits and holes caused by demolition as specified in Section 31 00 00 - Earthwork.

- G. Rough grade areas affected by demolition.

- H. Remove demolished materials, tools, and equipment upon completion of demolition.

3.4 RESTORATION

- A. General:
 - 1. Repair damage caused by demolition to conditions equal to those that existing prior to beginning of demolition.
 - a. Patch and replace portions of existing finished surfaces that are damaged, lifted, and discolored with matching material. Refinish patched portion surfaces in a manner which produces uniform color and texture to entire surface.
 - b. When existing finish cannot be matched, refinish entire surface to nearest change of plane where angle of change exceeds 45 degrees.

2. The cost of repairs shall be at the Contractor's expense at no increase in the Contract Price.
3. When new construction abuts or finishes flush with existing construction, make smooth transitions. Match finish of existing construction.
4. Where partitions are removed, patch floors, walls, and ceilings with finish materials that match existing materials.
5. Where removal of partitions results in adjacent spaces becoming one, rework floors, walls, and ceilings to provide smooth planes without breaks, steps, or bulkheads.
6. Where changes of plane exceed 2 inches, request instructions for making transition.
7. Trim and refinish existing doors as necessary to clear new floors.
8. Match patched construction with adjacent construction in texture and appearance so that patch or transition is invisible at 5-foot distance.
9. When finished surfaces are cut so that smooth transition is impossible, terminate existing surface in neat manner along straight line at natural line of division and provide appropriate trim.

B. Restore existing concrete reinforcement as follows:

1. Where existing reinforcement is to be incorporated into the new Work, protect, clean, and extend into new concrete.
2. Where existing reinforcement is not to be retained, cut off as follows:
 - a. Where new concrete joins existing concrete at the removal line, cut reinforcement flush with concrete surface at the removal line.
 - b. Where concrete surface at the removal line will become the finished surface, cut reinforcement 2 inches below the surface, paint ends with epoxy, and patch holes with dry pack mortar.

C. Restore areas affected by removal of existing equipment, equipment pads and bases, piping, supports, electrical panels, electric devices, and conduits such that little or no evidence of the previous installation remains:

1. Fill areas in existing floors, walls, and ceilings from removed piping, conduit, and fasteners with non-shrink grout and finish smooth.
2. Remove concrete bases for equipment and supports by:
 - a. Saw cutting clean, straight lines with a depth equal to the concrete cover over reinforcement minus 1/2 inch below finished surface.
 - 1) Do not cut existing reinforcement on floors.
 - b. Chip concrete within scored lines and cut exposed reinforcing steel and anchor bolts.
 - c. Patch with non-shrink grout to match adjacent grade and finish.
3. Terminate abandoned piping and conduits with blind flanges, caps, or plugs.

3.5 FIELD QUALITY CONTROL

- A. Do not proceed with demolition without Engineer's inspection of lay out.

- B. Do not deviate from the submitted demolition plan without notifying the Engineer prior to Work.

END OF SECTION 02 41 00.

SECTION 02 53 70 – INSTALLATION OF TRACE WIRE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Construction Standard governs trace wire installation on sewage lines. Trace wire shall be installed on top of all mains and service lines.

PART 2 - PRODUCTS

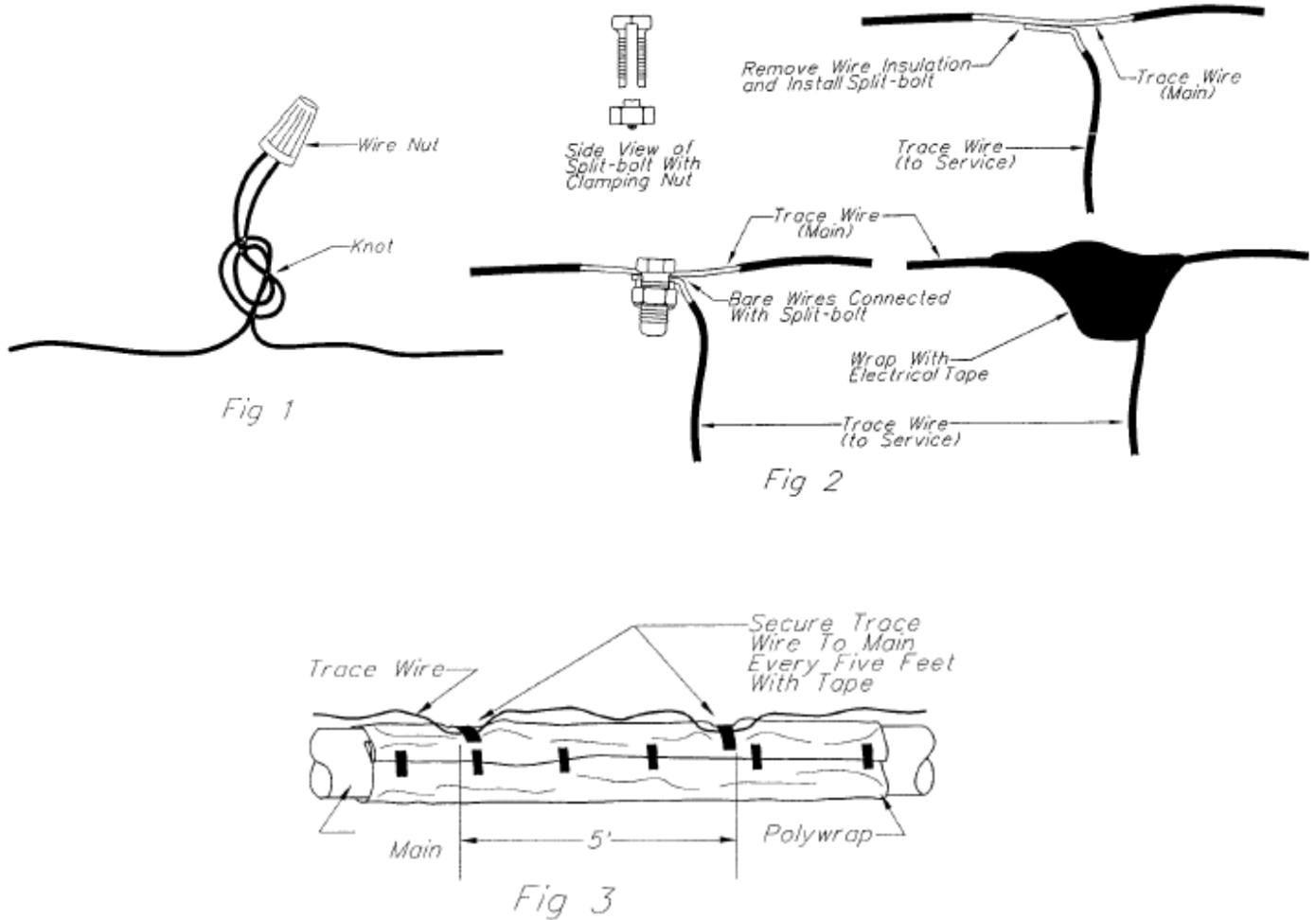
2.1 EXTRA TRACE WIRE MATERIAL

- A. Trace wire shall be #12 TW solid, coated copper wire.
- B. Blue tri-wire plastic markers by Rhino w/ Test Screws.
- C. 4 ft U-channel posts.
- D. Valve Box Top Sections.
- E. Plastic test box.
- F. Wire Nuts or Split-Bolts.

PART 3 - EXECUTION

3.1 APPROVED TRACE WIRE CONNECTIONS

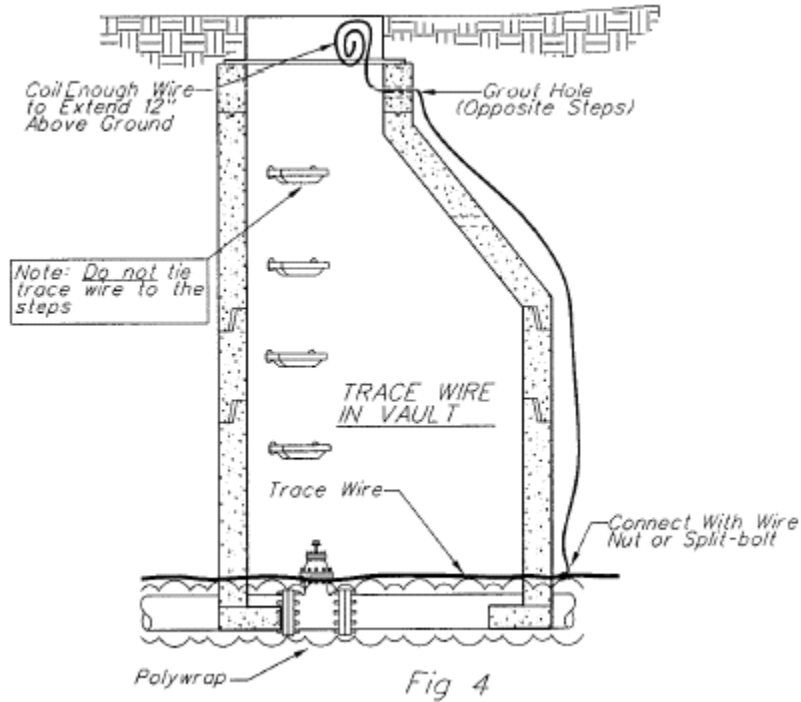
- A. When tying trace wire together, $\frac{3}{4}$ " to 1" of insulation should be removed and the bare copper wires twisted together with a wire nut. Fig 1 shows a typical splice using a plastic wire nut and tying the wire in a knot to strengthen the connection. When connecting a lead to the main run, a split-bolt may be used as shown in Fig. 2. Alternately, a 3M Scotchlok Electrical IDC 562 (or approved equal) can be used when connecting a lead to the main run. Always protect the connection with electrical tape when using the split-bolt. Alternately, 3M Heat Shrink Sleeves (or approved equal) can be used instead of electrical tape.



3.2 INSTALLATION

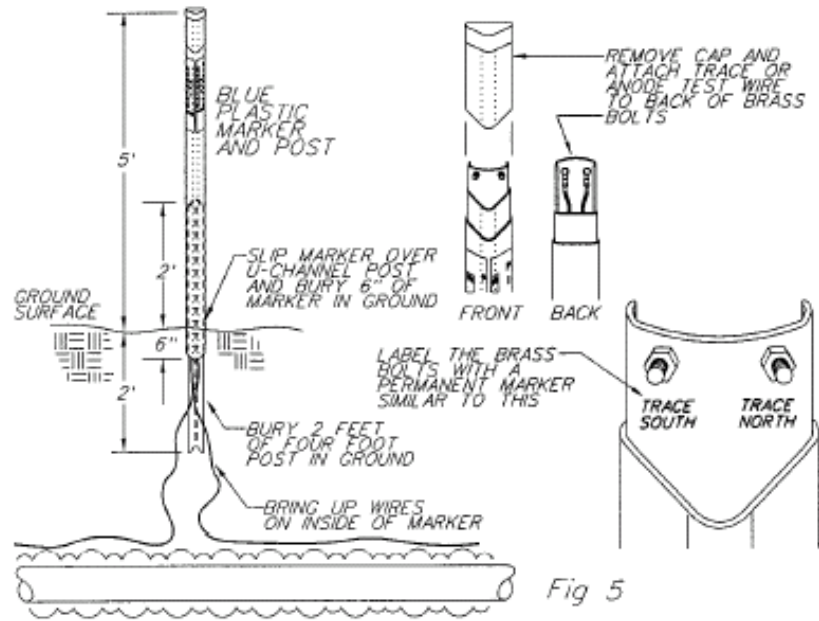
- A. Install trace wire on top of all mains and service lines and secure to pipe every five (5) feet with tape as shown in Fig 3. Provide trace wire on each service line with an access point in a protective enclosure.
- B. Bring trace wire to surface at a maximum spacing of one thousand (1,000) feet. The trace wire shall be brought to the surface in a vault, blue plastic marker, valve box top section, or in test box. Take care not to damage the wire coating. Repair damaged coating with electrical tape. Splice wire when necessary using wire nuts or split bolts. Terminate old wire runs and begin new ones at an approved access point.
- C. Trace Wire in a Vault or Manhole:
 1. When using a vault, bring the trace wire to the surface according to Fig 4. Do not wrap the trace wire around the steps or any other place where a person entering the vault could trip.
 2. When installing trace wire on gravity main, terminate the trace wire outside the manhole and bring the wire to the surface as shown in Fig 4. Do not wrap the trace wire around

the steps or any other place where a person entering the manhole could trip.



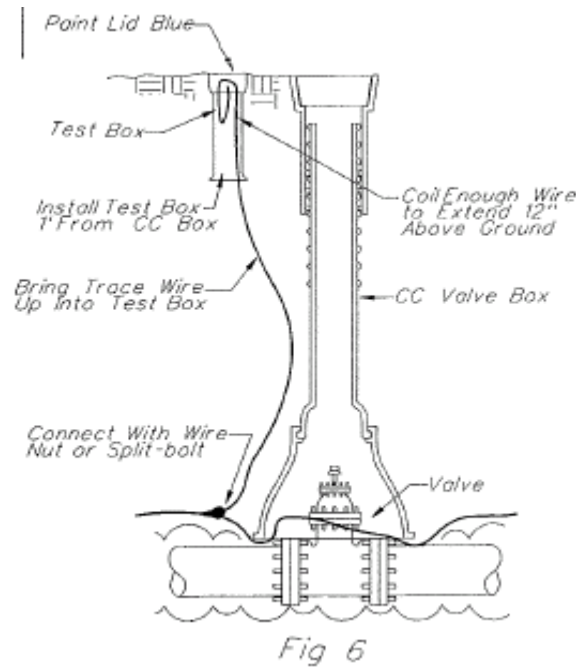
D. Trace Wire in a Blue Plastic Marker:

1. When bringing the trace wire up in a blue plastic marker, install the trace wire according to Fig 5. Bury a 4 foot u-channel post 2 feet in the ground. Run the trace wire up through the marker and slide the blue plastic marker over the post. Bury the bottom six inches of the marker. Connect the trace wire to the brass connecting screws and label the screws with a permanent marker as shown in Fig 5. Note location of trace wire marker on as-built drawings.
 - a. If a marker is used only to mark the main location and not bring up the trace wire, use the blue markers without the test point connectors.



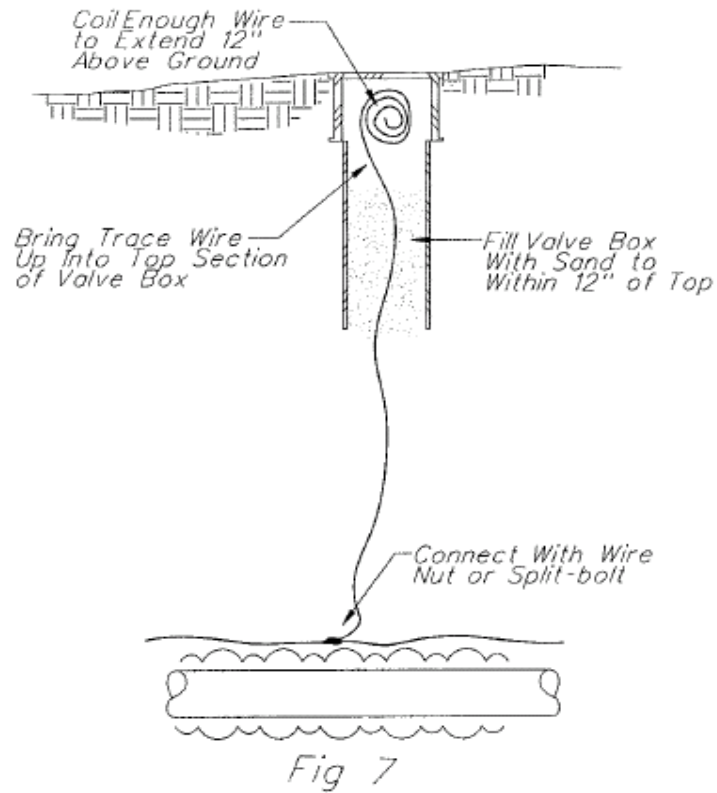
E. Trace Wire in a Test Box at a CC Valve Box

1. When bringing the trace wire at a valve box, install the trace wire in a test box about a foot from the valve box according to Fig 6. Make sure there is enough coiled wire to extend a foot above ground. Paint the lid blue. Note location of test box on as-built drawing.



F. Trace Wire in a Valve Box Top Section

1. When trace wire is to be brought to the surface in an area where a marker is not practical, a valve box top section may be used as shown in Fig 7. Coil enough wire to extend a foot above the surface of the ground. Fill with sand to a foot from the top. Spray paint the lid blue. Note location of trace wire box on as-built drawings



END OF SECTION 02 53 70

SECTION 03 31 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.2 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Form materials and form-release agents.
 - 3. Steel reinforcement and reinforcement accessories.
 - 4. Fiber reinforcement.
 - 5. Admixtures.
 - 6. Waterstops.
 - 7. Curing materials.
 - 8. Floor and slab treatments.
 - 9. Bonding agents.
 - 10. Adhesives.
 - 11. Vapor retarders.
 - 12. Epoxy joint filler.
 - 13. Joint-filler strips.
 - 14. Repair materials.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from

the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

- E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixes.
 - c. Ready-mix concrete producer.
 - d. Concrete subcontractor.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Avoid damaging coatings on steel reinforcement.
- C. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Plywood, metal or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch minimum.
- G. Form-Release Agent: Commercially formulated form-release agent that will not bond with,

stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 775, and Steel Reinforcement: ASTM A 615, Grade 60, deformed.
- C. Steel Bar Mats: ASTM A 184, assembled with clips. Steel Reinforcement: ASTM A 615, Grade 60, deformed bars.
- D. Plain-Steel Wire: ASTM A 82, as drawn.
- E. Deformed-Steel Wire: ASTM A 496.
- F. Epoxy-Coated Wire: ASTM A 884, Class A coated, plain-steel wire.
- G. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- H. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.
- I. Epoxy-Coated Welded Wire Fabric: ASTM A 884, Class A, plain steel.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.
- C. Epoxy-Coated Joint Dowel Bars: ASTM A 775; with ASTM A 615, Grade 60, plain-steel bars.
- D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. Class: Severe weathering region, but not less than 3S.
 - 2. Nominal Maximum Aggregate Size: 1 inch.
 - 3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.
- C. Lightweight Aggregate: ASTM C 330 with nominal Maximum Aggregate Size of 1 inch.
- D. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 FIBER REINFORCEMENT

- A. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
- B. Products: Subject to compliance with requirements, provide one of the following Monofilament Fibers:

1. Fibrasol IIP; Axim Concrete Technologies.
2. Fiberstrand 100; Euclid Chemical Co.
3. Fibermix Stealth; Fibermesh, Div. of Synthetic Industries.
4. Forta Mono; Forta Corporation.
5. Grace MicroFiber; W. R. Grace & Co., Construction Products Div.
6. Hi-Tech PPM Fiber; Hi-Tech Fibers, Div. of Martin Color-Fi, Inc.
7. Polystrand 1000; Metalcrete Industries.

2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes. As indicated in Profile.
- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes. As indicated in Profile.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following rubber waterstops:
 1. Rubber Waterstops:
 - a. Greenstreak.
 - b. Progress Unlimited Inc.
 - c. Westec Barrier Technologies; Div. of Western Textile Products, Inc.
 - d. Williams Products, Inc.
 2. PVC Waterstops:
 - a. Greenstreak.
 - b. Meadows: W. R. Meadows, Inc.
 - c. Murphy: Paul Murphy Plastics Co.
 - d. Progress Unlimited Inc.
 - e. Sternson Group.
 - f. Tamms Industries Co.; Div. of LaPorte Construction Chemicals North America, Inc.
 - g. Vinylex Corporation.
 - h. Westec Barrier Technologies; Div. of Western Textile Products, Inc.
- D. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete. Products are subject to comply with requirements. Provide one of the following:
 1. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
 2. Conseal CS-231; Concrete Sealants Inc.
 3. Swellseal Joint; De Neef Construction Chemicals (U.S.) Inc.
 4. Hydrotite; Greenstreak.
 5. Mirastop; Mirafi Moisture Protection, Div. of Royal Ten Cate (USA), Inc.
 6. Adeka Ultra Seal; Mitsubishi International Corporation.

7. Superstop; Progress Unlimited Inc.

2.8 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials:
 1. Polyethylene sheet, ASTM D 4397, not less than 10 mils thick:
 2. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils thick.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.
- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.10 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Epoxy Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.
- C. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to

hardened concrete.

2.11 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
 - 2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Slump: 4 inches.
 - 3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.
 - 4. Minimum Cementitious Materials Content: 540 lb/cu. yd.
- D. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements.
- E. Maximum Water-Cementitious Materials Ratio: 0.40.
- F. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated. Air content is to be 6 percent.
- G. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- H. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- I. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.
- J. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch.
 - 2. Class B, 1/4 inch.
 - 3. Class C, 1/2 inch.
 - 4. Class D, 1 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- B. Install anchor bolts, accurately located, to elevations required.
- C. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
- D. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. At least 70 percent of 28-day design compressive strength.
 - 2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
 - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.
- B. Fine-Graded Granular Material: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
- C. Granular Fill: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch. Place and compact a 1/2-inch-thick layer of fine-graded granular material over granular fill.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Limit dropping height of concrete in forms to 60 inches or less. Place each layer while the preceding layer is still plastic, to avoid cold joints.
 - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat

water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
- C. Rubbed Finish: Apply the following to smooth-formed finished concrete: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or

quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes.

- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
 - 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10-foot- long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4 inch.
- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- G. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
 - 1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 - 2. After broadcasting and tamping, apply float finish.
 - 3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still

green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining

cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed-formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be

conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample. Cast and field cure one set of four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. Test two field-cured specimens at 7 days and two at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- E. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.

END OF SECTION 03 31 00

SECTION 05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Ladders.
 - 2. Loose bearing and leveling plates.
 - 3. Shelf angles.
 - 4. Miscellaneous metal trim.
 - 5. Metal floor plate.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Extruded nosings and treads.
 - 3. Paint products.
 - 4. Grout.
- B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Samples for Verification: For each type and finish of extruded nosing and tread.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce the required units.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction,

verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
- E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.3 ALUMINUM

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.

2.4 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

2.5 GROUT

- A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 CONCRETE FILL

- A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.\
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.
- H. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

- I. Remove sharp or rough areas on exposed traffic surfaces.
- J. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.8 LADDERS

- A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
 - 1. Comply with ANSI A14.3, unless otherwise indicated.
- B. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
- C. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets. Size brackets to support design loads specified in ANSI A14.3. Hold ladder clear of wall a minimum of 7 inches from wall to centerline of rungs. If adjacent structure does not extend above the top run, goose-neck the extended rails back to the structure to provide secure ladder access.
- D. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
- E. Valve vault ladders shall include Halliday Products Series LIE Ladder Extension or approved equal.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.

2.10 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
- B. Galvanize shelf angles to be installed in exterior walls.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated. Galvanize miscellaneous steel trim located in any exterior location. Delete paragraph below if no trim is galvanized.

2.12 METAL FLOOR PLATE

- A. Fabricate raised-pattern floor plates from rolled-aluminum-alloy tread plate of thickness indicated below:
 - 1. Thickness: As indicated.
- B. Abrasive-Surface Floor Plate: Fabricate from steel plate, of thickness indicated below, with abrasive granules rolled into surface. Provide material with coefficient of friction of 0.6 or higher when tested according to ASTM C 1028.
- C. Include aluminum angle stiffeners, and fixed and removable sections as indicated.

2.13 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications.

2.14 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 SETTING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Extent of each type of dampproofing work is indicated on drawings and as follows:
 - 1. Manholes, all types and locations.
 - 2. Valve Vaults and Wet Wells.
 - 3. All underground structures or underground portions thereof.
 - 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.
- B. This Section includes the following:
 - 1. Cold-applied, cut-back asphalt dampproofing.

1.02 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. 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.
- C. 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. Installer Qualifications: Engage an experienced Installer who has completed bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record (not less than three years) of successful in-service performance. The Installer must be acceptable to manufacturer of primary materials.
- B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.04 PROJECT CONDITIONS

- A. Substrate: Proceed with dampproofing only after substrate construction and

penetrating work have been completed.

- B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.
- C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.01 BITUMINOUS DAMPPROOFING MATERIALS (BIT-DP)

- A. General: Provide bituminous dampproofing materials that comply with the following requirements or provide other similar products that are certified in writing by manufacturer of primary dampproofing materials to be superior in performance for application indicated.
- B. Manufacturer: Subject to compliance with requirements, provide coal-tar products of one of the following:
 - 1. Koppers Company, Inc.
 - 2. GAF Corporation
 - 3. Gardner-Gibson (ICP Group)
 - 4. Or approved equal

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

- A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.
- B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.
- C. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at construction joints.
- D. 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 with manufacturer's recommendations. Pay particular attention to requirements at building expansion joints, if any.

- E. Prime substrate as recommended by prime materials manufacturer.
- F. 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. Comply with manufacturer's recommendations 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. Cold Bitumen on Exterior Surfaces:
 - 1. Apply a coat of cold, semi-fibrated, semi-mastic asphalt dampproofing material, by brushing or spraying at rate certified by manufacturer to produce uniform dry film thickness of not less than 30 mils.
- C. Dampproof Protection Course:
 - 1. General: Where indicated, install protection course of type indicated, over completed-and-cured dampproofing treatment. Comply with dampproofing materials manufacturer's recommendations for method of support or attachment of protection materials. Support with spot-application of plastic cement where not otherwise indicated.

END OF SECTION 07 11 13

SECTION 07 20 00 – PROTECTIVE COATING FOR NEW CONCRETE SANITARY SEWER STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification covers work, materials and equipment required for protecting and/or rehabilitating concrete structures by spray-application of a monolithic high-build epoxy coating to eliminate infiltration, provide corrosion protection, repair voids and enhance structural integrity. Procedures for surface preparation, cleaning, application and testing are described herein.

1.2 SECTION INCLUDES

- A. Requirements for surface preparation, repairs and solvent-free epoxy coating application to specified surfaces.

1.3 RELATED SECTIONS

- A. Concrete Repair.
- B. Environmental, Health and Safety.

1.4 REFERENCES

- A. ASTM D638 - Tensile Properties of Plastics.
- B. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics.
- C. ASTM D695 - Compressive Properties of Rigid Plastics.
- D. ASTM D4541 - Pull-off Strength of Coatings Using a Portable Adhesion Tester.
- E. ASTM D2584 - Volatile Matter Content.
- F. ASTM D2240 - Durometer Hardness, Type D.
- G. ASTM D543 - Resistance of Plastics to Chemical Reagents.
- H. ASTM C109 - Compressive Strength Hydraulic Cement Mortars.
- I. ASTM C396 - Compressive Strength of Cement Mortars.
- J. ACI 506.2-77 - Specifications for Materials, Proportioning, and Application of Shotcrete.
- K. ASTM C579 - Compressive Strength of Chemically Setting Silicate and Silica Chemical

Resistant Mortars.

- L. ASTM - The published standards of the American Society for Testing and Materials, West Conshohocken, PA.
- M. NACE - The published standards of National Association of Corrosion Engineers (NACE International), Houston, TX.
- N. SSPC - The published standards of the Society of Protective Coatings, Pittsburgh, PA.

1.5 SUBMITTALS

- A. The following items shall be submitted:
 - 1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
 - 2. Material Safety Data Sheets (MSDS) for each product used.
 - 3. Project specific guidelines and recommendations.
 - 4. Applicator Qualifications:
 - a. Manufacturer certification that Applicator has been trained and approved in the handling, mixing and application of the products to be used.
 - b. Certification by the protective coating manufacturer that the equipment to be used for applying the products has been approved and Applicator personnel have been trained and certified for proper use of the equipment.
 - c. Proof of any necessary federal, state or local permits or licenses necessary for the project.
 - 5. Design details for any additional ancillary systems and equipment to be used in site and surface preparation, application and testing.

Or Equal Submittal: In order to be considered as an equal product, said product will have to meet the minimum characteristics as measured by the applicable ASTM standards referenced in paragraph 2.04 and on the Technical Data Sheets of the approved products.

Note: Equal products must be approved a minimum of three weeks prior to bid date. For a product to be considered equal the submitted product must have successfully passed the Los Angeles County evaluation of protective coatings for concrete or the product must be tested and meet or exceed the minimum standards included in this specification. A bonded third-party testing company must perform the testing. A contractor that has been licensed and trained by the manufacturer must install all products.

Prior pre-approval is required to determine if the prospective product may be bid on this project. Without prior pre-approval within the specified time frame a product may be rejected as unacceptable. This time frame allows the Engineer ample time to determine if the proposed product is an acceptable alternative.

1.6 QUALITY ASSURANCE

- A. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE and SSPC standards and the protective coating manufacturer's recommendations.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Materials are to be kept dry, protected from weather and stored under cover.
- B. Protective coating materials are to be stored between 50°F and 90°F. Do not store near flame, heat or strong oxidants.
- C. Protective coating materials are to be handled according to their material safety data sheets.

1.8 SITE CONDITIONS

- A. Applicator shall conform with all local, state and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.
- B. Method statements and design procedures are to be provided by the Owner when confined space entry, flow diversion, debris removal or bypass is necessary for Applicator to perform the specified work.

1.9 WARRANTY

- A. Applicator shall warrant all work against defects in materials and workmanship for a period of one (1) year, unless otherwise noted, from the date of final acceptance of the project. Applicator shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said one (1) year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

PART 2 - PRODUCTS

2.1 EXISTING PRODUCT

- A. Standard Portland cement or new concrete (not quick setting high strength cement) must be well cured prior to application of the protective coating. Generally, 28 days is adequate cure time for standard Portland. If earlier application is desired, compressive or tensile strength of the concrete can be tested to determine if acceptable cure has occurred. (Note: Bond strength of the coating to the concrete surface is generally limited to the tensile strength of the concrete itself.)
- B. Cementitious patching and repair materials should not be used unless their manufacturer provides information as to its suitability for top coating with an epoxy coating. Project specific submittals and procedures should be provided including application, cure time and surface

preparation procedures which permit optimum bond strength with the epoxy coating.

- C. Remove existing coatings prior to application of the new protective coating. Applicator is to maintain strict adherence to applicable NACE and SSPC recommendations with regard to proper surface preparation and compatibility with existing coatings.

2.2 MANUFACTURER

- A. Corrosion Protective Coating: Raven Lining Systems, Inc., Tulsa, Oklahoma 800-324-2810 or 918-584-2810 or FAX 918-582-4311.
- B. Cementitious Repair Material: Quadex[®], Inc, North Little Rock, AR 888-831-1650 or 501-945-3424 or FAX 501-945-3544.
- C. Or Pre-approved Equal

2.3 REPAIR MATERIALS

- A. Repair materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces, etc. as determined necessary by the engineer and protective coating applicator. Repair materials must be compatible with the specified epoxy coating and shall be applied in accordance with the manufacturer's recommendations.
- B. As an example, the following products may be accepted and approved by the protective coating manufacturer and could be used within the specifications:
 - 1. 100% solids, solvent-free epoxy grout that can be troweled or sprayed and specifically formulated for optimum epoxy top coating compatibility. The epoxy grout manufacturer shall provide instructions for epoxy top coating procedures.
 - 2. Quadex Alumiliner, factory blended, rapid setting, high early strength, fiber reinforced, non-shrink repair mortar that can be trowelled or pneumatically spray applied, has been approved and specifically formulated to be suitable for epoxy top coating. Other repair mortars should not be used unless their manufacturer provides information as to its suitability for top coating with an epoxy coating. Project specific submittals should be provided including application, cure time and surface preparation procedures which permit optimum bond strength with the epoxy coating.
 - 3. Shotcrete shall conform to all requirements of ACI-506.2-77 as published by the American Concrete Institute, Detroit, MI except as modified by these specifications. Shotcrete composed of Portland Cement, aggregate and water so proportioned as to produce a concrete suitable for pneumatic application. Shotcrete ingredients shall be selected, proportioned in such a manner as will produce sound concrete that is strong, dense and suitable for polymer top coating. Cured shotcrete shall have a minimum surface tensile strength of 300 psi. No coatings shall be applied prior to a full 28 day cure unless test patches of coatings exhibit acceptable bonding characteristics and no outgassing as prescribed herein or the repair mortar manufacturer certifies acceptable top coating parameters.

2.4 PROTECTIVE COATING MATERIAL

- A. Raven Lining Systems' Raven 405 coating system - 100% solids, solvent-free two-component epoxy resin system thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance acceptable to these specifications (up to 200 mils in a single coat).

Product type	Amine cured epoxy
Color	Light Blue
Solids Content (vol %)	100
Mix Ratio	3:1
Flexural Modulus	600,000 psi
Flexural Strength	13,000 psi
Compressive Strength	18,000 psi
Tensile Strength	7,600 psi
Tensile Elongation	1.50 %
Hardness, Type D	88
Bond Strength –	Concrete >Tensile Strength of Concrete
Sulfuric Acid,	10% Immersion Service
Sodium Hydroxide,	20% Immersion Service
MEK	Incidental Contact

2.5 PROTECTIVE COATING APPLICATION EQUIPMENT

- A. Manufacturer heated plural component spray equipment shall be used in the application of the specified protective coating.

2.6 REPAIR MORTAR SPRAY APPLICATION EQUIPMENT (IF SPRAY APPLIED)

- A. Spray applied repair mortars shall be applied with manufacturer approved equipment.

PART 3 - EXECUTION

3.1 ACCEPTABLE APPLICATORS

- A. Repair mortar applicators shall be trained to properly apply the cementitious mortar according to manufacturer's recommendations.
- B. Protective coating must be applied by a Certified Applicator of the protective coating manufacturer and according to manufacturer specifications.

3.2 EXAMINATION

- A. All structures to be coated shall be readily accessible to Applicator.
- B. Appropriate actions shall be taken to comply with local, state and federal regulatory and other

applicable agencies regarding the environment, health and safety.

- C. Any active flows shall be dammed, plugged or diverted as required to ensure that the liquid flow is maintained below the surfaces to be coated.
- D. Installation of the protective coating shall not commence until the concrete substrate has properly cured and been prepared in accordance with these specifications.
- E. Temperature of the surface to be coated should be maintained between 40°F and 120°F during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, care should be taken to apply the coating when the surface temperature is falling versus rising (ie. late afternoon into evening ... as opposed to ... morning into afternoon).

3.3 SURFACE PREPARATION

- A. Applicator shall inspect all surfaces specified to receive a protective coating prior to surface preparation. Applicator shall notify Owner of any noticeable disparity in the surfaces which may interfere with the proper preparation or application of the repair mortar and protective coating.
- B. All contaminants including: oils, grease, unsound or incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.
- C. All concrete that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface or replaced.
- D. Surface preparation method(s) should be based upon the conditions of the substrate and the requirements of the epoxy protective coating to be applied.
- E. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound concrete surface with adequate profile and porosity to provide a strong bond between the protective coating and the substrate. Generally, this can be achieved with a low pressure water cleaning using equipment capable of 5,000 psi at 5 gpm, using a zero degree rotating nozzle. Other methods such as high pressure water jetting (refer to NACE Standard No. 5/SSPC-SP12), abrasive blasting, shotblasting, grinding, scarifying or acid etching may also be used. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface that is not excessively damaged.
- F. Infiltration shall be stopped by using a material which is compatible with the specified repair mortar and is suitable for top coating with the specified epoxy protective coating.
- G. Test prepared surfaces after cleaning but prior to application of the epoxy coating to determine if a specific pH or moisture content of the concrete is required according to manufacturer's recommendations.

- H. All surfaces should be inspected during surface prep and before the repair mortar is applied.

3.4 APPLICATION OF REPAIR MATERIALS

- A. Areas where structural steel has been exposed or removed shall be repaired in accordance with the Project Engineer's recommendations.
- B. Repair materials shall meet the specifications contained herein. The materials shall be trowel or spray applied utilizing proper equipment on to specified surfaces. The material thickness shall be specified by the Project Engineer according to Owner's requirements and manufacturer's recommendations.
- C. Cementitious repair materials shall be trowelled to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the protective coating. No bug holes or honeycomb surfaces should remain after the final trowel procedure of the repair mortar.
- D. The repair materials shall be permitted to cure according to manufacturer recommendations.
- E. Application of the repair materials, if not performed by the coating certified applicator, should be inspected by the protective coating manufacturer's representative or certified applicator to ensure proper finishing for suitability to receive the specified coating.
- F. After abrasive blast and leak repairs have been performed, all surfaces shall be inspected for remaining laitance prior to protective coating application. Any evidence of remaining contamination or laitance shall be removed by additional abrasive blast, shotblast or other approved method. If repair materials are used, refer to these specifications for surface preparation. Areas to be coated must also be prepared in accordance with these specifications after receiving a cementitious repair mortar and prior to application of the epoxy coating.
- G. All surfaces should be inspected during and after preparation and before the protective coating is applied.

3.5 APPLICATION OF PROTECTIVE COATING

- A. Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.
- B. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.
- C. The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer.
- D. Specified surfaces shall be coated by spray application of a moisture tolerant, solvent-free, 100% solids, epoxy protective coating as further described herein. Spray application shall be to the following average wet film thicknesses:
Concrete, New/Smooth: 125 mils average thickness with a 100 mils minimum thickness.

(Thicknesses shown above are for general purposes only, each project should be evaluated independently, and thickness of system determined upon product, service environment, protection and restoration requirements.)

- E. Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. Air assisted spray application equipment may be acceptable, especially for thinner coats (<10 mils), only if the air source is filtered to completely remove all oil and water.
- F. If necessary, subsequent top coating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, ideally within 12 hours but no later than the recoat window for the specified product. Additional surface preparation procedures will be required if this recoat window is exceeded.
- G. (Optional) Fiberglass woven-roving fabric may be rolled into the resin or chopped glass spray applied with the resin for added tensile and flexural strength where desired, such as the crown of pipes. Sloped surfaces of the floor may be made non-skid by broadcasting aluminum oxide or silica sand into the surface prior to gelation.

3.6 TESTING AND INSPECTION

- A. During application a wet film thickness gage, such as those available through Paul N. Gardner Company, Inc. meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to ensure a monolithic coating and uniform thickness during application.
- B. After the protective coating has set hard to the touch it shall be inspected with high-voltage holiday detection equipment. Surfaces shall first be dried, an induced holiday shall then be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective coating material can be hand applied to the repair area. No spot repairs shall allow without 20 mil finish coat applied to entire structure after repairs are completed.
- C. Measurement of bond strength of the protective coating to the substrate can be made at regular intervals and along different sections of the structure (i.e.. crown of pipe, wall, invert -- every 200 ft). Bond strength can be measured in accordance with ASTM D4541. Any areas detected to have inadequate bond strength shall be evaluated by the Project Engineer. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Applicator in strict accordance with manufacturer's recommendations.
- D. A final visual inspection shall be made by the Inspector and manufacturer's representative. Any deficiencies in the finished coating shall be marked and repaired according to the procedures set forth herein by Applicator.
- E. The municipal sewer system may be put back into non-severe operational service as soon as the final inspection has taken place. However, for severe corrosion duty such as high

concentrations of acids, bases or solvents, 3 to 7 days and/or force cure by heat induction to the coated surfaces may be necessary prior to returning to service. Consult coating manufacturer for further details.

END OF SECTION 07 20 00

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- 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:
 - 1. Pavement and sidewalk joints.
 - 2. Concrete construction joints where indicated on the drawings.
 - 3. Concrete and masonry control joints.
 - 4. Door frames to masonry joints.
 - 5. Floor joints (interior).
 - 6. Wall joints (exterior).
 - 7. Flashing and coping joints.
 - 8. Gasketing of assemblies.

1.2 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.

1.3 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.

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

PART 2 - PRODUCTS

2.1 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):
 - a. Dow Corning Corp.; Midland, MI
 - b. General Electric Co.; Waterford, NY
 - c. Gibson-Homans Co.; Waterford, NY
 - d. W.R. Meadows, Inc.; Elgin, IL
 - e. Pecora Corp.; Harleysville, PA
 - f. Sika Chemical Corp.; Lindhurst, NJ
 - g. Sonneborn, A Division of Rexnord; Minneapolis, MN
 - h. Tremco, Inc.; Cleveland, OH
 - i. Woodmont Products Inc.; Huntingdon Valley, PA
 - j. Or approved equal.
 - 2. Manufacturers of Joint Fillers/Sealant Backers:
 - a. Dow Chemical Co.; Midland, MI
 - b. Hercules, Inc.; Middletown, DE
 - c. W.R. Meadows, Inc.; Elgin, IL
 - d. Sonneborn, A Division of Rexnord, Minneapolis, MN
 - e. Woodmont Products, Inc.; Huntingdon Valley, PA
 - f. Or approved equal.

2.2 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 non-tracking 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 non-sag 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 that 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, non-sag, 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 no 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 non-absorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type that will not be deteriorated by sealant application temperature as indicated.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work

is to be performed and must notify the 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.

3.2 JOINT PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements.
 - 1. 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.
 - 2. 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.
 - 3. Remove laitance and form release agents from concrete.
 - 4. 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:
 - 1. Prime joint substrates where indicated, or where recommended by sealant manufacturer based on pre-construction 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:
 - 1. 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.

3.3 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).
- G. 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.
- H. 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.
- I. Spillage:
 - 1. 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.
- J. Do not overheat or reheat hot-applied sealants; discard (do not use).
- K. 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.
- L. 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.

3.4 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 that will minimize increases in modulus of elasticity and other accelerated aging effects. Replace or restore sealants that are damaged or deteriorated during construction period.

END OF SECTION 07 92 00

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. THHN/THWN copper conductor, rated 600V.
2. Connectors, splices, and terminations rated 600 V.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 COPPER WIRE

- A. Description: THHN/THWN, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V.
- B. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. RoHS compliant.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

2.02 CONNECTIONS

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

PART 3 - EXECUTION

3.01 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.02 IDENTIFICATION

- A. Identify and color-code conductors and cables according from Owner.
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.03 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression or exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.

- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

3.04 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.05 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes and connect to the service grounding electrode conductor.

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- B. Perform resistance testing and provide results to engineer for review and approval. Test results shall indicate a resistance of 5 ohms or less.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

1.03 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame Rating: Class 1.
 - 2. Self-extinguishing according to ASTM D 635.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
 - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 2. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 3. Channel Width: Selected for applicable load criteria.
 - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Stainless-steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 3. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 4. Toggle Bolts: Steel springhead type.
 - 5. Hanger Rods: Threaded steel.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1
 - 2. NECA 101
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps, single-bolt conduit clamps and single-bolt conduit clamps using spring friction action for retention in support channel.

- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Spring-tension clamps.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Metal conduits and fittings.
 2. Nonmetallic conduits and fittings.
 3. Boxes, enclosures, and cabinets.
 4. Handholes and boxes for exterior underground cabling.

1.02 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of other (non-electrical) items involved.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:
1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. GRC: Comply with ANSI C80.1 and UL 6.
 3. IMC: Comply with ANSI C80.6 and UL 1242.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch, minimum.
 4. EMT: Comply with ANSI C80.3 and UL 797.
 5. FMC: Comply with UL 1; zinc-coated steel or aluminum.
 6. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Fittings, General: Listed and labeled for type of conduit, location, and use.

3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 4. Fittings for EMT:
 - a. Material: Steel
 - b. Type: Compression.
 5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- C. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

- A. Listing and labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
1. ENT: Comply with NEMA TC 13 and UL 1653.
 2. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
 3. LFNC: Comply with UL 1660.
- B. Nonmetallic Fittings:
1. Fittings, General: Listed and labeled for type of conduit, location, and use.
 2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 3. Fittings for LFNC: Comply with UL 514B.
 4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, with gasketed cover.
- F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

H. Cabinets:

1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.04 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77. Tier 15 rated. Coordinate Tier Rating with Civil/Structural Engineer
2. Standard: All concrete installed shall comply with FAA specifications P-610.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." Or other approved lettering.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Underground Conduit: Type EPC-40-PVC.
3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Do not install raceways or electrical items on any “explosion-relief” walls or rotating equipment.
- C. Do not fasten conduits onto the bottom side of a metal deck roof.
- D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- I. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35 mm) trade size and insulated throat metal bushings on 1-1/2-inch (41 mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Conduit extending from interior to exterior of building.
 - 4. Conduit extending into pressurized duct and equipment.
 - 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - 6. Where otherwise required by NFPA 70.
- R. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations: Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.

- b. Outdoor Locations: Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- W. Locate boxes so that cover or plate will not span different building finishes.
- X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom for pipe less than 6 inches (150 mm) in nominal diameter.
 2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to

provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal.

3. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.04 "INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.06 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. GFCI receptacles, 125 V, 20 A.

1.02 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Device Color:

1. Wiring Devices Connected to Normal Power System: Gray unless otherwise indicated or required by NFPA 70 or device listing.
- F. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Standards: Comply with UL 498.
 4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

2.03 GFCI RECEPTACLES, 125 V, 20 A

- A. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 2. Configuration: NEMA WD 6, Configuration 5-15R.
 3. Type: Feed through.
 4. Standards: Comply with UL 498 and UL 943 Class A.
 5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.04 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with cover.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

B. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

C. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

3.02 GFCI RECEPTACLES

- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.03 FIELD QUALITY CONTROL

- A. Tests for Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- B. Wiring device will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Enclosures.

1.02 DEFINITIONS

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuse Pullers: Two for each size and type.

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.07 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with NFPA 70.

2.02 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:
 1. Single throw.
 2. Three pole.
 3. 600-V ac.
 4. 200 A and smaller.
 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Hookstick Handle: Allows use of a hookstick to operate the handle.
 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.03 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.02 PREPARATION

3.03 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Outdoor Locations: NEMA 250, Type 3R.

3.04 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install fuses in fusible devices.
- C. Comply with NFPA 70 and NECA 1.

3.05 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.

- a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify correct phase barrier installation.
 - i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.06 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 2. Excavating and backfilling for buildings and structures.
 3. Drainage course for slabs-on-grade.
 4. Subbase course for concrete walks and pavements.
 5. Base course for asphalt paving.
 6. Subsurface drainage backfill for walls and trenches.
 7. Excavating and backfilling trenches within building lines.
 8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

1.2 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations.
1. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- K. Utilities include on-site underground pipes, conduits, ducts, and cables.

1.3 SUBMITTAL

- A. Product Data: For the following:
 - 1. Each type of plastic warning tape.
 - 2. Drainage fabric.
 - 3. Separation fabric.
- B. Samples: For the following:
 - 1. 30-lb samples, sealed in airtight containers, of each proposed soil material from on-site or borrow sources.
 - 2. 12-by-12-inch sample of drainage fabric.
 - 3. 12-by-12-inch sample of separation fabric.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

1.4 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Includes suitable approved materials from excavations and borrow areas(s). Shall be friable sandy or silty clay containing fine material sufficient to provide dense mass free of voids and capable of satisfactory compaction. Shall be free of roots or other organic matter, refuse, cinders, ice, snow, frozen earth, or other unsuitable matter. Do not use material containing gravel, stones, or shale particles greater in dimension than one-half the depth of the layer to be compacted. 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. No rock greater than one (1) foot, measured along its longest axis, shall be placed within two (2) feet of a structure.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- H. Bedding: Embedment for ordinary trench conditions for eight-inch (8") nominal diameter through fifteen-inch (15") nominal diameter PVC gravity sewer line is compacted ASTM D2487 Class IB dense graded, clean, manufactured and processed aggregates described as angular crushed stone, crushed rock, crushed gravel, or crushed stone/sand mixtures containing little or no fines with gradations selected to minimize migration of adjacent soils with amounts finer than each square opening laboratory sieve as mass percent of 100 percent passing a 3/4-inch sieve, 30-55 percent passing a 1/2-inch sieve, 0-15 percent passing a No. 4 sieve, and 0-5 percent passing a No. 8 sieve compacted to 85% or greater standard proctor density and tested to ensure proper compaction.

<u>Sieve</u>	<u>% Passing</u>
¾"	100
½"	30-55
No. 4	0-15
No. 8	0-5

- I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No. 8 sieve.
- J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1- inch sieve and 0 to 5 percent passing a No. 4 sieve.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- L. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 3 percent organic material content; free of subsoil, clay lumps, gravel, stones, and other objects more than 1 inch in diameter in any dimension; and free of weeds, roots, and other deleterious materials harmful to plant growth. Topsoil shall contain less than 5% by volume of stones, rocks, and gravel.
 - 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Where surface soils do not meet the requirements of this section and/or where quantities of surface soils that do meet this section of this specification are insufficient, use imported or manufactured soils from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.
- B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength: 110 lbf; ASTM D 4632.
 - 2. Tear Strength: 40 lbf; ASTM D 4533.

3. Puncture Resistance: 50 lbf; ASTM D 4833.
 4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D 4491.
 5. Apparent Opening Size: No. 50; ASTM D 4751.
- C. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
1. Grab Tensile Strength: 200 lbf; ASTM D 4632.
 2. Tear Strength: 75 lbf; ASTM D 4533.
 3. Puncture Resistance: 90 lbf; ASTM D 4833.
 4. Water Flow Rate: 4 gpm per sq. ft.; ASTM D 4491.
 5. Apparent Opening Size: No. 30; ASTM D 4751.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 BLASTING

- A. Blasting will not be permitted on this project.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete form work, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated. Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One block or 400 feet (whichever is the shorter) shall be the maximum length of open trench permitted on any line under construction.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Only sewer lines shall be placed in the Owner's trench. No other utilities will be permitted inside the trench.

3.8 APPROVAL OF SUBGRADE

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Engineer.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Place and compact initial backfill of bedding material, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- D. Coordinate backfilling with utilities testing.
- E. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- F. For areas not under pavement, place and compact final backfill of satisfactory soil material to final subgrade.
- G. For areas under pavement, place and compact final backfill using bedding material to final subgrade.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. No rock greater than one (1) foot, measured along its longest axis, shall be placed within two (2) feet of any structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as

indicated. Place a 6-inch course of filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 12 inches of filter material and wrap in drainage fabric, overlapping sides and ends at least 6 inches.

1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches.
1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698.
 2. Place and compact impervious fill material over drainage backfill to final subgrade.

3.18 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course on prepared subgrade and as follows:
1. Place base course material over subbase.
 2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
 3. Shape subbase and base to required crown elevations and cross-slope grades.
 4. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
 5. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.
- B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 DRAINAGE COURSE

- A. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:
1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
 2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.
 3. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses (1 year), remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

3.23 TRENCH SETTLEMENT

- A. Any settlement of the trench within the warranty period for the project will be corrected by the contractor at his own expense.

END OF SECTION 31 00 00.

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Protecting existing trees and vegetation to remain.
 2. Removing trees and other vegetation.
 3. Clearing and grubbing.
 4. Topsoil stripping.
 5. Removing above-grade site improvements.
 6. Disconnecting, capping or sealing, and abandoning site utilities in place.
 7. Disconnecting, capping or sealing, and removing site utilities.

1.2 DEFINITIONS

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 3 percent organic material content; free of subsoil, clay lumps, gravel, stones, and other objects more than 1 inch in diameter in any dimension; and free of weeds, roots, and other deleterious materials harmful to plant growth. Topsoil shall contain less than 5% by volume of stones, rocks, and gravel.
1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Where surface soils do not meet the requirements of section 1.02.A of this specification and/or where quantities of surface soils that do meet section 1.02.A of this specification are insufficient use imported or manufactured soils from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

1.3 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.4 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings according to Division 1.

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. Protect existing site improvements to remain from damage during construction.
 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

- A. Trees within permanent easements may be removed unless noted otherwise. Trees within temporary easements shall be removed only with approval of engineer and Owner as required for construction.
- B. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.

- 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- C. Do not excavate within drip line of trees, unless otherwise indicated.
- D. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- E. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.
 - 1. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.3 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange to shut off indicated utilities with utility companies.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineer's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 4. Use only hand methods for grubbing within drip line of remaining trees.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material,

unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Limit height of topsoil stockpiles to 72 inches.
 2. Do not stockpile topsoil within drip line of remaining trees.
 3. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 10 00.

SECTION 31 23 00 – CONTROLLED LOW STRENGTH MATERIAL (CLSM)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Controlled Low Strength Material (CLSM) mix design shall consist of Portland cement, fine aggregate, water and chemical admixtures to accelerate cure time and entrained air.
- B. The actual mix design shall be determined by the producer of the CLSM within these guidelines.

1.2 REFERENCE STANDARDS

- A. Referenced ASTM:
 - 1. ASTM C 12 Standard Practice for Installing Vitrified Clay Pipe Lines
 - 2. ASTM C 33 Standard Specification for Concrete Aggregates
 - 3. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 4. ASTM C 138 Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
 - 5. ASTM C 143 Standard Test Method for Slump of Hydraulic Cement Concrete
 - 6. ASTM C 150 Standard Specifications for Portland Cement
 - 7. ASTM C 226 Standard Specifications for Air-Entrained Additions for use in the Manufacture of Air Entrained Hydraulic Cement
 - 8. ASTM C 403 Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
 - 9. ASTM C 494 Standard Specifications for Chemical Admixtures
 - 10. ASTM C 618 Standard Specifications for Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - 11. ASTM C 684 Standard Test Method for Making, Accelerated Curing, and Testing Concrete Compression Test Specimen
 - 12. ASTM C 684 Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)

PART 2 - PRODUCT

2.1 PORTLAND CEMENT

- A. Portland cement shall meet the requirements of ASTM C 150, Type II, V or a combination thereof, including Section 03 30 00 – Cast In Place Concrete.

2.2 FINE AGGREGATES

- A. Aggregates shall conform to ASTM C 33 and Section 03 30 00 – Cast In Place Concrete Specifications, except as follows: Aggregates shall be pretested in CLSM mixtures similar to

those anticipated for the work, confirming their ability to perform as required for the specific application. Fine aggregates will be 75% - 80% of total aggregate by weight.

2.3 COARSE AGGREGATES

- A. Aggregates shall conform to ASTM C 33 and Section 03 30 00 – Cast In Place Concrete of the EMWD Specifications, be 3/8" in size, except as follows: Aggregates shall be pretested in CLSM mixtures similar to those anticipated for the work, confirming their ability to perform as required for the specific application. Coarse aggregates will be 20% - 25% of total aggregate by weight.

2.4 WATER

- A. Water shall be free of oils, acids, alkalies, organic matter or other deleterious substances.

2.5 ACCELERATOR

- A. Chemical admixtures for the use in accelerating the CLSM cure time shall be 4% of the cement content. CaCl shall not be used because of its corrosive nature and the availability of admixtures specifically designed for the purpose. Accelerating admixtures shall meet the requirements of ASTM C 494.

2.6 AIR ENTRAINMENT

- A. Chemical admixtures shall be specifically designed for air entrainment and meet the requirements of ASTM C 226.
- B. The mix shall have 15% - 20% air entrainment including entrapped air.

2.7 SLUMP

- A. Slump shall have 8 inch +/- 1 inch spread diameter using a three (3) inch diameter by six (6) inch long cylinder and shall meet the requirements of ASTM D 6103.

2.8 COMPRESSIVE STRENGTH

- A. The 28 day compressive strength of the CLSM shall be 100 psi to 300 psi per ASTM C 39.

2.9 PENETROMETER

- A. A penetrometer shall be used to determine the set time for the placed CLSM and meet the requirements of ASTM C 403.
- B. The penetrometer must have a maximum load reading of 700 psi and have a one (1) square inch by one (1) inch long cylinder foot attachment to a 1/4 inch diameter pin. ASTM C 403 for

configuration.

- C. The penetrometer shall be inserted into the CLSM to a depth of one (1) inch and the reading recorded.
- D. The load readings on the penetrometer are not the compressive strength of the CLSM as measured by the standard concrete cylinder test.

PART 3 - EXECUTION

3.1 MIXING

- A. The supplier shall determine the unit weights based upon the specific gravity of the fine and coarse aggregate. The ratio shall be 75% - 80% fine aggregate to 20% - 25% coarse aggregate by weight.
- B. Adjustment of the mixture to achieve improved placement characteristics shall be through the use of chemical admixtures. No increase in water content or water to cement ratio will be allowed.
- C. Admixtures shall be added per the suppliers' recommendations.
- D. Water shall be added as specified and yield a slump as above.

3.2 TESTING

- A. CLSM shall be tested for plastic unit weight. Unit weight shall be determined in accordance with ASTM C138.
- B. CLSM's consistency shall be tested by the slump method. The slump shall be measured in accordance with ASTM C143.
- C. Penetrometer readings shall be made.

3.3 PLACEMENT

- A. Refer to ASTM C 12 for bedding details.
- B. CLSM must be thoroughly mixed in the delivery truck immediately before discharge and carefully placed by tremme, chute, conveyer, bucket or pump and placed on top of the pipe and alternating equally on both sides of the pipe in a manner so as not to move the pipe from the installed position. CLSM should not be free fall placed from a height greater than seven (7) feet or impact against the trench walls.
- C. Vibratory equipment must not be used.

END OF SECTION 31 23 00.

SECTION 32 11 00 – GRANULAR PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes crushed rock base and surface course.

1.2 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.

1.3 QUALITY ASSURANCE

- A. Applicable Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. C117 - Material Finer than 76-um (No. 200) Sieve in Mineral Aggregates by Washing.
 - b. C131 - Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - c. C136 - Sieve or Screen Analysis of Fine and Coarse Aggregates.
 - d. D423 - Liquid Limit of Soils.
 - e. D424 - Plastic Limit and Plasticity Index of Soils.
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. 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

2.1 GENERAL

- A. Crushed Rock base and surface course shall consist of aggregate specified.

2.2 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:

Percent by Weight Passing Square-Mesh Sieve		
Sieve Designation	Surface Course	Base Course
1-inch	100	100
1/2-inch	--	60-90
3/8-inch	65*	--
No. 4	--	40-60
No. 10	5-25	--
No. 40	--	15-35

*Indicates Maximum

2.3 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

3.1 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.
- 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 vegetative 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 vegetative matter from the surface of the ground.
3. Grub and dispose of all vegetative 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.

3.2 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.

3.3 MAINTENANCE

- A. Maintain finished base course in a condition satisfactory to the Engineer until job completion or until surface is placed upon it.

3.4 WAYBILLS AND DELIVERY TICKETS

- A. Submit daily to the Engineer during progress of work.

END OF SECTION 32 11 00.

SECTION 32 12 16 – HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt patching.
 - 3. Hot-mix asphalt overlays.
 - 4. Asphalt surface treatments.
 - 5. Pavement-marking paint.
 - 6. Hot-mix asphalt curbs.
 - 7. Wheel stops.

1.2 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the standard specifications of the state or of authorities having jurisdiction.

1.3 SUBMITTALS

- A. Product Data: For each product specified. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Job-Mix Designs: For each job mix proposed for the Work.
- D. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international graphics symbol.
- E. Samples: 12 by 12 inches minimum, of paving fabric.
- F. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.
- G. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.
- H. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. **Manufacturer Qualifications:** Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.
- C. **Testing Agency Qualifications:** Demonstrate to Engineer's satisfaction, based on Engineer's evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- D. **Regulatory Requirements:** Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.
- E. **Asphalt-Paving Publication:** Comply with AI's "The Asphalt Handbook," except where more stringent requirements are indicated.
- F. **Preinstallation Conference:** Conduct conference at Project site to review methods and procedures related to asphalt paving including, but not limited to, the following:
 - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - 2. Review condition of substrate and preparatory work performed by other trades.
 - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - 4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving Installer's personnel, and equipment required to execute the Work without delays.
 - 5. Review inspection and testing requirements, governing regulations, and proposed installation procedures.
 - 6. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag; complying with ASTM D 692.
- C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073.
 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.

2.2 ASPHALT MATERIALS

- A. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.
- C. Undersealing Asphalt: ASTM D 3141, pumping consistency.
- D. Prime Coat: ASTM D 2027; medium-curing cutback asphalt; MC-30, MC-70, or MC-250.
- E. Prime Coat: Asphalt emulsion prime coat material shall conform to Missouri Standard Specifications for Highway Construction, Section 408.
- F. Tack Coat: Asphalt emulsion tack coat material shall conform to Missouri Standard Specifications for Highway Construction, Section 409.
- G. Fog Seal: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

- H. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073, Grade Nos. 2 or 3.
- C. Paving Geotextile: Nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot, and mildew.
- D. Pavement-Marking Paint: Alkyd-resin type, ready-mixed, complying with FS TT-P-115, Type I, or AASHTO M-248, Type N.
- E. Pavement-Marking Paint: Latex, water-base emulsion, ready-mixed, complying with FS TT-P-1952.
- F. Glass Beads: AASHTO M-247.
- G. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, approximately 6 inches high, 9 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside, and provide holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, diameter 3/4 inch, minimum length 10 inches.

2.4 MIXES

- A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: As indicated.
 - 3. Surface Course: As indicated.
- B. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Provide mixes complying with the composition, grading, and tolerance requirements of ASTM D 3515 for the following nominal, maximum aggregate sizes:
 - a. Base Course: 1 inch.
 - b. Surface Course: 1/2 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Notify Engineer in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 COLD MILLING

- A. Clean existing paving surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement, including hot-mix asphalt and, as necessary, unbound-aggregate base course, by cold milling to grades and cross sections indicated.
 - 1. Repair or replace curbs, manholes, and other construction damaged during cold milling.

3.3 PATCHING AND REPAIRS

- A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.
 - 1. Tack coat faces of excavation and allow to cure before paving.
 - 2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
 - 3. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
 - 1. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
 - 2. Remove disintegrated or badly broken pavement. Prepare and patch with hot-mix asphalt.
- C. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

- D. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of 1/4 inch. Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.
- E. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. of surface.
 - 1. Allow tack coat to cure undisturbed before paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat when formulated by manufacturer for that purpose.
- C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 72 hours minimum.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.

3.5 GEOTEXTILE INSTALLATION

- A. Apply bond coat, consisting of asphalt cement, uniformly to existing surfaces at a rate of 0.20 to 0.30 gal./sq. yd.
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.
 - 1. Protect paving geotextile from traffic and other damage and place overlay paving the same day.

3.6 HOT-MIXING ASPHALT PLACING

- A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide, except where infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

- A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat.
 - 2. Offset longitudinal joints in successive courses a minimum of 6 inches.
 - 3. Offset transverse joints in successive courses a minimum of 24 inches.
 - 4. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints

and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to ASTM D 1559, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.10 ASPHALT CURBS

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat,

unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F.

1. Asphalt Mix: Same as pavement surface-course mix.
- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.11 SURFACE TREATMENTS

- A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. Lightly dust areas receiving excess fog seal with a fine sand.
- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
 1. Roll slurry seal to smooth ridges and provide a uniform, smooth surface.

3.12 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.
- B. Allow paving to cure for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal.

3.13 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than 2 galvanized steel dowels embedded in precast concrete at one-third points. Firmly bond each dowel to wheel stop and to pavement.
 1. Extend upper portion of dowel 5 inches into wheel stop and lower portion a minimum of 5 inches into pavement.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.
 1. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 1559, and compacted according to job-mix specifications.
 2. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 3. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 32 12 16.

SECTION 32 13 13 – PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of portland cement concrete paving is shown on drawings, including curbs, gutters, walkways and pavement.
- B. Prepared subbase is specified in "Earthwork" section.
- C. Concrete and related materials are specified in Division 3.
- D. Joint fillers and sealers are specified in Division 7.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

1.4 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

2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
 - 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
 - 2. Coat with a non-staining form release agent that will not discolor or deface surface of concrete.
- B. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40 or Grade 60.
- C. Fabricated Bar Mats: Welded or clip-assembled steel bar or rod mats, ASTM A 184. Use ASTM A 615, Grade 40 steel bars, unless otherwise indicated.

- D. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and other required materials.
- E. Expansion Joint Materials: Comply with requirements of applicable Division 7 sections for preformed expansion joint fillers and sealers.
- F. Liquid Membrane Forming Curing Compound: Complying with ASTM C 309, Type I, Class A unless other type acceptable to Engineer. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to the following:
 - a. "Masterseal"; Master Builders.
 - b. "J-20 Acrylic Cure"; Dayton Superior.
 - c. "Kure-N-Seal"; Sonneborn-Contech.
 - d. "L&M Cure"; L & M Construction Chemicals.
 - e. "LR-152"; Protex Industries.
 - f. or approved equal.
- G. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "J-40 Bonding Agent"; Dayton Superior Corp.
 - b. "Weldcrete"; Larsen Products.
 - c. "Everbond"; L & M Construction Chemicals.
 - d. "EucoWeld"; Euclid Chemical Co.
 - e. "Hornweld"; A. C. Horn.
 - f. "Sonocrete", Sonneborn-Contech.
 - g. "Acrylic Bondcrete"; The Burke Co.
 - h. or approved equal.
- H. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "Epoxtite", A. C. Horn.
 - b. "Edoco 2118 Epoxy Adhesive"; Edoco Technical Prod.
 - c. "Sikadur Hi-Mod"; Sika Chemical Corp.
 - d. "Euco Epoxy 463 or 615"; Euclid Chemical Co.
 - e. "Patch and Bond Epoxy"; The Burke Co.
 - f. "Sure-Poxy"; Kaufman Products Inc.
 - g. or approved equal.

2.2 CONCRETE MIX, DESIGN AND TESTING

- A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling

and testing, and quality control.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Remove loose material from compacted subbase surfaces immediately before placing concrete.
- B. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.2 FORM CONSTRUCTION

- A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- B. Check completed form work for grade and alignment to following tolerances:
 - 1. Top of forms not more than 1/8" in 10'.
 - 2. Vertical face on longitudinal axis, not more than 1/4" in 10'.
- C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT

- A. Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

3.4 CONCRETE PLACEMENT

- A. General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as herein specified.
- B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

1. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 2. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.
 3. When adjacent pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained sufficient strength to carry loads without injury.
- D. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as required before placement. Set mats for a minimum 2" overlap to adjacent maps.
- E. Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike-off and screed.
1. Remove and replace portions of bottom layer of concrete which has been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Engineer.
- F. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.5 JOINTS

- A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.
1. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Weakened Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness as follows:
1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
 2. Sawed Joints: Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
 3. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.
- C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such

placements terminate at expansion joints.

1. Construct joints as shown or, if not shown, use standard metal keyway-section forms.
- D. Expansion Joints: Provide premolded joint filler for expansion joints, putting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.
1. Extend joint fillers full width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surfaces.
 2. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.
 3. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
- E. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

3.6 CONCRETE FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- B. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
- C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
- D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
1. Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Engineer.
- E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Engineer.

3.7 CURING

- A. Protect and cure finished concrete paving, complying with applicable requirements of Division 3 sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

3.8 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete, as directed by Engineer.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement unless specified otherwise. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION 32 13 13

SECTION 32 31 13 – CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Fencing shall be chain link with three-strand barbed wire extension provided in the alignment indicated on the drawings.
- B. The height shall be as shown on the drawings.

1.2 SUBMITTALS

- A. Submit manufacturer's product specifications and installation instructions.

PART 2 - PRODUCTS

2.1 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 or surface area conforming to Standard specification ASTM F1083; or
 - 2. Type II – Pipe manufactured from steel conforming to ASTM A569, cold-formed, high frequency or induction welded and having a minimum yield strength of 50,000 PSI. External surface triple coated per ASTM F1043, 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 maximum of 5% red rust in a test conducted in accordance with ASTM B117. Internal surface coated per ASTM F1043, 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. Fabric to be zinc-coated 9 gauge wire woven in a 2" diamond mesh.

2. Top selvage shall be twisted and barbed. Bottom selvage shall be knuckled.
3. Fabric shall be galvanized after weaving with a minimum 2.0 ounces of zinc per square foot of surface area and conform to ASTM A392, Class II.

2.2 CONCRETE MIX

- A. ASTM C 94 Portland Cement concrete, air entrained, with maximum ¾” aggregate having a minimum compressive strength of 4,000 PSI at 28 days. Conform to Division 3 specification requirements.

2.3 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 9'	2-1/2"	3"
9' to 12'	3"	4"

- B. Gate Posts:

Single Gate Width	Double Gate O.D.	Post O.D. Type II
Up to 6'	Up to 12'	4"
Up to 16'	13' to 25'	6 5/8"

- 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
 - a. over posts to exclude moisture. Supply cone type caps for terminal posts and loop
 - b. type for line posts. All fittings shall conform to ASTM F626.

2. Rail and Brace Ends – Pressed steel, cast iron or cast aluminum alloy, cup-shaped
 - a. 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 3/4” 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, cast iron or cast aluminum alloy fitted with clips
 - a. or slots for attaching three strands or barbed wire. Arms shall be set outward on a 45 degree
 - b. angle and be capable of supporting a 250 pound load at outer barbed wire connecting point
 - c. without causing permanent deflection.
- F. Tension Wire: Marcellled 7 gauge steel wire minimum coating of 0.80 ounces of zinc or 0.40ounces of aluminum per square foot of wire surface and conforming to ASTM A824.
- G. Tie Wires: Aluminum, 9 gauge, alloy 1100-H4 or equal.
- H. Hog Rings: Steel wire, 11 gauge, with a minimum zinc coating or 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 A121 or a minimum of 0.30 ounces of aluminum per square foot of wire surface conforming to ASTM A-585.
- J. Padlocks: Keyed alike for all gates, provided 4 keys for each padlock required.

PART 3 - EXECUTION

3.1 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.

3.2 INSTALLATION

- A. General:
 1. Conform to ASTM F567, except as modified herein.
 2. Conform to the alignment and finished grade indicated on the drawings. 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.

3. Concrete footings for line and terminal posts shall be 42 inches deep. Concrete footings for gate posts shall be 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. Concrete footings shall be of a uniform thickness around the post, shall extend above the finish ground surface, and shall be crowned approximately one inch. Concrete for footings shall conform to Specification Division 03. Each footing shall be cured for at least 72 hours before further work is done on the post.
4. 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.
5. Attach fabric to the top rail and bottom tension wire at 24 inches centers and to the line posts at 15-inch centers. Fasten barbed wire to each extension arm by internal clips or external fabric ties. Provide stretcher bars 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.
6. Brace each gate and terminal post by a horizontal pipe brace and an adjustable truss extending to an adjacent line post. Brace corner posts in both directions.

B. Gates:

1. 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.
2. 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.
3. Install gates 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 32 31 13

SECTION 32 80 00 – IRRIGATION SPRAYER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Irrigation sprayer system including rain gun nozzle, tripod, piping, fittings, anchors and supports.

1.2 SUBMITTALS

- A. Product Data: Dimensional drawings and submittal specifications.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A manufacturer experienced with machine and fabrication of rain gun nozzles and accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle irrigation sprayer equipment and accessories per manufacturer recommendations.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Sime Ambo; or approved equal.

2.2 Rain Gun Nozzle

- A. Configuration:
 - 1. Dual port sprinkler with secondary stream nozzle located above main barrel to cover close and intermediate ranges.
 - 2. Jet stream breaker shall be located on main barrel.
 - 3. Drive arm shall be located on secondary stream.
- B. Drive Mechanism: Spring Arm Impact.

- C. Material: Heavy cast aluminum body with brass drive arm and brass lower turning union.
- D. Trajectory: 30 degrees.
- E. Base: 1.5" FNPT.
- F. Operation: Nozzle shall allow for full-circle rotation with a 40-55 foot throw.
- G. Installation: Nozzle shall be suitable for above-grade installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer recommendations.

END OF SECTION 32 80 00.

SECTION 32 92 00 – LAWNS AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Soil Preparation
 - 2. Seeding
 - 3. Sodding
 - 4. Meadow grasses
 - 5. Lawn renovation
 - 6. Maintenance

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
- E. Lawns: Areas of grass that are currently manicured and maintained
- F. Meadows: Areas that are not manicured containing trees, brush, and native grasses left in natural condition.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of Grass Seed: From seed vendor for each grass seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Certification of each seed mixture for identifying source, including name and telephone number of supplier.
- C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

- D. Qualification Data: For landscape Installer.
- E. Material Test Reports: For existing surface soil and imported topsoil.
- F. Planting Schedule: Indicating anticipated planting dates for each type of planting.
- G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.5 SCHEDULING

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 - 1. Spring Planting: March 1st to June 1st
 - 2. Fall Planting: August 15th to November 1st
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.6 LAWN MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Seeded Lawns: 60 days from date of Substantial Completion.
 - a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.
 - 2. Sodded Lawns: 30 days from date of Substantial Completion.
 - 3. Plugged Lawns: 30 days from date of Substantial Completion.
 - 4. Sprigged Lawns: 30 days from date of Substantial Completion.
- B. Maintain and establish lawn by watering, fertilizing, weeding, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth

lawn.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.
- C. Watering: It is the Contractor's responsibility to provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from approved sources and to keep lawn uniformly moist to a depth of 4 inches. This may require coordination with Property Owners.
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch.
 2. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 3. Water lawn at a minimum rate of 1 inch per week until acceptance.

1.7 MEADOW MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than 40 days from date of Substantial Completion.
- B. Maintain and establish meadow by watering, weeding, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from approved sources and to keep meadow uniformly moist.
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch.
 2. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 3. Water meadow at a minimum rate of 1/2 inch per week until acceptance.

1.8 MAINTENANCE – GENERAL

- A. Maintenance of lawns shall be ongoing during the project period and during fall and spring seeding seasons during the warranty period until a hardy stand of grass is established per section 3.09 of this specification.

PART 2 - PRODUCTS

2.1 LAWN GRASSES

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
1. Full Sun, High Traffic: Bermuda grass mix (warm season)
 2. Full Sun: Turf type fescue blend.

3. Sun and Partial Shade: Proportioned by weight as follows:
 - a. 50 percent Turf Type Fescue Blend.
 - b. 35 percent Chewings Red Fescue (*Festuca rubra* variety).
 - c. 15 percent Annual Rye Grass.

C. Shade: Proportioned by weight as follows:

1. 50 percent Chewings Red Fescue (*Festuca rubra* variety).
2. 35 percent Turf Type Fescue Blend.
3. 15 percent Annual Rye Grass.

2.2 MEADOW GRASSES

A. Native Grass Seed: Fresh clean, dry, new seed, mixed species as follows:

1. 20 percent Buffalo Grass
2. 15 percent Little Bluestem
3. 15 percent Side Oats Gramma
4. 15 percent Indian Grass
5. 15 percent Switch Grass
6. 10 percent Annual Rye Grass
7. 10 percent Purple Coneflower

- a. Native Grass Seed to be sown at a rate of 150 lbs/acre.
- b. Pasture Grass Seed to be sown at rate indicated by Property Owner.

B. Seed Carrier: Inert material, sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed.

2.3 TURFGRASS SOD

A. Turfgrass Sod: Approved Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Turf type fescue blend.
2. Sun and Partial Shade: Proportioned by weight as follows:
 - a. 50 percent Turf Type Fescue Blend.
 - b. 35 percent Chewings Red Fescue (*Festuca rubra* variety).
 - c. 15 percent Annual Rye Grass.

3. Shade: Proportioned by weight as follows:
 - a. 50 percent Chewings Red Fescue (*Festuca rubra* variety).
 - b. 35 percent Turf Type Fescue Blend.
 - c. 15 percent Annual Rye Grass.

2.4 TOPSOIL

- A. Topsoil - Lawns: ASTM D 5268, pH range of 5.5 to 7, a minimum of 3 percent organic material content; free of subsoil, clay lumps, gravel, stones, and other objects more than 1 inch in diameter in any dimension; and free of weeds, roots, and other deleterious materials harmful to plant growth. Topsoil shall contain less than 5% by volume of stones, rocks, and gravel.
 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Where surface soils do not meet the requirements of section 2.04.A of this specification and/or where quantities of surface soils that do meet section 2.04.A of this specification are insufficient use imported or manufactured soils from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
- B. Topsoil - Meadows: Free of subsoil, clay lumps, gravel, stones, and other objects more than 3 inch in diameter in any dimension; and free of weeds, roots and other deleterious materials harmful to plant growth. Topsoil shall contain less than 10% by volume of stones, rocks, and gravel.
 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 2. Meadow areas for this project are designated as the following and are the only areas approved to receive onsite soils restoration:
 - a. Force Main 1 from STA 35+81.25 to STA 43+15.00
 - b. Force Main 2 from STA 0+00.00 to STA 18+17.50
 - c. Line B entirely
 - d. Line C entirely
 - e. All other areas will need to be restored in accordance with Section 2.04A.

2.5 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
 1. Class: Class O, with a minimum 95 percent passing through No. 8 sieve and a minimum 55 percent passing through No. 60 sieve.

- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- G. Sand: Clean, washed, natural or manufactured, free of toxic materials.
- H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.6 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing 3/4 inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Wood Derivatives: Decomposed, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
- D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, or other bedding materials; free of toxic substances, stones, sticks, weed seed, and material harmful to plant growth.

2.7 PLANTING ACCESSORIES

- A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.8 FERTILIZER

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of

fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.9 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Peat Mulch: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
1. Organic Matter Content: 50 to 60 percent of dry weight.
 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- D. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- E. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- F. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.10 EROSION CONTROL MATERIALS

- A. Landlok® Erosion Control Blankets (ECB's) as manufactured by Propex, or approved equal, must be installed on all surfaces requiring seeding with slopes greater than or equal to 10% or in areas where grass cannot be established due to erosion. ECB's shall be selected and installed in accordance with manufacturer's recommendations.
- B. ECB's are not recommended in drainage channels. Rock riprap in accordance with details and specifications shall be used in drainage channels.

C. Ground Anchoring Devices

1. U-shaped wire staples or metal geotextile pins can be used to anchor blanket to the ground surface. Wire staples should be a minimum thickness of 8 gauge. Metal pins should be at least 0.20 in diameter steel with a 1-1/2 in steel washer at the head of the pin. Wire staples and metal pins should be driven flush to the soil surface. All anchors should be 6-18 in long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils. Heavier metal stakes may be required in rocky soils.

D. Anchor Pattern Guide

1. The shaded areas in the diagram shown in Propex's Installation Guidelines for ECB's provide anchor suggestions based on slope gradient and/or anticipated flow conditions. When the correct number of anchors has been evaluated, refer to the three illustrations in Propex's Installation Guidelines for ECB's to establish anchor pattern. Increased anchoring may be required depending upon site conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify the existence or non-existence of irrigation systems. Damaged systems shall be repaired with equipment to match existing and system tested for operation in an efficient and satisfactory manner. If damages to existing irrigation systems are incurred, the contractor shall be responsible for irrigation system repairs at the expense of the contractor.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, retaining walls, irrigation systems, and other facilities, trees, shrubs, and other plantings from damage caused by restoration operations.
 1. Protect adjacent and adjoining areas from hydroseeding overspray.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN AND MEADOW RESTORATION

- A. Renovate existing lawns and meadows damaged by Contractor's operations including excavating, grading, clearing and grubbing, storage of materials and equipment, and movement of vehicles. Limit lawn and meadow subgrade preparation to areas to be planted.
- B. Measurement and payment for lawn and meadow restoration i.e. topsoil, seeding, fertilizing

and mulching will be limited to disturbed areas within the permanent and temporary easement areas. Areas disturbed by construction activities outside these areas must be restored in accordance with these specifications but will be considered incidental and not paid for separately.

C. Unchanged Subgrades: If lawns or meadows are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, such as material or equipment storage areas or areas where vehicles and equipment were driven then lawn or meadow renovation to be as follows:

1. Remove unsatisfactory existing rocks, grass, vegetation, or turf. Do not mix into surface soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil droppings, fuel spills, stone, gravel, and other construction materials.
2. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
3. Raise subgrade to finish grade with topsoil.
4. Loosen surface soil to a depth of at least of 6 inches. Remove stones larger than 1 inch in any dimension, sticks, roots, trash, and other extraneous matter.
5. Apply soil amendments according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture. Remove any rock larger than 1 inch in any dimension, sticks, roots, trash, and other extraneous matter brought to the surface through tilling operations.
6. Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
7. Apply fertilizer directly to surface soil per manufacturer's recommendations.
8. Moisten prepared areas before planting if soil is dry. Do not create muddy soil.
9. Apply seed per Section 3.04.
10. Install erosion control materials per Section 3.05, as required, to begin establishment of renovated area.
11. Water newly planted areas and keep moist until new lawn or meadow is established.
12. Legally dispose of all waste materials, including grass, vegetation, and turf, off Owner's property.

D. Disturbed Subgrades: If lawns or meadows are to be planted in areas altered or disturbed by excavating, grading, or surface soil stripping operations, then lawn renovation to be as follows:

1. Backfill disturbed areas per project construction plans and details to within 4 inches of finish grade elevations. Remove unsatisfactory existing rocks, grass, vegetation, weeds, or turf. Do not mix into surface soil.
2. Bring disturbed areas to finish grade using a minimum of 4 inches of topsoil. Remove stones larger than 1 inch in any dimension, sticks, roots, trash, and other extraneous matter.
3. Apply soil amendments according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture. Remove any rock larger than 1 inch in any dimension, sticks, roots, trash, and other extraneous matter brought to the surface through tilling operations.
4. Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that

- can be planted in the immediate future.
 - 5. Apply fertilizer directly to surface soil per manufacturer's recommendations.
 - 6. Moisten prepared areas before planting if soil is dry. Do not create muddy soil.
 - 7. Apply seed per Section 3.04.
 - 8. Install erosion control materials per Section 3.05 as required to begin establishment of renovated area.
 - 9. Water newly planted areas and keep moist until new lawn or meadow is established.
 - 10. Legally dispose of all waste material, including grass, vegetation, and turf, off Owner's property.
- E. Meadow areas, while allowed to use onsite soils, will still be required to be seeded, fertilized and mulched in order to establish grass growth. A prepator or some other means or equipment shall be used to remove rocks larger than 4 inches and to clean areas where bedding material has been stored on the ground. If grass cannot be established by the end of the warranty period, Contractor will be required to bring in topsoil or other suitable soil approved by Engineer in order to facilitate grass growth.
- F. Restored areas are to be maintained for the duration of the project and during the one year maintenance period until a hardy stand of grass has been established. Areas eroded, washed out or otherwise disturbed during these periods must be reestablished.

3.4 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
- 1. Do not use wet seed or seed that is moldy or otherwise damaged.
- B. Sow lawn seed at the rate of 3 to 4 lb/1000 sq. ft. Meadow grasses to be sown at the rate noted in Section 2.02.
- C. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes greater than or equal to 10% with Landlock erosion-control blankets, or approved equal, as outlined in Section 3.05 of this specification. Erosion-control blankets shall be installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with slopes not exceeding 10% by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches (38 mm) in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
- 1. Anchor straw mulch by crimping into topsoil with suitable mechanical equipment.
 - 2. Bond straw mulch by spraying with asphalt emulsion at the rate of 10 to 13 gal. /1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

3.5 EROSION CONTROL BLANKETS

A. Site Preparation

1. Grade and compact area of ECB installation as directed and approved by Engineer. Subgrade shall be uniform and smooth. Remove all rocks, clods, vegetation or other objects so the installed blanket will have direct contact with soil surface. Prepare seedbed by loosening the top 2-3 in (50-75 mm) minimum of soil. Incorporate amendments such as lime and fertilizer and/or wet the soil, if needed. Do not mulch areas where blanket is to be placed.

B. Seeding

1. Apply seed to soil surface before installing blanket. Disturbed areas shall be reseeded.
2. Apply seed as specified in Section 3.04 of this specification.

C. Installation on Soil Slopes

1. Excavate a 12 x 6 in minimum longitudinal anchor trench 2-3 ft over crest of slope (see Figure 1 in Propex's Installation Guidelines for ECB's).
2. Install top end of blanket into trench and secure to bottom of trench using ground anchoring devices spaced every 12 in minimum. Backfill and compact soil into trench.
3. Verify correct side of ECB is facing ground. Unroll blanket down slope.
4. Overlaps of adjacent rolls shall be 3 in minimum and anchor every 18 in minimum along the overlap. Secure using ground anchoring devices at the appropriate frequency and pattern shown below. Overlaps are shingled away from prevailing winds (see Figure 2 in Propex's Installation Guidelines for ECB's).
5. Unroll blanket in a manner to maintain direct contact with soil. Do not pull blanket taut. Secure blanket to ground surface using anchoring devices.
6. Excavate a 12 x 6 in minimum anchor trench at toe of slope (see Figure 3 in Propex's Installation Guidelines for ECB's).
7. Install bottom end of blanket into trench and secure to bottom of trench using ground anchoring devices spaced every 12 in minimum. Backfill and compact soil in trench (see Figure 3 in Propex's Installation Guidelines for ECB's).
8. Anchor blanket to the ground using U-shaped wire staples or metal geotextile pins. Wire staples should be a minimum thickness of 8 gauge. Metal pins should be at least 0.20 in diameter steel with a 1-1/2 in steel washer at the head of the pin. Wire staples and metal pins should be driven flush to the soil surface. All anchors should be 6-18 in long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils. Heavier metal stakes may be required in rocky soils.
9. The shaded areas in the diagram shown in Propex's Installation Guidelines for ECB's provide anchor suggestions based on slope gradient and/or anticipated flow conditions. When the correct number of anchors has been evaluated, refer to the three illustrations in Propex's Installation Guidelines for ECB's to establish anchor pattern. Increased anchoring may be required depending upon site conditions.
10. Irrigate as specified.

3.6 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
 - 1. Mix slurry with asphalt-emulsion tackifier.
 - 2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.

3.7 SODDING

- A. Sod shall be placed in areas where sod was pre-existing.
- B. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across angle of slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- D. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 4 inches below sod. Sod which dries out will be rejected.

3.8 SATISFACTORY LAWNS AND MEADOWS

- A. Satisfactory Seeded Lawn or Meadow: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Satisfactory Sodded Lawn or Meadow: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- C. Reestablish areas of lawns or meadows that do not comply with requirements and continue maintenance until areas are satisfactory.

3.9 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn or meadow renovation work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or

other paved areas.

- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after grass is established.
- C. Remove erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

SECTION 33 05 23.13 – HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration. The section also includes materials, dimensions and other pertinent properties of pipe and required accessories. These properties provide minimum performance requirements for various components including joints.

1.2 DESCRIPTION OF THE SYSTEM

- A. Installation of the pipelines below Roaring River shall be carried out by the HDD as shown on the construction drawings. The bore path shall be designed by the drilling contractor to ensure that pipe joints do not deflect more than 50% of manufacturer's recommended maximum deflection.

1.3 QUALITY ASSURANCE

- A. The requirements set forth in this document specify a wide range of procedural precautions necessary to ensure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification or within any associated permit. Adherence to the specifications contained herein, or the Engineer's approval on any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract. The Contractor shall be responsible for the repair of all damage to private and/or public property at no additional expense to the Owner. Repair work shall meet all local and state rules and requirements.

1.4 WARRANTY

- A. The contractor shall supply to Owner a two (2) year unconditional warranty. The warranty shall include materials and installation and shall constitute complete replacement and delivery to the site of materials and installation of same to replace defective materials or defective workmanship with new materials/workmanship conforming to the specifications.

1.5 SUBMITTALS

- A. Shop Drawing Submittals:
The Contractor shall submit shop drawings, working drawings, schedules and samples.

B. Record Drawings:

Submit for Owner and Engineer's approval the as-built records within thirty days (30) after completing the pull back. The as-built records shall include a plan, profile (data every 25 LF of main, at a minimum), and all information recorded during the progress of the work, including all subsurface anomalies identified by Ground Penetrating Radar or excavation. The HDD contractor shall certify the accuracy of all as-built record drawings. Contractor shall maintain a daily project log of drilling operations and a guidance system log with a copy given to Engineer at completion of project.

1.6 ENVIRONMENTAL PROTECTION

- A. The Contractor shall be fully responsible for the directional drilling operation. Contractor shall place silt fence or silt soxx between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Contractor shall place hay bales, or approved protection, to limit intrusion upon project area. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. The HDD operation is to be performed in a manner to eliminate the discharge of water, drilling mud and cuttings to nearby waterways. All excavated pits used in the drilling operation shall be lined by the Contractor with heavy duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.
- B. Contractor shall adhere to all applicable environmental regulations including environmental condition stated in local, state and federal permits. Fuel may not be stored in bulk containers (greater than 25 gallons) within 200' of any waterbody or wetland.

1.7 SAFETY

- A. The Contractor shall be solely responsible for the safety of all parties. The contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner.

1.8 PERSONNEL QUALIFICATIONS CERTIFICATION

The Contractor shall have equipment and expertise, appropriate for horizontal directional drilling installations. This includes the preparation and maintenance of the bore path using drilling fluids appropriate for the geology of the soils. The Contractor shall also have experience in safety and dependability installing, in similar geology, similar size and length of piping involved.

- A. Directional Boring:
Directional drilling and pipe installation shall be done only by an experienced Contractor specializing in directional drilling and whose key personnel have at least five (5) years experience in this work.
- B. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. (Each person must have been fully trained for over 1,000 hours on all facets of directional drilling, including, but not limited to machine operations, mud mixing, locating,

and material fusion.) A responsible representative who is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual Directional Bore operation. The Contractor shall have a sufficient number of competent workers on the job at all times to insure the Directional Bore is made in a timely and satisfactory manner.

C. Pipe and Fitting Jointing

1. Heat Fusion Joining:

Joints between plain end pipes and pipe fittings shall be made by butt fusion when possible. Electro fusion welding may also be used to complete when the location is not accessible to butt fusion welding equipment. The on-site welder making the joints (butt fusion or electro fusion) shall have received specific training from the manufacturer of the fittings and/or pipe being welded and shall have written proof of proper training/certification from the associated manufacturers. Only certified welders who have written training certifications from the fitting and/or pipe manufacturer will be allowed to perform this work. That is, to weld a fitting or electro fusion coupling in place, the on-site welder (employee) must be trained and certified by the fitting manufacturer. To butt weld pipe, the on-site welder (employee) must be trained and certified by the pipe manufacturer. The fusion work shall be accomplished (welding and cool-down/closing times) in accordance with the fitting and pipe manufacturers' recommendations, at a minimum.

2. Heat Fusion Training Services:

Upon request, the Manufacturer shall provide training and training materials in the Manufacturer's recommended butt fusion, saddle fusion and electro fusion procedures to the Contractor's installation personnel, and to inspectors representing the Owner. Only certified (manufacturer certification) employees will be allowed to complete this fusion work.

PART 2 - PRODUCTS

2.1 HIGH DENSITY POLYETHYLENE (HDPE, PE) PIPE AND FITTINGS:

A. Materials:

Materials used for the manufacturer of polyethylene pipe and fittings shall be PE3408 high density polyethylene meeting cell classification 345464C per ASTM D3350; and meeting Type III, Class B or Class C, Category 5, Grade P34 per ASTM D1248; and shall be listed in the name of the pipe and fitting Manufacturer in PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1600 psi at 73°F per ASTM D-2837. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.

B. Polyethylene Pipe (4 inch and larger):

HDPE Pipe shall conform to AWWA C906, DR-11, Ductile Iron Pipe (DIP) size and NSF 61 Standard. For pipe sizes 24-inch and larger, the HDPE may be IPS size, DR 11. Polyethylene pipe shall be manufactured in accordance with ASTM F714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter and shall be so marked. Each production lot

of pipe shall be tested for (from material or pipe) melt index, density, % carbon, dimensions and either quick burst or ring tensile strength (equipment permitting). Nominal pipe sizes only are indicated on the drawings and bid form. Outside diameter of pipe is generally 1 to 2-inches greater than the nominal pipe diameter.

C. Service Identification:

Permanent identification of piping service shall be provided by co-extruding multiple equally spaced color stripes into the pipe outside surface or by solid colored pipe shell. The striping material shall be the same material as the pipe material except for color. The following colors shall be used to identify piping service (pressure service):

1. Blue – potable water
2. Green – wastewater or force main
3. Purple – reclaimed water
4. Black – raw water

Sanitary sewer pipe interior shall be light in color for internal video inspection.

D. Polyethylene Fittings and Custom Fabrication:

Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer or trained personnel. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Fabricated fittings must have the same working pressure as the mating pipe.

E. Molded Fittings:

Molded fittings shall be manufactured in accordance with ASTM D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the test required under ASTM D3261.

F. Fabricated Fittings:

Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full service pressure rating of the mating pipe. Directional fittings 16" and larger such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets.

G. Electro Fusion Branch Saddles:

Shall meet AWWA C-906, outlet shall comply with ASTM-D3261, and shall be specifically manufactured for HDPE pipe. This saddle may be utilized for wet-tap applications. These electro fusion fittings shall be designed and manufactured in accordance with ASTM Specifications F-1055 for use with HDPE (DIPS) pipe.

H. Polyethylene Flange Adapters:

Flange adapter shall be made with sufficient throughbore length to be clamped in a butt fusion joining machine without the use of a stubend holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to provide gasketless sealing, or to restrain the gasket against blow-out. Below ground flange adapter may be utilized for 30" and larger, DIP and valves. Adapters for 24 inch and smaller utilize an MJ adapter (see below).

I. Back-up Rings and Flange Bolts:

Flange adapters shall be fitted with lap joint flanges pressure rated equal to or greater than the mating pipe. Convolute style backup rings preferred over the flat stock rings. The lap joint flange bore shall be chamfered to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.

J. Manufacturer's Quality Control:

The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rated, and contamination. The cell classification properties of the material shall be certified by the supplier, and verified by Manufacturer's Quality Control.

K. Polyethylene Mechanical Joint (MJ) Adapters:

Mechanical connections of HDPE pipe (4" through 24" diameter) to Ductile Iron or PVC piping, mechanical joint fittings, or valves shall be through a self-restraining, fusible mechanical joint adapter with or without an integral, internal stainless steel insert. Mechanical joint adapter shall be of the same SDR rating as the pipe. A separate, loose stainless steel type insert will only be allowed for pipe sizes 4 inch through 8 inches. Provide the mechanical joint adapter, including but not limited to longer tee bolts or all thread rods with nuts at the mechanical joint bell. Note that PE flanged adapters may be utilized for pipe sizes 30 inches and larger.

L. Cast Transition Couplings:

HDPE to MJ cast transition coupling may only be utilized for 8 inch and smaller pipe size. A stainless steel stiffener is required sized at proper ID of HDPE pipe. The transition coupling must be epoxy lined (3 mils minimum for water use and 12 mils minimum for sewer use). Acceptable is a Power Seal model 3520 or approved equal.

M. Electro Fusion Couplings:

Polyethylene pipe and fittings may be joined using approved electro fusion couplings. Fittings shall be PE3408 HDPE, Cell Class 345464C as determined by ASTM D3350-99. Electro fusion fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe. All electro fusion fittings shall be suitable for use as pressure conduit per AWWA C906, and have nominal burst value of 3.5 times the working pressure of the fitting. To minimize "toe-in" problems when installing an electro fusion coupling larger than 12 inch size, the contractor shall remove 12 inches (minimum) from all associated "factory ends" and use a re-rounding clamp on the associated pipe. The contractor shall mark pipe insertion depth prior to assembly and construct in accordance with manufacturer's instructions.

2.2 DRILLING FLUIDS

- A. Drilling fluids shall consist of a bentonite slurry. The Contractor shall be responsible for making provisions for a clean water supply for mixing of drilling fluid.

2.3 DELIVERY, STORAGE, AND HANDLING

- A. Care shall be taken during transportation of the pipe to ensure that it is not cut, kinked, or otherwise damaged. Inspect materials delivered to the site for damage. All materials found during inspection or during the progress of work to have cracks, flaws, cracked linings, or other defects shall be rejected and removed from the job site without delay.
- B. Unload and store opposite or near the place where the work will proceed with minimum handling. Store material under cover out of direct sun light. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature condition. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports. Keep all materials free of dirt and debris.
- C. The handling of the joined pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at butt-fused joints. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section. Waterproof nightcaps of approved design may be used but they shall also be so constructed that they will prevent the entrance of any type of natural precipitation into the pipe and will be fastened to the pipe in such a manner that the wind cannot blow them loose. The practice of stuffing cloth or paper in the open ends of the pipe will be considered unacceptable.
- D. Contractor is responsible for obtaining, transporting and sorting any fluids, including water, to the work site.
- E. Disposal of fluids is the responsibility of the Contractor. Disposal of fluids shall be done in a manner that is in compliance with all permits and applicable federal, state, or local environmental regulations. The bentonite drilling slurry may be recycled for reuse in the hole opening operation, or shall be hauled by the Contractor to an approved location or landfill for proper disposal. Contractor shall thoroughly clean entire area of any fluid residue upon completion of installation, and replace any and all plants and sod damaged, discolored or stained by drilling fluids.

PART 3 - EXECUTION

3.1 EQUIPMENT REQUIREMENTS

A. General:

The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the specified bore and pullback the pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the drill, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be re-used, a guidance system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, trained and competent personnel to operate the system. All equipment shall be in good, safety operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

B. Drilling System:

1. Drilling Rig:

The directional drilling machine shall consist of a power system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The power system shall be self contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during drilling and pull-back operations. There shall be a system to detect electrical current from the drilling string and an audible alarm which automatically sounds when an electrical current is detected.

2. Drill Head:

The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

3. Mud Motors (if required):

Mud motors shall be of adequate power to turn the required drilling tools.

4. Drill Pipe:

Shall be constructed of high quality 4130 seamless tubing, grade D or better with threaded box and pins. Tool joints should be hardened to 32-36 RC.

C. Guidance System:

- 1.** A guidance system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at the maximum depth required and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction) The guidance system shall be accurate to +/-2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet and accurate within 5 feet horizontally.
- 2.** The Guidance System shall be of a proven type and shall be operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies on the surface of the drill path and shall consider such influences in the operation of the guidance system if using a magnetic system.

D. Bore Tracking and Monitoring:

At all times during the pilot bore the Contractor shall provide and maintain a bore tracking system that is capable of accurately locating the position of the drill head in the x, y, and z axes. The Contractor shall record these data at least once per drill pipe length or every twenty-five (25) feet, whichever is most frequent. Deviations between the recorded and design bore path shall be calculated and reported on the daily log.

E. Drilling Fluid (Mud) System:

1. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid. Mixing system shall continually agitate the drilling fluid during operations.
2. Drilling Fluids: Drilling fluid shall be composed of clean water, appropriate additives and clay. Water shall be from an authorized source with a minimum pH of 6.0. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No potentially hazardous material may be used in drilling fluid.
3. Delivery System: The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system. A berm, minimum of 12" high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid cycling system to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and recycling facilities.
4. Drilling Fluid Recycling System: The drilling fluid recycling system shall separate sand, dirt and other solids from the drilling fluid to render the drilling fluid re-usable. Spoils separated from the drilling fluid will be stockpiled for later use or disposal.
5. Control of Drilling Fluids: The Contractor shall follow all requirements of the Frac-Out and Surface Spill Contingency Plan as submitted and approved and shall control operational pressures, drilling mud weights, drilling speeds, and any other operational factors required to avoid hydrofracture fluid losses to formations, and control drilling fluid spillage. This includes any spillages or returns at entry and exit locations or at any intermediate point. All inadvertent returns or spills shall be promptly contained and cleaned up. The Contractor shall maintain on-site mobile spoil removal equipment during all drilling, pre-reaming, reaming and pullback operations and shall be capable of quickly removing spoils. The Contractor shall immediately notify the Owner of any inadvertent returns or spills and immediately contain and clean up the return or spill.

F. Other Equipment:

1. Pipe Roller: Pipe rollers, if utilized, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. A sufficient number of rollers shall be used to prevent excess sagging of pipe.
2. Pipe Rammers: Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of the Engineer.
3. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those defined above in the preceding sections shall not be used unless approved by the Engineer prior to commencement of the work. Consideration for

approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the projects.

3.2 DRILLING PROCEDURES

- A. Drill Path: Prior to drilling Contractor shall utilize all verified locate information to determine drill pathway. Marked up drawings shall be on site at all times and referred to during the drill operation.
- B. Guidance System: Contractor shall provide and maintain instrumentation necessary to accurately locate the pilot hole (both horizontal and vertical displacements), measure pilot string torsional and axial and measure drilling fluid discharge rate and pressure. The Owner's Onsite Representative and the Engineer shall always have access to instrumentation and readings during operation.
- C. Pilot Hole: The pilot hole shall be drilled along the path shown on the plans and profile drawings to the following tolerances:
 - 1. No deviations greater than 5% of depth over a length of 100 feet; the Contractor will notify the Engineer and the Engineer may require the Contractor to pull-back and re-drill from the location along the bore path before the deviation.
 - 2. Entry Point Location – The pilot hole shall initially penetrate the ground surface at the exact location intended. The angle of entry shall not exceed 75% of the allowable bending radius of the carrier pipe.
 - 3. Exit Point Location – The pilot hole shall finally penetrate the ground surface within:
 - a. +/- 10 feet overall length tolerance and +/- 5 feet left/right alignment tolerance for directional drills of 1,000 linear feet.
 - b. +/- 40 feet of overall length and +/- 5 feet left/right alignment tolerance for directional drills greater than 1,000 linear feet.

In the event of a drilling fluid fracture, inadvertent returns, or returns loss during pilot hole drilling operations, Contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a Marsh funnel and wait another 30 minutes. If mud fracture or returns loss continues, Contractor will discuss additional options with the Engineer and work will then proceed as agreed.

- D. Reaming: Upon successful completion of the Pilot Hole, the Contractor will ream the bore hole to a minimum of 25% greater than the outside diameter of the pipe and a maximum of 1.5 times the outside diameter of the pipe. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface conditions that were encountered during the pilot hole drilling operation. The Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.
- E. Pull Back: Upon successfully reaming the bore hole to the required diameter, Contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel and reamer to compact bore hole walls. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations

Contractor will not apply more than the maximum safe pipe pull pressure at any time. The maximum allowable tensile force imposed on the pull section shall be equal to 80% of the pipe manufacturer's safety pull (or tensile) strength.

1. Torsional stress shall be minimized by using a swivel to connect a pull section to the reaming assembly.
2. The pullback section of the pipeline shall be supported during pullback operations so that it moves freely, and the pipe is not damaged.
3. External pressure shall be minimized during installation of the pullback section in the reamed hole. Damaged pipe resulting from external pressure shall be replaced at no cost to the Owner.
4. Buoyancy modification shall be at the discretion of the Contractor and shall be approved by the Engineer. The Contractor shall be responsible for any damage to the pull section resulting from such modifications.
5. In the event that the pipe becomes stuck, the Contractor will cease pulling operations to allow any potential hydro-lock to subside and then commence pulling operations. If pipe remains stuck, the Contractor will notify the Engineer. The Engineer and the Contractor will discuss options and then work will proceed accordingly.
6. The pipe shall be sealed at both ends with a cap or a plug to prevent water, drilling fluids and other foreign materials from entering the pipe as it is pulled back.
7. For HDPE DR-17 pipe with a pulling length greater than 500 LF, the contractor shall utilize a break-away link. The contractor shall provide a break-away link between the swivel and the pipe or a combination swivel and break link. Break-away link shall be rated at 80% of pipe manufacturer's safe pull (tensile) strength. Break pins shall be color coded for easy identification. Contractor shall provide rated break-away link for each material and pipe size(s) for the project.

3.3 PIPE ASSEMBLY

A. General:

1. Pipe shall be welded/fused together in one length, if space permits. Pipe may be placed on pipe rollers before pulling into bore hole to minimize damage to the pipe. For pipes 16 inch and larger, a re-rounding clamp tool shall be utilized during the electro-fusion process to ensure pipe roundness. For pipe sizes larger than 12-inch, mechanical scrappers (per the fitting manufacturer's recommendation) shall be utilized during the electro-fusion work. It is critical that all original oxidized pipe surface be removed in order for fusion to take place. The scraping process requires that approximately .10" of the outer "skin" be removed in order to penetrate the oxidation and contamination barrier. Oxidized pipe surface simply will not bond.

B. Acceptability of Damaged Pipe:

1. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.

C. Butt Fusion Testing:

1. When requested by the Owner or Engineer, butt fusion testing will be performed. The test fusion shall be allowed to cool completely, and then fusion test straps shall be cut out.

The test strap shall be 12” (min) or 30 times the wall thickness in length with the fusion in the center and 1” (min) or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new test fusion shall be made, cooled completely and tested

D. Mechanical Joining:

1. Polyethylene pipe and fittings may be joined together or to the materials by means of flanged connections (flange adapters, electrofused couplings, and back-up rings) or mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material. Mechanical couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer’s recommendations, a longitudinal load applied to the mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins. External joint restraints shall not be used in lieu of fully restrained mechanical couplings.

E. Mechanical Joint and Flange Installation:

1. Mechanical joints and flange connections shall be installed in accordance with the Manufacturer’s recommended procedure. Flange faces shall be centered and aligned to each other before assembling and tightening bolts. In no case shall the flange bolts be used to draw the flanges into alignment. Bolt threads shall be lubricated, and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be 100 ft-lbs. or less as recommended by the Manufacturer.

3.4 TESTING

A. Pressure and Leakage Tests:

1. The Contractor shall test horizontal directional drilled pipelines installed under this Contract in accordance with these specifications prior to acceptance of the pipeline by the Owner. All other conventionally installed pipe shall be tested in accordance with Section 02530 of these specifications. All field tests shall be made in the presence of the Project Representative. Except as otherwise directed, all pipelines shall be tested. Unless approved otherwise by the Owner, all fusible or butt weld joints shall be tested, All piping to operate under liquid pressure shall be tested in sections of approved length.

- B. For these tests, the Contractor shall furnish clean water, suitable temporary testing plugs or caps, and other necessary equipment, and all labor required. The Contractor will furnish suitable pressure gauges, calibrated by an approved testing laboratory, with increments no greater than 2 psi. Gauges used shall be of such size that pressures tested will not register less than 10% or more than 90% of the gauge capacity. All valved sections shall be hydrostatic tested to insure sealing (leak allowance) of all line valves.

1. Unless it has already been done, the section to pipe to be tested shall be filled with potable water and air shall be expelled from the pipe. Reclaimed water may be utilized for filling new reclaimed water or sewer force main installations. If blow offs or other

outlets are not available at high points for releasing air, the Contractor shall provide 1 inch (minimum taps and blow-off valves (at the 12:00 position), as necessary. The cost of constructing blow-off valves and plugging them, after a successful pressure test, shall be included in the unit price bid amount for the HDPE pipe.

2. For mains larger than 20-inch size, it is highly recommended that the contractor profile (line and grade) the main after installation and prior to pressure and leakage test to accurately locate all high points. Field survey instrument (Level equipment) shall be utilized for this task. Blow off valves shall be installed (at a minimum) at all high points which offset vertically more than two pipe diameters in length (at a minimum). The contractor shall consult the design engineer on any technical questions or concerns.
3. Hydrostatic testing shall consist of a 150 psig test pressures, based on the elevation of the highest point of the line or section under tests. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Project Representative. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor and shall be subject to the approval of the Project Representative.
4. Maximum duration for pressure test, including initial and final phase of the test, shall not exceed eight (8) hours. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section, and then allow it to “relax” for at least eight (8) hours before bringing the test section up to test pressure again.
5. Initial Phase of Pressure Testing: First, all air must be removed from the test section. The pressure test shall be completed after the line is backfilled. Initially, the pressure within the test section should be raised to approximately 160 psi and then allowed to be idle (no additional make-up water/pressure to be injected), for approximately 3 hours. During this 3 hour period, the test section shall be allowed to stabilize and come to an equilibrium stage. No additional make-up water/pressure shall be applied to the test section during this 3 hour stabilization period unless the line pressure drops below 140 psi. In this case, make-up water/pressure shall only be applied to the test section to maintain a minimum of 140 psi (during the 3 hour stabilization period).
6. Final Phase of Pressure Testing: The final phase of the pressure test shall involve applying make-up water/pressure to achieve an “initial test pressure” of 150 psi (minimum)/155 psi (maximum). The test section is then allowed to be idle (no make-up water/pressure is added) for a period of 2 hours. After this 2 hour period, make-up water/pressure is applied and measured to re-establish the “initial test pressure”. The quantity of water utilized to re-pump the line shall be measured and compared to the allowable quantities as determined by the table below. If the actual make-up water quantity is equal or less than the allowable amount, the pressure test passes. If the actual make-up water quantities are greater than the allowable amount, the pressure test fails.

Table 1: Allowable Make Up Amount
Nominal Pipe Size
(inches)
Make-up Water
Allowance
(Gallons/Linear feet of
Pipe) 2-hour test

6	0.0030
8	0.0050
10	0.0065
12	0.0115
14	0.0140
16	0.0165
18	0.0215

20	0.0275
22	0.0350
24	0.0440
26	0.0500
28	0.0555
30	0.0635
32	0.0715
34	0.0810
36	0.0900
42	0.1155
48	0.1350
54	0.1570

7. In the event a section fails to pass the tests, the Contractor shall do everything necessary to locate, uncover (even to the extent of uncovering the entire section), and replace the defective pipe, valve, fitting or joint. Visible leaks shall be corrected regardless of total leakage. Lines which fail to meet these tests shall be retested as necessary until test requirements are complied with. All testing shall be performed at the Contractor's expense.
8. If, in the judgment of the Owner, it is impracticable to follow the foregoing procedures exactly for any reason, modifications in the procedure shall be made with approval; but, in any event, the Contractor shall be responsible for the ultimate tightness of the piping within the above requirement.

3.5 LOCATE WIRE

- A. Locate wire shall be installed along the horizontal directional drilled pipe.

END OF SECTION

SECTION 33 11 33 – VERTICAL TURBINE PUMPS-WET PIT

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish one (1) vertical turbine, wet pit pumping units, complete with motors, baseplates, couplings and guards, as shown on the Contract Drawings and as specified herein.

1.2 REFERENCE STANDARDS

- A. Design, manufacturing and assembly of elements of the equipment herein specified shall be in accordance with, but not limited to, published standards of the following, as applicable:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing and Materials (ASTM)
 - 3. American Bearing Manufacturers Association (ABMA)
 - 4. Hydraulic Institute (HI)
 - 5. National Electrical Manufacturers Association (NEMA)
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.3 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Division 1. Submittals shall include the following:
 - 1. Certified dimensional drawings of each item of equipment and auxiliary apparatus to be furnished, including equipment weights and location and size of anchor bolts.
 - 2. Literature and drawings describing the equipment, including parts list and materials of construction, in sufficient detail to indicate full conformance with the detail specifications.
 - 3. Motor performance data, wiring diagrams, one-lines and conduit entry dimensions and details. Other submittals as required by Division 26.
 - 4. Cut sheets on accessory items.
 - 5. Manufacturer's certified rating curves, to satisfy the specified design conditions, showing pump characteristics of discharge, head, brake horsepower, efficiency and net positive suction head required (NPSHR).
- B. Operation and Maintenance Data
 - 1. Complete operating and maintenance instructions shall be furnished for all equipment specified in this Section as provided in Division 1. The maintenance instructions shall include troubleshooting data and full preventative maintenance schedules and complete spare parts lists with ordering information.
 - 2. Include certified performance data and curves from factory tests.

1.4 QUALITY ASSURANCE

- A. To assure unity of responsibility, the motors, couplings, guards and supporting base shall be furnished by the pump manufacturer. All pumping units specified herein shall be furnished by a single manufacturer.
- B. The equipment specified herein is intended to be of proven ability as manufactured by concerns having extensive experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed to operate satisfactorily when installed as shown on the Drawings. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards, except where otherwise specified herein.
- C. The pump manufacturer shall be fully responsible for the design, arrangement and operation of all connected rotating components as assembled and mounted on a fabricated steel base to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.
- D. Vibration, when measured in the direction of maximum amplitude on the pump bearing housings, shall not exceed limits given in the latest ANSI/HI nomograph for the applicable pump type.
- E. Manufacturer shall have installations of like or similar application with a minimum of 5 years service for this pump size.
- F. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.
- G. Pump(s) are to be engineered and manufactured under the certification of ISO-9001.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the unit and equipment are ready for operation.
- B. All equipment and parts must be properly protected against any damage during shipment. The Contractor shall store equipment in accordance with the manufacturer's instruction.

1.6 EQUIPMENT WARRANTY

- A. Equipment warranty shall be manufacturers standard, extended to 12 months from startup, not to exceed 18 months from shipment. Manufacturers warranty shall not relieve the Contractor from furnishing a complete system warranty as specified in the General Conditions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, baseplates, couplings, guards and other accessories as specified herein.
- B. The pumps, motors, drives, couplings and base plates shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating, without damaging cavitation, and without excessive vibration or noise.
- C. Each major piece of equipment shall be furnished with a stainless steel nameplate (with embossed data) securely mounted to the body of the equipment. As a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, head and speed. As a minimum, nameplates for motors shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles, power and service factors.

2.2 CONDITIONS OF OPERATION

- A. Pumps shall be designed to pump screened water. Pumps shall have a 4" discharge connection. Pumping units shall be selected to perform under following operating conditions:

Design Capacity (GPM)	210
Design Head (FT)	288
Sump Depth (FT)	14
Low Liquid Level (FT)	1.5
Horsepower	25
Maximum Pump Speed (RPM)	1800
VAC, Phase	460/3/60
Enclosure	TEFC

* Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head and vertical static head from the minimum water level to the centerline of the pump discharge.

2.3 PUMP CONSTRUCTION

- A. Design
 - 1. Rotation
 - a. The pump will be counterclockwise rotation when viewed from the driver end looking at the pump.
 - 2. Discharge Styles
 - a. The discharge elbow may be located above or below ground.
 - b. The discharge nozzle is an integral part of the head.

- c. The discharge nozzle is located 90° to the shaft axis, in any lateral orientation necessary to match the discharge piping.
 - d. The driver mounting base is integral with the pump support base unless access to the stuffing box is required above the mounting floor, in which case a driver support stand is supplied.
3. Discharge Head Assembly
- a. The discharge head shall be of ASTM A48 Class 30 cast iron, free of blow holes, sand holes and other detrimental defects and shall be accurately machined. The discharge shall include an elbow with a standard 125-pound ANSI pipe flange integrally cast. (If the pressure warrants, a 250-pound ANSI flange is required.)
 - b. An alternate discharge head shall be of fabricated steel of the proper configuration for the application. Fabricated steel discharge heads should have 150-pound ANSI flanges, or 300-pound when required. On 16-inch and larger sizes of fabricated steel heads, they shall have a three-piece mitered discharge elbow.
 - c. Pumps shall be provided with a stuffing box drain connection and a pressure gauge connection.
 - d. The top of the discharge head shall have a registered fit for mounting driving motor. On units with a BD 30" and greater, alignment screws shall be provided in lieu of a register fit.
 - e. The head shaft shall be 416SS and shall be turned and ground. The head shaft or top shaft shall not exceed 10 feet in length. The pump manufacturer shall include a method of adjusting the pump impellers at the top of the head shaft. On vertical hollowshaft drivers, this should be at the top of the motor. On vertical solid shaft motors, this shall be through an adjustable flanged coupling between the motor shaft and the pump top shaft. In either case, this method shall provide a positive locking device.
 - f. The pump shall be supplied with a sub-base plate, which shall be grouted in place to which the pump discharge head shall be bolted. This mounting plate will facilitate removal and reinstallation of pumps without re-leveling and grouting.
4. Column Assembly
- a. When column assembly is required, it should be of flanged type construction. The outer column shall be a butt welded steel pipe, not more than 10 feet in length. The ends of each section shall be machined parallel. Register fit circles shall be machined on the flanges on each end and positive alignment shall be assured by accurately machined bearing retainers with register fit circles. The column size shall be such that the friction loss will not exceed 8 feet per 100 feet of length at the rated capacity of the pump. Also, the column size shall be such as to provide a velocity of 12 foot per second, or less, at the rated capacity. The pipe should be A53, Grade B and of sufficient wall thickness for the application.
 - b. A rigid type bearing retainer shall be provided at each column joint for supporting the lineshaft bearings. On 16-inch and larger column sizes, the bearing retainer shall be welded integral to the column pipe. The bearing material shall be dependent upon the temperature and liquid being pumped.
 - c. When rubber lineshaft bearings are used, 304 stainless steel sleeves shall be provided on the lineshaft at each lineshaft bearing location. These shall be field replaceable and securely fastened to the shaft with a minimum of two set screws.
 - d. When using rubber lineshaft bearings, bearing spacing shall not exceed 10 ft. On

pumps with hard lineshaft bearings, bearing spacing shall be sized so that the pump operating speed is at least 20% lower than the pump first critical speed.

5. Inner Column (Enclosing Tubes)

- a. When enclosed lineshaft construction is required, all bearings shall be protected by steel enclosing tubes in interchangeable sections of not over 5 feet in length.
- b. Inner columns are used to lubricate the lineshaft bearings and are manufactured from heavy wall pipe.
- c. A tube tension assembly is used for alignment and adjustment purposes.
- d. Bearing lubrication, either oil or clean water, is injected at the stuffing box in the discharge head.
- e. Sections shall be fastened together with internal threads by a bronze threaded lineshaft bearing.
- f. A bypass port to drain excess oil/water from the shaft enclosing tube shall be provided.
- g. Tube stabilizers shall be provided at appropriate intervals for supporting the enclosing tube. On 16-inch and larger column sizes, the stabilizer shall be welded integral to the column pipe.

6. Bowl Assembly

- a. The pump bowls, including the suction bell, shall be ASTM A48 Class 30 cast iron, free of blow holes, sand holes and other detrimental defects. They shall be accurately machined with register fit circles. All bowls should be of the flanged type construction (except 6-inch and 8-inch bowls, which may be of the threaded type).
- b. Impellers shall be bronze, ASTM B584 Grade C903 (Pumps 20" and smaller) or ASTM B148 Grade C952 (Pumps above 20"). They may be enclosed or semi-open. All impellers shall be statically and dynamically balanced. They shall be securely fastened to the shaft with tapered lock collets, threaded lock collets or double keys. The impellers shall be adjustable vertically by external means at the driver location.
- c. All pump bowls 20" and smaller shall have porcelain or powder epoxy lined water passageways.
- d. The pump shaft shall be type 416SS turned and ground. It shall be supported by bronze bearings above and below each impeller.
- e. A bowl adaptor or discharge case shall be provided to ensure proper transition from the bowl assembly to the column assembly. It shall contain an extra long support bearing.
- f. The suction bell is flared at the bottom to provide a smooth waterway entrance to the impeller and has integral splitters to reduce inlet swirl and entrance losses. The suction bell bearing shall be extra long and permanently grease packed and sealed with a bronze sand collar.

7. Shafting

- a. Shaft sizes through 3-inch have threaded sleeve couplings of extra heavy wall thickness seamless steel. Sizes above 3-inch have solid sleeve keyed couplings with split rings. The size of the shaft shall be no less than determined by ANSI/AWWA specification E101, section A4.15 line shaft selection and shall be

such that elongation due to hydraulic thrust will not exceed the actual clearance of the impellers in the pump bowls.

- b. Line shaft shall be of ample size to transmit the torque and operate the pump without distortion or vibration.
- c. The lineshaft shall be of carbon steel, turned and ground. They shall be furnished in sections not over 10 feet in length. The butting faces shall be machined square to the axis of the shaft with the maximum permissible axial misalignment of the threaded axis with the shaft axis .002 inch in 6 inches. Type 416SS shafting may be required on certain applications. Bowl shafting shall be a minimum 416SS.
- d. Steel lineshaft couplings with a safety factor of 1.5 times the shaft safety factor shall join the lineshafts. These threaded couplings shall have left-hand threads to tighten during pump operation. Flanged couplings are required on shaft diameters greater than 2.94”.

8. Sealing System Options

- a. Packed box
 - 1) The pump shall be equipped with a cast iron stuffing box, suitably drilled and tapped for a grease fitting. Packing shall include a minimum of six (6) packing rings plus a lantern ring. A Plan 13 shall be included for discharge pressures greater than 100 psi.
- b. Mechanical seal
 - 1) For high pressure and critical applications, a cartridge style mechanical seal shall be used. The seal shall be accompanied by a Plan 13 seal flush plan.
- c. Tube Tension Assembly
 - 1) The pump shall be equipped with a tube tension assembly for directing the lubricating fluid (oil or fresh water injection) to the lineshaft.
 - 2) The pump shall be equipped with a solenoid, manually operated lubricating system, which shall supply lubricant to the lineshaft bearings.
 - 3) The oiler shall be designed for outdoor operation and shall have a reservoir with a capacity of not less than one gallon.

B. Analysis

- 1. To ensure that neither harmful nor damaging vibrations occur to the pump structure at any speed within the specified operating range, the following analysis shall be required:
 - a. Pump manufacturer shall perform a structural frequency analysis of the above ground structural components utilizing a FEA method to ensure that no structural frequencies occur within +/-20% of the operating speed range or -50% to -30% operating speed range. When deemed necessary by the experience of the manufacturer, the below ground structural components shall also be included in the analysis.
 - b. The FEA method should include the use of ProE/Mechanica or an equivalent software. All pump assembly components, including the motor, shall be represented as solid elements, and if idealizations are used in place of solid

elements, then a complete description of method for the idealization shall be included in the report. The analysis shall also include all modes of interest and pictorially represent them in a fringe plot format. Modes of interest are defined as those structural frequencies that exist below 120% of the maximum operating speed. When significant modifications are required to lower the system's natural frequency, the pump structure's stresses and deflections shall also be reviewed.

- c. Manufacturer to provide documentation of the analysis ensuring that the specified requirements have been met, and that documentation should be signed and stamped by the professionally licensed engineer who performed the analysis work.

2. Vibration

- a. When measured in the direction of maximum amplitude on the pump bearing housings, shall not exceed limits given in the latest ANSI/HI nomograph for the applicable pump type.

2.4 PUMP DRIVE SYSTEM

- A. Motors shall be 460 volt, 3 phase, 60 hertz. Motors shall be US, GE, TECO/Westinghouse or Reliance, no further substitute allowed.
- B. The thrust bearing in the motor is utilized to carry both mechanical and hydraulic thrust of the pump.
- C. Motor are sized for maximum horsepower from shut-off to run-out.
- D. Torque capabilities must exceed those required by the pump at all operating conditions.
- E. This is shown on the pump speed-torque curve, which is available from the factory upon request.
- F. For engine or steam turbine drive, a right angle gear is mounted on the steel base.
- G. To ensure proper alignment and successful operation, a drive shaft with needle-bearing universal joints is often used between the engine and the drive shaft of the gear.
- H. Maximum horsepower and speed as specified under Paragraph 2.2B

2.5 BASEPLATES

- A. The pump shall be supplied with a sub-base plate (soleplate), which shall be grouted in place to which the pump discharge head shall be bolted. This mounting plate will facilitate removal and reinstallation of pumps without re-leveling and grouting.

2.6 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. All interior and exterior surfaces of pump columns and discharge elbows and the exterior of the bowl assemblies shall be cleaned of all rust and mill scale and supplied with a protective coating in accordance with Manufacturer standard procedure.

2.7 SPARE PARTS AND SPECIAL TOOLS

- A. Spare parts: Deliver the following:
 - 1. Thrust bearing set.
 - 2. Radial bearing set.
 - 3. Mechanical seal: 1 each size and type.
 - 4. O-ring set.
 - 5. Wear ring set (rotating and stationary).
- B. Special tools: Deliver 1 set of special tools required for complete assembly or disassembly of pump system components for each type or size of pump specified.

PART 3 - EXECUTION

3.1 SHOP TESTS

- A. The Engineer shall have the right to witness the factory tests and inspect any equipment to be furnished under this Section prior to their shipment from place of manufacture.
 - 1. A complete test report for each pump, including certified characteristic curves of the pump, consisting of at least all information required in Paragraph 1.3 above, except for NPSHR, and certified copies of the hydrostatic test report, shall be submitted to and approved by the Engineer before the pumps are shipped.
- B. Each pump specified herein shall be factory tested in accordance with the latest edition of the Hydraulic Institute Standards. Notification of such test and a list of test equipment and procedures shall be furnished to the Engineer at least 10 working days before the schedule test date.
 - 1. Each pump shall be tested and data recorded at its operating conditions of service as listed in Paragraph 2.02 above. Sufficient test point readings shall be made to establish complete head flow capacity, efficiency and brake horsepower curves for each pump.
 - 2. Tests may be conducted with shop column, discharge head and motor to facilitate the manufacturing process.
 - 3. If the application is variable speed a minimum speed curve shall be plotted on the performance curve basis the affinity laws and the test data.
 - 4. All gauges and other test instruments shall be calibrated within 30 days of the scheduled test and certified calibration data shall be provided. All Venturi flow meters shall be calibrated as required by ANSI/HI standards.

3.2 COMMISSIONING

- A. As specified in Section 01 91 00 - Commissioning and this Section.
- B. Manufacturer services:
 - 1. Provide certificates:

- a. Manufacturer's Certificate of Source Testing.
 - b. Manufacturer's Certificate of Installation and Functionality Compliance.
2. Manufacturer's Representative on-site requirements:
- a. Installation: 1 trip, 1-day minimum.
 - b. Functional testing: 1 trip, 1-day minimum.
3. Training:
- a. Maintenance: 4 hours per session, 1 session.
 - b. Operation: 2 hours per session, 1 session.
4. Process operational period:
- a. As required by Owner or Contractor.

END OF SECTION 33 11 33

SECTION 33 32 00 – SEWAGE PUMPING STATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the furnishing of sewage pumping stations, or lift stations, as indicated and specified. Only submersible pump lift stations will be allowed, with a minimum of two pumping units, unless otherwise indicated.
- B. Pump station identification:
 - 1. Pump stations are identified by numbers 1 – 9.

1.2 SUBMITTALS

- A. Shop drawings:
 - 1. Within 30 days after award of contract, and before any of the materials of this section are delivered to the job site, submit complete shop drawings and catalog cuts to the Engineer in accordance with the provisions of these Specifications, showing details of all equipment of this Section.
- B. Project Record Documents:
 - 1. Accurately record actual sewer inlet invert elevations at the wet well; wet well bottom elevation; pump on/off level switch elevations; and high level alarm elevation.
 - 2. Identify and describe all approved modifications. Unexpected modifications resulting from field variations shall be made only with the approval of the Engineer.

1.3 QUALITY ASSURANCE

- A. Applicable Standards:
 - 1. HIS Hydraulic Institute Standards
 - 2. AFBMA Std. 11-78 Load and Fatigue Life for Roller Bearings
 - 3. ASTM A36-84a Structural Steel
 - 4. ASTM A48-83 Gray Iron Castings
 - 5. ASTM A176-83 Stainless and Heat-Resisting Steel Bars and Shapes
 - 6. ASTM A322-82 Steel Bars, Alloy, Standard Grades
 - 7. ASTM A351 Ferritic and Austenitic Steel Castings for High Temperature Service
 - 8. ASTM A536 Ductile Iron Castings
 - 9. ASTM A744 Castings-from-Chromium-Nickel, Corrosion Resistant for Severe Service
 - 10. NEPA National Fire Protection Association National Electrical Code
 - 11. AGMA American Gear Manufacturer's Association
 - 12. ANSI American National Standards Institute

- 13. NEMA
- 14. IEEE

National Electrical Manufacturer's Association
Institute of Electrical and Electronics Engineers

PART 2 - PRODUCTS

2.1 GENERAL

- A. The arrangement shown on the drawings is based on the 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 shown or specified. Therefore, it may be anticipated that the layout, electrical power supply, appurtenances, structural supports, foundations, connected piping, and valves indicated on the drawings or as specified in these specifications, in part or whole, may have to be changed in order to accommodate the pumping equipment furnished. Any modifications required for installation and operation of the equipment shall be made at the expense of the Contractor. All necessary calculations and drawings for any related redesign shall be submitted to the Engineer for approval prior to beginning the work.

2.2 ACCESS HATCHES

- A. Contractor shall provide access hatches as manufactured by Halliday Products or approved equal in accordance with the size of the pumps. An access hatch with safety grating shall be provided for the wet well and valve vault to combine covering of the opening and fall through protection. Hatches shall have open and close assist.
- B. Door leaf shall be 1/4" thick aluminum diamond plate reinforced to a 300 psf live load. The frame shall be extruded aluminum with an integral anchor flange and door seat on all four (4) sides. The floor access door shall be equipped with a flush aluminum drop handle that does not protrude above the cover, and a stainless steel automatic hold open arm with a red vinyl grip to lock the cover in the open position. The door shall have stainless steel hinges with stainless steel tamper proof bolts and nuts. A staple for a padlock shall be supplied for security. All parts of the frame and cover shall be aluminum or stainless steel. Installation shall be in accordance with the manufacturer's attached instructions. Manufacturer shall guarantee against defects in materials and workmanship for a period of ten (10) years. Provide anti-slam lock, open and close assist, open stainless steel compression springs for all doors, bituminous coating, and nutrail.
- C. Grate shall open in the same direction as the door leaf and not cause restricted access to wet well or valve vault.
- D. The safety grate shall be made of 6061-T6 aluminum and designed per the "Specifications for Aluminum Structures", by the Aluminum Association, Inc., 5th Edition, Dec. 1986 for "Bridge Type Structures". This specification requires the manufacturer to use 38,000 psi as the ultimate strength of grade 6061-T6 aluminum and then a safety factor of 2.2 be applied, leaving a 17,300 psi design stress.
- E. The grating shall be designed to withstand a minimum live load of 300 pounds per square foot using 17,300 psi as the design stress for the aluminum. Deflection shall not exceed 1/150th of the span.

- F. Grate openings shall be 5" x 5", which will allow for visual inspection, limited maintenance and float adjustments while the safety grate fall through protection is left in place.
- G. Design must assure that the fall through protection is in place before the doors can be closed, thereby protecting the next operator. Each grate shall be provided with a permanent hinging system, which will lock the grate in the 90° position once opened.
- H. Each grate shall have an opening arm, which will allow opening of the grate, while providing the grate as a barrier between the operator and the pit. The opening arm shall also be equipped with a controlled confined space entry lock (lock provided by others). This locking device will prevent unauthorized entry to the confined space. The grating system will allow anyone to make visual inspection and float adjustments without entering the confined space.
- I. Each aluminum safety grate shall be coated with an OSHA type safety orange color, promoting visual awareness of the hazard, by a powder coat system, applied by the electrostatic spray process. The coating is a thermosetting epoxy powder coat finish with a minimum thickness of 2-4 mils and shall be baked at 350-375°F until cured.
- J. Welding shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum.

2.3 PIPES, VALVES, AND FITTINGS

- A. All pipes, valves, and fittings shall be as specified in Section 33 33 00 – Sanitary Sewerage.
- B. All pump discharge piping within the wet well and valve vault shall be flanged ductile iron pipe. All bolts shall be stainless steel.
- C. All pipe fittings shall be installed with stainless steel bolts.
- D. “Megalug” fittings shall be installed on each force main between the wet well and valve vault.
- E. PVC back flow preventors shall be installed on all floor drains in lift station vaults such that flow from leakages can drain into wet well while no wastewater collected in the wet well can flow into the downstream vaults.
- F. Valmatic Surgebuster check valves and Valmatic plug valves, and no others, shall be installed on each force main in the valve vault. All valves shall be equipped with open and closed indicators and backflow actuators on all check vavles.

2.4 WET WELLS

- A. Cast-in-place concrete structures shall be constructed as specified in Section 03 31 00 – Cast-In-Place Concrete.
- B. For precast concrete structures, the precast manufacturer is to submit shop drawings on all precast structures. Precast manufacturers are to meet the following requirements:
 - 1. Precast manufacturer shall provide calculations documenting that the precast wet well structure will not float, should it become completely submerged, with a safety factor of

- 1.5, signed and sealed by a professional engineer licensed in the State of Missouri.
 2. Precast manufacturer shall provide calculations documenting that the structural integrity of the integral expanded base/flange will resist bending moments imparted during flotation, signed and sealed by a professional engineer licensed in the State of Missouri.
 3. Precast manufacturer to provide calculations that ensure selected wall thickness for the wet well provides adequate resistance from soil lateral loading to the depths shown on the plans, signed and sealed by a professional engineer licensed in the State of Missouri. Reference the project geotechnical engineering report for loading criteria.
 4. All circular precast concrete structures shall comply with ASTM C-478, with 4,000 psi concrete.
 5. ACI 318 building code required for reinforced concrete.
- C. The bottom of the basin shall have a smooth troweled surface for mounting support casting.
 - D. Wet well shall be ventilated with 4" diameter pipe with rust resistant 16 mesh screen.
 - E. A 6-mil vapor barrier shall be provided beneath all cast-in-place base slabs.
 - F. Backfill wet well in 8" lifts compacted to 95% Standard Proctor.
 - G. No rock larger than 4" maximum dimension shall be placed within one foot of the exterior surface of the wet well.
 - H. All exterior surfaces of the wet well shall be coated with two coats of bituminous material, or approved equal.
 - I. All power cords and control cable handles and strain relief grips shall be stainless steel.
 - J. PVC rings cut from six inch or eight inch pipe shall be mounted three feet from the wet well floor and at intervals of no more than six feet above that. PVC rings shall be at least three inches and no more than six inches in height and have sanded edges. PVC rings shall be bolted into the wet well with a single bolt at each location. The purpose of the PVC rings is to keep the pressure transducer against the wall and away from the pumps and shall be accessible from an access hatch directly above the rings.
 - K. Wet well shall include a pressure transducer, mounted as close to floor as possible.
 - L. Pumping equipment shall be mounted to wet well base per manufacturer's spacing requirements.

2.5 VALVE VAULTS

- A. Cast-in-place concrete structures shall be constructed as specified in Section 03 31 00 – Cast-In-Place Concrete.
- B. For precast concrete structures, the precast manufacturer is to submit shop drawings on all precast structures. Precast manufacturers are to meet the following requirements:
 1. Precast manufacturer shall provide calculations documenting that the precast valve vault

- structure will not float, should it become completely submerged, with a safety factor of 1.5, signed and sealed by a professional engineer licensed in the State of Missouri.
2. Precast manufacturer shall provide calculations documenting that the structural integrity of the integral expanded base/flange will resist bending moments imparted during flotation, signed and sealed by a professional engineer licensed in the State of Missouri.
 3. Precast manufacturer to provide calculations that ensure selected wall thickness for the valve vault provides adequate resistance from soil lateral loading to the depths shown on the plans, signed and sealed by a professional engineer licensed in the State of Missouri. Reference the project geotechnical engineering report for loading criteria.
 4. All circular precast concrete structures shall comply with ASTM C-478, with 4,000 psi concrete.
 5. ACI 318 building code required for reinforced concrete.
- C. Valve vault shall be ventilated with 4” galvanized pipe with rust resistant 16 mesh screen.
 - D. A 6-mil vapor barrier shall be provided beneath all cast-in-place base slabs.
 - E. Backfill valve vault in 8” lifts compacted to 95% Standard Proctor.
 - F. No rock larger than 4” maximum dimension shall be placed within one foot of the exterior surface of the valve vault.
 - G. All exterior surfaces of the valve vault shall be coated with two coats of bituminous material, or approved equal.
 - H. Valve vaults shall include a GFI receptacle.
 - I. Valve vaults shall include a series L1D aluminum ladder and series L1E ladder extension by Halliday Products or approved equal.
 - J. Minimum clearance between wall of valve vault and outside of check valve shall be 24”.

2.6 LEVEL CONTROLS

- A. Refer to Section 33 32 16.13 – Submersible Sewage Pumps.

2.7 ELECTRICAL CONTROL PANELS

- A. The manufacturer of all panels shall be a UL listed shop for industrial control systems and shall provide evidence of such by serializing each unit per the requirements OF UL 508.

2.8 INSTRUCTIONS AND LABELS

- A. All panel boxes shall include a schematic wiring diagram displayed in cover of box. All terminals shall be clearly labeled with proper designation. Overload heater chart shall be displayed in box cover or heaters shall be listed on the drawing.

2.9 POWER

- A. The Contractor shall install a meter pedestal as shown on the Construction Plans. The Contractor shall be responsible for appropriate power supply extended to the lift station meter. The Contractor shall make arrangements with the local electrical power company to coordinate all electrical items of work. The Contractor will be responsible for all electrical works. The cost for the appropriate power supply shall be considered subsidiary to other pay items of work, unless otherwise indicated.

2.10 FINISHES

- A. All surfaces, unless otherwise indicated, shall be factory painted as specified in Section 05500 – Metal Fabrications.
- B. Coatings other than those listed in Section 05 50 00 – Metal Fabrications may be submitted, but must receive the approval of the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and align pump and motor in conformance with manufacturer's recommendations and Hydraulic Institute Standards.
- B. Do not place grout for base plate until unit is in complete alignment.
- C. Make all electrical and control connections.
- D. Provide all necessary lubrication for initial start-up, testing and as required for final acceptance.
- E. Provide a complete unit with all materials, components and adjustments as required for successful operation.
- F. Have the manufacturer's service representative perform the items described above prior to start-up.

3.2 FIELD QUALITY CONTROL

- A. All tests shall be witnessed by the Engineer.
- B. Make all necessary equipment adjustments and corrective work indicated by tests.
- C. Equipment Tests:
 - 1. Check performance of all components as a functioning unit.
 - 2. Check vibration and alignment on each unit and make necessary adjustments such that equipment vibration velocity is less than the maximum value set by Hydraulic Institute Standards.

D. Operation Tests:

1. Conduct such operational tests as necessary to determine that the performance of equipment and controls is as specified.
2. Tests will generally consist of placing equipment in operation under varying conditions and observing performance.

E. Inspection:

1. Inspection shall be performed on each pumping unit by a qualified service engineer from the manufacturer of the pumps.
2. Inspection shall be performed within 60 days prior to date of warranty expiration.
3. Inspection shall ascertain or appraise the following:
 - a. Status of compliance with new equipment and controls performance specifications after normal usage.
 - b. Adherence to manufacturer's recommended maintenance and operation of equipment.
4. Adjustments shall be made as necessary to restore equipment within original tolerances and performance specifications.
5. Redowelling shall be performed if alignment adjustments are made.
6. A written report shall be submitted to Engineer covering all inspection items, corrective work performed and recommendations, when applicable.

END OF SECTION 33 32 00

SECTION 33 32 16 – SUBMERSIBLE SEWAGE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Submersible pump with features scheduled in the Pump Schedule.

1.2 REFERENCE STANDARDS

- A. Design, manufacturing and assembly of elements of the equipment herein specified shall be in accordance with, but not limited to, published standards of the following, as applicable:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing and Materials (ASTM)
 - 3. American Bearing Manufacturers Association (ABMA)
 - 4. Hydraulic Institute (HI)
 - 5. National Electrical Manufacturers Association (NEMA)
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.3 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Division 1. Submittals shall include the following:
 - 1. Certified dimensional drawings of each item of equipment and auxiliary apparatus to be furnished, including equipment weights and location and size of anchor bolts.
 - 2. Literature and drawings describing the equipment, including parts list and materials of construction, in sufficient detail to indicate full conformance with the detail specifications.
 - 3. Motor performance data, wiring diagrams, one-lines and conduit entry dimensions and details. Other submittals as required by Division 26.
 - 4. Cut sheets on accessory items.
 - 5. Manufacturer's certified rating curves, to satisfy the specified design conditions, showing pump characteristics of discharge, head, brake horsepower, efficiency and net positive suction head required (NPSHR). When applicable, variable speed curves shall be provided showing at least three speeds plotted equally from maximum rpm to minimum rpm. Minimum rpm shall be no less than that required to obtain minimum flow. Curves shall show the full recommended range of performance and include shut off head. This information shall be prepared specifically for the pump proposed. Catalog sheets showing a family of curves will not be acceptable.
- B. Operation and Maintenance Data
 - 1. Complete operating and maintenance instructions shall be furnished for all equipment specified in this Section as provided in Division 1. The maintenance instructions shall

- include troubleshooting data and full preventative maintenance schedules and complete spare parts lists with ordering information.
2. Include certified performance data and curves from factory tests.

1.4 QUALITY ASSURANCE

- A. To assure unity of responsibility, the motors, couplings, guards and supporting base shall be furnished by the pump manufacturer. All pumping units specified herein shall be furnished by a single manufacturer.
- B. The equipment specified herein is intended to be of proven ability as manufactured by concerns having extensive experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed to operate satisfactorily when installed as shown on the Drawings. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards, except where otherwise specified herein.
- C. The pump manufacturer shall be fully responsible for the design, arrangement and operation of all connected rotating components as assembled and mounted on a fabricated steel base to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.
- D. Vibration, when measured in the direction of maximum amplitude on the pump bearing housings, shall not exceed limits given in the latest ANSI/HI nomograph for the applicable pump type.
- E. Manufacturer shall have installations of like or similar application with a minimum of 5 years service for this pump size.
- F. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect and to include a written record of periodic internal and external audits to confirm compliance with such program.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the unit and equipment are ready for operation.
- B. All equipment and parts must be properly protected against any damage during shipment. The Contractor shall store equipment in accordance with the manufacturer's instruction.

1.6 MAINTENANCE

- A. Furnish all special tools and test equipment required for the proper servicing of all equipment.
- B. Furnish the following spare parts for each size of pump in a given service.
 1. One set of pump bearings
 2. One set of shaft sleeves

3. One set of wear rings (if applicable)
4. One set of packing
5. One set o-rings

1.7 EQUIPMENT WARRANTY

- A. Equipment warranty shall be manufacturers standard, extended to 12 months from startup, not to exceed 18 months from shipment. Manufacturers warranty shall not relieve the Contractor from furnishing a complete system warranty as specified in the General Conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Submersible Pumps;
 1. Myers: VS series (grinder pumps for small lift stations).
 2. KSB: KRT F series (centrifugal pumps for lift station no. 8).
 3. Or equal

2.2 DESIGN AND PERFORMANCE CRITERIA

- A. Submersible sump pumps with components: Pumps, drivers, motors, variable frequency drives, base elbows, guide rails and lifting devices, electrical devices internal to pump housing, submersible cabling for power and control conductors, and Vendor Control Panels (if scheduled), and other items as required for a complete and operational system.
- B. Design requirements:
 1. Pump performance characteristics:
 - a. As specified in the Pump Schedule.
 - b. All required conditions (flow/head) shall be within the pump manufacturer's Allowable Operating Range (AOR).
 - c. Performance tolerances shall be the same as the test tolerances specified in Section 23 05 93 - Mechanical Equipment Testing.
 2. Motor characteristics: As specified in Pump Schedule.

2.3 MATERIALS

- A. General: When materials are referenced in this Section or on the pump schedule, the compositions shall be the UNS Alloys, Types, or Grades in this Article unless specified or scheduled otherwise.
- B. Cast iron: ASTM A48, Class 35 B minimum.

- C. Nickel cast iron: ASTM A48, Class 35 minimum with 3 percent nickel added.
- D. Steel: ASTM A108, Grade or UNS Alloy as specified or scheduled.
- E. Stainless steel: ASTM A276 or ASTM A582, Type or UNS Alloy as specified or scheduled.
- F. Bronze: ASTM B505 or ASTM B584, UNS Alloy C83600.
- G. Zincless bronze: ASTM B505 or ASTM B584, Leaded Tin Bronze, UNS Alloy C92700.
- H. Aluminum bronze: ASTM B148, ASTM B505 or ASTM B584, UNS Alloy C95200.
- I. Fasteners: Stainless steel, ASTM F593 or ASTM F594, type or grade as specified.

2.4 GENERAL PUMP CONSTRUCTION

- A. The pump shall be an overhung impeller, close-coupled, single-stage, volute-style, end-suction submersible unit, capable of handling raw unscreened sewage, stormwater and other solids-laden fluids without clogging.

2.5 PUMP AND MOTOR CASING

- A. Type: Watertight, air-filled.
- B. Material: Cast iron (minimum).
- C. Design working pressure: Minimum 1.10 times maximum shutoff total dynamic head with maximum diameter impeller at maximum operating speed plus maximum suction static head or minimum 20 pounds per square inch gauge.
- D. O-ring seals: Capable of sealing mated surfaces (major components) watertight; with the following features:
 1. Machined surfaces and grooves.
 2. O-ring contact on 4 surfaces and o-ring compression on 2 surfaces.
 3. Does not require specific fastener torque or tension to obtain watertight joint.
 4. Does not require secondary sealing compounds, gasket, grease, or other devices.

2.6 IMPELLERS

- A. General:
 1. Water passages: Smooth enough to prevent clogging by stringy or fibrous materials.
 2. Passage sizes: Large enough to pass solids with sphere size of 3 inches or smaller for motors larger than 2 horsepower.
 3. Casting: 1 piece, free of cracks and porosity.
 4. Balance vanes: On impeller back shrouds.
 5. Method for securing impeller to shafts:

- a. For pumps 5 horsepower and less, secured by bronze nut or Allen head bolt locked in place, but readily removable without the use of special tools.
 - b. For pumps greater than 5 horsepower, keyed to the shaft and secured by bronze nut or Allen head bolt locked in place, but readily removable without the use of special tools.
- B. Rotation: As indicated on the Drawings; clockwise looking from top when not indicated.
- C. Vibration: When measured in the direction of maximum amplitude on the pump bearing housings, shall not exceed limits given in the latest ANSI/HI nomograph for the applicable pump type.
- D. Type: As specified in the Pump Schedule:
- 1. Myers-supplied pumps:
 - a. Material: SST
 - b. Dynamically balanced, semi-open, multi-vane, backswept, non-clog design.
 - c. The impeller vane leading edges shall mechanically self-clean as they pass a spiral groove located on the volute section.
 - d. Impeller vanes shall have a screw-shaped leading edge hardened to Rockwell Rc 57-60.
 - 2. KSB-supplied pumps:
 - a. Material: Grey cast iron, (A 48 Class 35B).
 - b. Dynamically balanced, close-coupled, single-vane, non-clog design.
 - c. The cast iron, Class 40 front plate shall be mounted to the volute by 4 stainless steel adjusting screws.
 - d. The front plate shall be designed with a wave-shaped inlet and outward-spiraling V-shaped groove on the impeller side.

2.7 WEAR RINGS

- A. Provide one of the following systems:
- 1. Wear ring system:
 - a. General: Used to provide efficient sealing between the volute and suction inlet of the impeller.
 - b. Volute wear ring:
 - 1) Material: Brass.
 - 2) Fitted to the volute inlet.
 - c. Impeller wear ring:
 - 1) Material: Type 316 stainless steel.
 - 2) Heat-shrunk fitted onto the suction inlet of the impeller.
 - 2. Wear plate system:

- a. Material: Cast iron, ASTM A48, Class 40, with a minimum Brinell Hardness of 250.
- b. Attached to the pump volute to prevent rotation.
- c. Replaceable and adjustable to maintain proper clearances between the wear plate and the impeller.

2.8 PUMP SHAFTS

- A. Features:
 1. Strength: Able to withstand minimum of 1.5 times maximum operating torque and other loads.
 2. Maximum deflection: Minimum 0.002 inches under operating conditions.
- B. Tapered to fit at impeller with key and bolt for securing impeller.
- C. Pump and motor shaft shall be a solid continuous shaft.
- D. Type: As specified in the Pump Schedule:
 1. Myers-supplied pumps:
 - a. Material: 416 SST
 2. KSB-supplied pumps:
 - a. Material: Type 420 stainless steel

2.9 BEARINGS

- A. Pump shaft shall rotate on a minimum of 2 permanently sealed, grease-lubricated bearings:
 1. Upper bearing for radial forces shall be self-aligning spherical roller type.
 2. Lower bearing for combined axial and radial forces shall be angular contact ball type.
- B. Bearing type: Anti-friction in accordance with ABMA standards.
- C. Bearing lubrication system shall be sized to safely absorb heat energy normally generated in bearing under maximum ambient temperature of 60 degrees Celsius.
- D. Bearing life: 1 of the following, whichever provides longer bearing life in intended service:
 1. Minimum ABMA 9 or 11, L10 bearing life of 50,000 hours at rated design point.
 2. Minimum 24,000 hours at bearing design load imposed by pump shutoff with maximum sized impeller at rated speed.

2.10 SHAFT SEALS

- A. Upper seal unit material: 1 stationary stainless steel ring and 1 positively driven rotating

stainless steel ring.

B. Lower seal unit material: 1 stationary and 1 positively driven rotating tungsten carbide ring.

C. Features:

1. Tandem arrangement running in an oil chamber.
2. Design oil chamber to ensure that air is left in the oil chamber to absorb the expansion of the oil due to temperature variations.
3. Oil in oil chamber shall be FDA approved, paraffin-type, colorless, odorless, and non-toxic.
4. Independent spring system between seal interfaces able to withstand maximum suction submergences.
5. Does not require pressure differential to effect sealing.
6. Does not use pumped media for lubrication.
7. Lower mechanical seal effectively lubricated from oil chamber housings.
8. Not damaged when pump is run dry (unsubmerged) for extended periods.
9. Springs and other hardware: Stainless steel, Type 300 or 400 series.

2.11 DISCHARGE BASE AND ELBOW

A. Materials: Same as pump casing.

B. Features:

1. Structurally capable of firmly supporting guide rails, discharge piping, and pumping unit under operating conditions.
2. Integral support legs or pads with bolting to sump floor provisions: 1 or more.
3. Incorporates 90-degree flanged elbow that receives horizontal flow from pump and discharges flow vertically.
4. Discharge interface:
 - a. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact.
 - b. Self-aligning without having to enter the wet well.
 - c. Discharge elbow to mate to pump discharge and transition to discharge piping.

2.12 GUIDE RAILS, BRACKETS, FASTENERS, AND LIFTING CHAIN FOR EACH PUMP

A. Material: Type 316 stainless steel, with the following features:

1. Dual pipes or dual rails that extend from discharge base to upper bracket unless scheduled otherwise.
2. Rail wall thickness sufficient to suspend pump unit between brackets plus minimum 50 percent safety factor.
3. Sized to fit discharge base and sliding bracket of pump.
4. Integral, self-aligning, guide rail sliding brackets that seal pump to discharge base under operating conditions.
5. Upper guide rail bracket.

6. Intermediate guide rail brackets where indicated on the Drawings or at 10 foot maximum intervals.
7. Lifting chain of sufficient strength and length to permit safe removal of pump unit from sump.

2.13 DRIVERS

A. Horsepower:

1. As scheduled.
2. Listed driver horsepower is the minimum to be supplied.
 - a. Increase driver horsepower if required to prevent driver overload while operating at any point of the supplied pump operating head-flow curve including runout.
 - b. When scheduled driver is a motor, increase motor horsepower if required to prevent operation in the service factor.
 - c. Make structural, mechanical, and electrical changes required to accommodate increased horsepower.

B. Motors:

1. Revolutions per minute: As scheduled:
2. Enclosure: As scheduled.
3. Electrical characteristics: As scheduled.

C. Motor construction:

1. Squirrel cage induction motor, shell type design.
2. If explosion proof motor is scheduled, provide motor that is UL or FM listed for NEC Class I, Division 1, Groups C and D service, whether submerged or unsubmerged.
3. NEMA design type: B.
4. Motor insulation, either one:
 - a. Class F, moisture resistant, rated for 155 degrees Celsius.
 - b. Class H, moisture resistant, rated for 185 degrees Celsius.
5. The motor shall be designed for continuous duty handling pumped media of 40 degrees Celsius and capable of a minimum of 15 evenly spaced starts per hour.
6. The motor shall be capable of continuous operation under load with the motor submerged, partially submerged, or exposed, without derating the motor.
7. Motor cooling, one of the following:
 - a. Motor cooled by the surrounding media.
 - b. Cooling jacket:
 - 1) Non-clogging ports and channels that use pumped fluid as the cooling media.
 - 2) Functional with motor submerged, partially submerged, or exposed.
 - 3) Provide capability to relieve entrapped air from the system.

- c. Spray systems, air moving equipment or other secondary cooling systems are not acceptable.
 - 8. Motor sealing: Design motor case and seals to withstand 65 feet of submergence.
 - 9. Coordinate motors with the variable frequency drive manufacturer to ensure compatibility between the motor and variable frequency drive. Other drivers: As scheduled and as specified in sections listed in the Pump Schedule.
- D. Power and control cables:
- 1. Submersible to same water depth as motor casing.
 - 2. Type SPC with Hypalon/Buna N or chloroprene rubber jacket.
 - 3. Insulation rated for 90 degrees Celsius.
 - 4. Non-wicking fillers.
 - 5. Length: Sufficient to connect to surface junction box (without the need of splices) as indicated on the Drawings or 30 feet, whichever is greater.
 - 6. All power and control conductors shall terminate at terminal blocks in the local control panel or junction box.
 - 7. Sized in accordance with NEC, ICEA, and CSA specifications.
 - 8. Provide stainless steel cable and stainless steel wire braid sleeve to support power cable from underside of wet well roof slab or access frame.
- E. Cable entry/junction chamber:
- 1. Cable entry seal design shall not require specific torque requirements to insure a watertight and submersible seal.
 - 2. Cable entry seal shall consist of a single cylindrical elastomer grommet, flanked by stainless steel washers.
 - 3. The entry body shall perform compression and strain relief that is separate from the sealing function.
 - 4. The cable entry junction chamber shall be separate from the motor chamber to prevent foreign material from gaining access to the motor interior through the top of the pump.
- F. Control/protection module:
- 1. Each pump shall be supplied with its own self-contained control/protection module to provide for the direct connection to internal pump monitoring devices, including:
 - a. Thermal protection: Provide automatic reset motor stator temperature detectors, 1 switch in each phase winding. If any detector is activated, the sensor shall activate an alarm and shut down the motor. The thermal detectors shall activate when the stator temperature exceeds 125 degrees Celsius.
 - b. Moisture detection: one of the following:
 - 1) Provide capacitive type leakage sensor for the detection of water in the oil chamber or a moisture sensor in the lower motor chamber to detect any fluid in the motor. The sensor shall have an explosion proof rating.
 - 2) Provide a small float to detect the presence of water in the stator chamber.
 - 2. The module shall signal an alarm condition if any of the internal monitoring devices is activated.

3. Install module in manufacturer-supplied VCPs (if scheduled in the Pump Schedule) and provide necessary modules to the Contractor for installation in control panels not provided by the manufacturer.

2.14 ACCESSORIES

A. Hoists:

1. Type 316 stainless steel.
2. Winch:
 - a. Type 316 stainless steel marine grade.
3. Anchor bolts: Size of anchors and fasteners, including diameter and length or minimum effective embedment depth: As indicated on the Drawings or as specified in this Section. In the event of conflicts, contact Engineer for clarification.
4. Mounting: Type 316 stainless steel socket, off side of sump access opening.
5. Winch: Manual, adjustable boom with safety hook, and sufficient lift for pump removal from deepest sump.
6. Hoist and winch safe load rating: Minimum 1.25 times heaviest sump pump furnished or 500 pound minimum with maximum reach, whichever is greater.
7. Anchors:
 - a. Flush with internal thread anchor bolt sockets at each sump and socket with allowable working load of 5 times hoist pull-out tension load on anchor bolts.

2.15 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. All interior and exterior surfaces of pump columns and discharge elbows and the exterior of the bowl assemblies shall be cleaned of all rust and mill scale and supplied with a protective coating in accordance with Manufacturer standard procedure.

2.16 SPARE PARTS AND SPECIAL TOOLS

A. Spare parts: Deliver the following:

1. Thrust bearing set.
2. Radial bearing set.
3. Mechanical seal: 1 each size and type.
4. O-ring set.
5. Power cable entry seal set.
6. Wear ring set (rotating and stationary).

- B. Special tools: Deliver 1 set of special tools required for complete assembly or disassembly of pump system components for each type or size of pump specified.

PART 3 - EXECUTION

3.1 COMMISSIONING

- A. Manufacturer services:
 - 1. Provide certificates:
 - a. Manufacturer’s Certificate of Source Testing.
 - b. Manufacturer’s Certificate of Installation and Functionality Compliance.
 - 2. Manufacturer’s Representative on-site requirements:
 - a. Installation: 1 trip, 5-day minimum.
 - b. Functional testing: 2 trips, 2-day minimum each.
 - 3. Training:
 - a. Maintenance: 4 hours per session, 2 sessions.
 - b. Operation: 2 hours per session, 2 sessions.
 - 4. Process operational period:
 - a. As required by Owner or Contractor.

3.2 PUMP SCHEDULE

Lift Station Name	Duplex Stations No. 9, 1, 5, 6 & 7	Simplex Station No. 4	Duplex Station No. 2	Duplex Station No. 3	Duplex Station No. 8
Manufacturer	Myers	Myers	Myers	Myers	KSB
Series	V2 Standard Flow	V2 Standard Flow	VS30	VS30	KRT F
GPM	31.3, 31.1, 30.8, 30.9, 31.0	30.8	29.4	38.1	400
TDH, Static Head (ft)	5.5, 28.5, 65.9, 47.1, 38.4	62.6	66.3	64.7	49/17
HP	2	2	3	3	15

VAC, Phase	230/1/60	230/1/60	230/1/60	230/1/60	460/3/60
FL Amps	27A	14.5A	27A	30.5 A	47 A
Discharge Size	1-1/4"	1-1/4"	2-1/2"	2-1/2"	3"
RPM	3,450	3,450	3,450	3,450	1,800
Qty Pumps	10	2	2	1	2
Soft Starts	Required				
Wet Well Floor Hatch	Required				
Guide Rails	Required				
Lifting Chain	Required				
Shut-off Level Float	Required				
Lead Pump On Float	Required				
High Level/Lag Pump On Float	Required				
High-High Level Float	Required				

END OF SECTION 33 32 16

SECTION 33 33 00 – SANITARY SEWAGE

PART 1 - GENERAL

1.1 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene-monomer rubber.
- B. NPS: Nominal pipe size.
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic.

1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.
- B. Force-Main Pressure Ratings: At least equal to system operating pressure, but not less than 150 psig (1035 kPa).

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Valves and cleanouts.
 - 2. Manhole cover inserts.
 - 3. Pipe and fittings.
 - 4. Manhole Repair Materials
- B. Shop Drawings: Include plans, elevations, details, and attachments for precast concrete manholes, including frames and covers.
- C. Record Drawings: At Project closeout of installed sanitary sewerage all record drawings shall be submitted to the Owner. The record drawings shall accurately record actual locations of pipe runs, connections, cleanouts, manhole top and invert elevations, air-relief valves and lift station data. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.
- D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves according to the following:
1. Do not remove end protectors, unless necessary for inspection; then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support piping to prevent sagging and bending.
- H. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated. Notify property owner not less than two days in advance of proposed utility interruptions.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.2 PIPES AND FITTINGS

- A. Ductile-Iron Pressure Pipe: AWWA C151, C150, and C151 except as otherwise specified.

1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, buried or flooded pipe shall have mechanical joints, interior or exposed pipe shall have flanges unless otherwise indicated or specified. No 90 degree bends are allowed.
 2. Gaskets: AWWA C111, Rubber
 3. Flanges: Ductile iron, conforming to ANSI B16.1 and shall be drilled class 125.
 4. Flange Bolts: Bolts shall conform to ASTM A307 Grade B. All exposed bolts shall be Type 304 stainless steel.
 5. Flange Gaskets: Shall be 1/8" thick, full-faced synthetic rubber.
- B. Ductile-Iron Gravity Sewer Pipe: ASTM A 746, for push-on joints.
1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
 2. Gaskets: AWWA C111, rubber.
 3. Lining: All ductile iron gravity piping and fittings shall be lined with 401 Protecto lining conforming to ASTM E-96, ASTM G-95, ASTM B-117, ASTM G-14, ASTM D-714 ASTM D-1308 or equal, unless otherwise indicated. Lining shall extend from edge of plain end to the gasket seat in the bell socket. Lining to be applied in accordance with the specifications in the "Protecto 401 Ceramic Epoxy Standard for Lining Ductile Iron Pipe and Fittings for Sewer Service" Fifth Edition, March 2001.
 4. Polyethylene Plastic (PE) Film, Pipe Encasement: All buried ductile iron piping and fittings shall be encased in polyethylene as per Section 2.05.
- C. PVC Pressure Pipe: AWWA C900, Class 200 or ASTM 2241, 200 psi, SDR 21, for gasketed joints.
1. Ductile-Iron, Compact Fittings: AWWA C153, for push-on joints. All ductile iron fittings shall be lined with 401 Protecto lining conforming to ASTM E-96, ASTM G-95, ASTM B-117, ASTM G-14, ASTM D-714 ASTM D-1308 or equal, unless otherwise indicated. No 90 degree bends are allowed.
 2. Gaskets for Ductile-Iron Fittings: AWWA C111, rubber.
 3. Joint Restraints for PVC Pipe: Megalug or approved equal, AWWAC600, ASTM D 2774, ASTM F 1674.
- D. PVC Gravity Sewer Pipe and Fittings: According to the following:
1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller:
 - a. Less than 12 feet of cover: ASTM D 3034, SDR 35, bell and spigot for gasketed joints. Gaskets are to conform to ASTM F 477, elastomeric seals.
 - b. 12 feet to 20 feet of cover: SDR 21, Class 200, bell and spigot for gasketed joints. Gaskets are to conform to ASTM F 477, elastomeric seals.
 - c. Over 20 feet of cover: Pipe material and classification for PVC sewer pipe 20 feet or greater in depth will be considered on a case by case basis by the Owner.
 2. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-1 wall thickness, bell and spigot for gasketed joints. Gaskets are to conform to ASTM F 477, elastomeric seals.
 3. PVC Sewer Lateral Pipe and Fittings, NPS 4 to 6: ASTM D2665 and ASTM D1785, Schedule 40, solvent-cemented joints, or gaskets and gasketed joints.
- E. Polyethylene Pressure Pipe and Fittings
1. Polyethylene Pipe (4 inch and larger):

- a. Polyethylene pipe shall be made from HDPE material having a material designation code of PE3608 or higher. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE345464C. In addition, the material shall be listed as meeting NSF-61.
- b. The pipe and fittings shall meet the requirements of AWWA C906.
- c. HDPE pipe shall be rated for use at a pressure class of 200 psi, DR-9. The outside diameter of the pipe shall be based upon the IPS or DIPS sizing system.
- d. The pipe shall be marked in accordance with the standards to which it is manufactured.
- e. Color identification by the use of stripes on pipe to identify pipe service shall be required. Stripes or colored exterior pipe product shall be blue for potable water, green for wastewater/sewage, purple for reclaimed water, or black for raw water.
- f. Pipe manufacturer shall be listed in Manufacturer list in PPI TR-4.
- g. Pipe shall be gray in color.

2. Polyethylene Fittings:

- a. Butt Fusion Fittings: Fittings shall be made of HDPE material with a minimum material designation code of PE3608 and with a minimum Cell Classification as noted in 2.01A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All fittings shall meet the requirements of AWWA C906. Markings for molded fittings shall comply with the requirements of ASTM D 3261. Fabricated fittings shall be marked in accordance with ASTM F 2206. Socket fittings shall meet ASTM D 2683.
- b. Electrofusion Fittings: Fittings shall be made of HDPE material with a minimum material designation code of PE 3608 and with a minimum Cell Classification as noted in 2.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rating (WPR) of the fitting. Markings shall be according to ASTM F 1055.
- c. Flanges and Mechanical Joint Adapters (MJ Adapters): Flanges and Mechanical Joint Adapters shall have a material designation code of PE3608 or higher and a minimum Cell Classification as noted in 2.01A. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261. Fabricated (including machined) flange adapters shall be per ASTM F 2206.
- d. Van-Stone style, metallic (including stainless steel), convoluted or flat-plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C207 Class 150 Series B, D, or E. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure-class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back-up ring, bolts, and nuts shall be protected from corrosion by a system such as paint, coal-tar epoxy, galvanization, polyether or polyester fusion bonded epoxy coatings, anodes, or cathodic protection, as specified by the project engineer.
- e. Service Connections: Service connections shall be electrofusion saddles with a

brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles.

- 1) Electrofusion Saddles: Electrofusion Saddles with threaded outlet the size of the outlet shall be one inch IPS unless a larger size is shown on the plans. Electrofusion saddles shall be made from materials required under Electrofusion Fittings.
- 2) Sidewall Fusion Saddles: For sidewall fusion saddles the size of the saddle shall be as indicated on the plans. The saddle shall be made in accordance to ASTM D 3261 or ASTM F 2206. After installation, approximately ¼” of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provided ¼ inch of area beyond the saddle are not acceptable.
- 3) Tapping Tees
- 4) Tapping tees shall be made to ASTM D3261 or D2683.
- 5) Mechanical Strap-On Saddles: Mechanical strap-on saddles shall only be used where this use on PE pipe is approved by the mechanical saddle manufacturer. The body of the saddle shall be stainless steel, epoxy coated cast iron or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for one inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed per the manufacturer’s instructions.

f. Fitting manufacturer shall be listed in Manufacturer list in PPI TR-4

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

- A. Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.
 1. Sleeve Material for Cast-Iron Soil Pipe: ASTM C 564, rubber.
 2. Sleeve Material for Plastic Pipe: ASTM F 477, elastomeric seal.
 3. Sleeve Material for Dissimilar Pipe: Compatible with pipe materials being joined.
 4. Bands: Stainless steel, at least one at each pipe insert.
- B. Bushing-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric bushing fabricated to mate with OD of smaller pipe and ID of adjoining larger pipe, for nonpressure joints.
 1. Material for Cast-Iron Soil Pipe: ASTM C 564, rubber.
 2. Material for Plastic Pipe: ASTM F 477, elastomeric seal.
 3. Material for Dissimilar Pipe: Compatible with pipe materials being joined.
- C. Pressure-Type Pipe Couplings: AWWA C219, iron-body sleeve assembly matching OD of pipes to be joined, with AWWA C111 rubber gaskets, bolts, and nuts. Include PE film, pipe encasement.
- D. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated. Include PE film, pipe encasement.
- E. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section,

gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees deflection. Include PE film, pipe encasement.

- F. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated. Include PE film, pipe encasement.

2.4 VALVES AND ACCESSORIES

- A. Nonrising-Stem, Resilient-Seated Gate Valves, 2-1/2 Inch NPS and Larger: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Include 200-psig minimum working-pressure design, interior coating according to AWWA C550, and buried valves shall be mechanical-joint with a 2-inch operating nut, exposed or interior valves shall have flanged ends and have hand wheel operators. Valves shall open counter clockwise. Valve stems shall use double "O" ring seals. Bolts shall be stainless steel. Exterior surface of valve shall have corrosion inhibitor coating.
- B. Check Valves, 2-1/2 Inch NPS and Larger: (to be used only when plans specify that swing check valve is not required) AWWA C508, with 175-psig working-pressure rating. Include interior coating according to AWWA C550. Exterior surface of valve shall have corrosion inhibitor coating. Valve hinge pins shall be stainless steel. Valve disc shall be full opening with a composition to metal seat. The composition material shall be suitable for use in domestic water and wastewater service. Valve shall be flanged unless noted otherwise on the Drawings. Valves shall be equipped with an external lever that is spring assisted. The spring tension shall be field adjustable by a hex nut. The lever arm shall be keyed to the valve hinge shaft.
- C. Check Valves: AWWA C508, with 250-psig working pressure rating. Valmatic Surgebuster Swing Check Valve or approved equal. Check valve shall be of the full body type, with a domed access cover and only two moving parts, the flexible disc and the disc accelerator. Flanges shall be ANSI B16.1, Class 125. The disc shall be molded Buna-N, ASTM D2000-BG. The disc shall be of one-piece construction with an integral o-ring type sealing surface and contain alloy steel and nylon reinforcement in the flexible hinge area. The disc accelerator shall be Type 302 stainless steel. The disc accelerator shall be of one piece construction and provide rapid closure of the valve in high head applications. The disc accelerator shall be enclosed within the valve and shall be field adjustable and replaceable without removal of the valve from the line. The disc accelerator shall be securely held in place captured between the cover and disc. It shall be formed with a large radius to allow smooth movement over the disc surface. Provide mechanical indicator on all size valves. The mechanical indicator shall be a lever type, with no plunger action and no hard connection to the back of the disc required. Provide backflow actuator on all size valves. A screw-type backflow actuator shall be provided (when specified) to allow opening of the valve during no-flow conditions. Buna-N seals shall be used to seal the stainless steel stem in a Lead-Free bronze bushing. The backflow device shall be of the rising-stem type to indicate position. A stainless steel T-handle shall be provided for ease of operation. Interior and exterior surface of valve shall have Fusion Bonded Epoxy corrosion inhibitor coating.
- D. Eccentric Plug Valves:
 - 1. Plug valves shall be quarter-turn non-lubricated eccentric type with resilient faced plug.

Include interior coating according to AWWA C550. 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 150 for diameter and drilling. Include interior coating according to AWWA C500. 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.

2. Materials and Construction:

- a. Bodies shall be of ASTM A126, Class B cast iron. Exterior surface of valve shall have corrosion inhibitor coating.
- b. 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.
- c. 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.
- d. 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.
- e. 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".
- f. All exposed fastening hardware shall be zinc plated or stainless steel. Provide stainless steel bolting on buried service valves.

3. Manual Operators:

- a. All valves shall open counterclockwise.
- b. Provide indicators to show position of plug except on buried operators.
- c. 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.

- d. Exposed or interior valves shall be operated by a hand wheel to be supplied with the valve.
 - e. Buried valves shall be operated by a 2" square AWWA nut.
4. 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.
5. Electric Motor Operator for Eccentric Plug Valves:
- a. As manufactured by AUMA or approved equal.
 - b. SQ part turn actuator with mechanical end stops
 - c. Handwheel extension for emergency operation
 - d. AM Integral Controls – Open, Stop, Close
 - e. Flange and Output Shaft
 - 1) Coupling unbored
 - f. Plug/Socket Connector
 - g. Electromechanical Control Unit
 - 1) Limit/Torque Switch – Single Switch
 - 2) Handwheel Activation
 - 3) Vibration Resistance: Actuators withstand vibration during start-up or in case of plant failures up to 1g, within the frequency range from 10 to 200 Hz
 - 4) Mount Position: Can be operated without restriction in any mounting position
 - 5) Noise Level: Noise level originated by the actuator shall remain below the noise level of 72 dB (A).
 - h. Supply Voltage: 480 VAC
 - i. Nema 4x/6 with Local Controls

E. Ball Valves

- 1. 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 50 for thickness and drilling. Mechanical or push-on type rubber-gasketed joint ends shall conform to AWWA C111.
- 2. Materials and Construction:
 - a. Ball valves 6" and larger shall conform to AWWA C507 with a minimum design operating pressure of 150 psig.
 - b. Bodies shall be of ASTM 126, Class B cast iron for 2-1/2" and larger. Smaller valves shall be bronze body.
 - c. Valve trim shall be bronze.
- 3. Manual Operators:
 - a. All valves shall open counterclockwise.

- b. Exposed valves 3" and smaller shall be lever operated.
- c. Provide indicators to show position of ball.
- d. AWWA 2" size nut operators operated by enclosed worm gear operators shall be provided for buried valves.
- e. Exposed valves over 3" diameter shall have AWWA 2" square operation by enclosed worm gear operators.

F. Ball Valves (Polymer Service and Non-Potable Water 2" And Smaller)

- 1. Ball valves shall be PVC true union with either solvent socket or threaded pipe connections. Pressure rating shall exceed 230 psi.
- 2. Seats shall be PTFE with backing rings. Backing rings and seals shall be EPDM.
- 3. PVC shall meet or exceed cell classification 12454B, ASTM D-1784.
- 4. Socket end connections shall conform to ASTM D-2467. Threaded pipe connections shall conform to ANSI B2.1.
- 5. Exposed valves shall be operated by a 2" AWWA nut. Valve shall not be buried.

G. Backwater Valves

- 1. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
 - a. Horizontal Type: With swing check valve and hub-and-spigot ends.
 - b. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.
 - c. Terminal Type: With bronze seat, swing check valve, and hub inlet.
- 2. PVC Backwater Valves: Similar to ASME A112.14.1, horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

H. Air Release/Vacuum Valves:

- 1. Air release/vacuum valves shall be A.R.I. model D-025 combination air valve for sewage or approved equal.
- 2. Valve shall be heavy-duty combination air release/vacuum, sewage style.
- 3. Body shall be made of stainless steel or reinforced nylon.
- 4. Float shall be stainless steel.
- 5. All internal parts shall be stainless steel or non-metallic poly materials.

I. Appurtenances:

- 1. Valve Boxes shall be slide-type, cast iron, adjustable with the word "SEWER" on the lid.
- 2. Trace Wire: See Section 02537 for Tracer Wire Specification. Tracer required on all gravity mains, force mains, and service laterals.

2.5 POLYETHYLENE PLASTIC (PE) FILM, PIPE ENCASEMENT

- A. Buried gravity ductile iron piping and fittings shall be encased with a polyethylene plastic coating conforming to ASTM A 674 or AWWA C105; PE film, tube, or sheet; 8-mil thickness.

2.6 MANHOLES

- A. Normal-Traffic Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
1. Diameter: 48 inches minimum, unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having base section with integral floor.
 4. Riser Sections: 5-inch minimum thickness and lengths to provide depth indicated.
 5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 6. Gaskets: ASTM C 443 rubber.
 7. Grade Rings: No more than three reinforced-concrete rings shall be used on any manhole. Combined ring height shall not be less than 4" or exceed 12". The minimum ring thickness is 4". Grade rings shall match 24-inch diameter frame and cover.
 8. Steps: Per ASTM C478, plastic steps, individual steps. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12- to 16-inch intervals.
 9. Pipe Connectors: ASTM C 923 resilient, of size required, for each pipe connecting to base section. A-LOK manhole pipe connector or equal.
 - a. When connecting into an existing manhole, the manhole shall be cored drilled to allow new pipe to enter. Cutting or chipping the opening is not permitted. A rubber gasket and non-shrink grout shall be used to provide a tight seal around pipe.
- B. Heavy-Traffic Precast Concrete Manholes: ASTM C 913; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for rubber gasketed joints.
1. Ballast: Increase thickness of one or more precast concrete sections or add concrete to structure, as required to prevent flotation.
 2. Gaskets: ASTM C 443 rubber.
 3. Grade Rings: No more than three reinforced-concrete rings shall be used on any manhole. Combined ring height shall not be less than 4" or exceed 12". The minimum ring thickness is 4". Grade rings shall match 24-inch diameter frame and cover.
 4. Steps: Per ASTM C478 plastic steps, individual steps. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12- to 16-inch intervals.
 5. Pipe Connectors: ASTM C 923 resilient, of size required, for each pipe connecting to base section. A-LOK manhole pipe connector or equal.
 - a. When connecting into an existing manhole, the manhole shall be cored drilled to allow new pipe to enter. Cutting or chipping the opening is not permitted. A rubber gasket and non-shrink grout shall be used to provide a tight seal around pipe.
- C. Manhole Frames and Covers: ASTM A48-76, Class 35.
1. Standard manhole frames and covers shall have a minimum weight of 300 pounds and shall be Neenah R-1642 or equal.

2. Bolt down manhole frames and covers shall have bolt down lid with waterproof gasket, minimum weight of 300 pounds, and shall be Neenah R-1916-F or approved equal.
3. Bolt down type manhole frames shall be anchored to the manhole with not less than four (4) ¾ inch diameter anchor bolts having a minimum of Eight inches of embedment into concrete.
4. Valve manhole frames and covers shall have a minimum weight of 300 pounds and shall be Neenah R-1741-D or equal.
5. Include indented top design with lettering "SANITARY SEWER" cast into cover.

2.7 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.
 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope is to be 5 percent through manhole (minimum).
 2. Benches: Concrete, sloped to drain into channel. Slope must be 5 percent (minimum).
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

2.8 PROTECTIVE COATINGS

- A. Refer to Section 07 11 13 Bituminous Dampproofing for specifications on protective coatings.
- B. Refer to Section 07 20 00 Flexible Protective Coating for New Concrete Sanitary Sewer Structures for specifications on interior protective coatings.

2.9 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot

connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass foot-traffic areas.
 2. Medium Duty: In paved foot-traffic areas.
 3. Heavy Duty: In vehicle-traffic service areas.
 4. Extra-Heavy Duty: In roads.
 5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout. PVC Cleanout piping shall be Schedule 40.
- C. Cleanouts to be installed at right of way line, every 50 feet along service line and at connection to existing service line above septic tank.

2.10 MANHOLE REPAIR MATERIALS

- A. Polyurethane Grout: SealGuard II or approved equal
- B. Non-Shrink Grout: Conspec 100 or approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."
- B. Hand trim excavations to required elevations. Correct over excavation with bedding material.
- C. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.

3.3 IDENTIFICATION

Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

- A. Use warning tape or detectable warning tape over ferrous piping.
- B. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.4 PIPING APPLICATIONS

- A. General: Include watertight joints.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- C. Gravity-Flow Piping: As indicated on the Drawings:
 - 1. NPS 4 and NPS 6: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints. (4-inch pipe is allowed on gravity service laterals from building to main line only.)
 - 2. NPS 8 to NPS 15: PVC sewer pipe and fittings, or gaskets and gasketed joints.
- D. Force-Main Piping: As indicated on the Drawings:
 - 1. NPS 4 to NPS 15: Ductile-iron sewer pipe; standard- or compact-pattern, ductile-iron fittings; gaskets; and gasketed joints.
 - 2. NPS 4 to NPS 15: PVC pressure pipe, PVC pressure fittings, gaskets, and gasketed joints.
 - 3. NPS 4 and larger: Polyethylene pressure pipe, polyethylene pressure fittings, fusion welded joints.

3.5 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

- A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
 - 1. Use the following pipe couplings for nonpressure applications:
 - a. Sleeve type to join piping, of same size, or with small difference in OD.
 - b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.
 - c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 - 2. Use pressure-type pipe couplings for force-main joints. Include PE film, pipe encasement.
- B. Special Pipe Fittings: Use where indicated. Include PE film, pipe encasement.

3.6 INSTALLATION, GENERAL

- A. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.
- B. All gravity sewer mains should be constructed to a minimum depth of thirty-six inches (36") or as required and as measured from the final ground surface to the top of the barrel of the pipe. Minimum depths of less than thirty-six inches (36") will be considered on a case by case basis by the Owner. Tracer wire is required on all gravity mains.

All force mains should be constructed to a minimum depth of forty-two inches (42") or as required and as measured from the final ground surface to the top of the barrel of the pipe. Minimum depths of less than forty-two inches (42") will be considered on a case by case basis by the Owner. Tracer wire is required on all force mains.

All service laterals, gravity or pressure, shall be constructed to a minimum depth of twenty four inches (24") and a minimum grade of one percent (1%). Service laterals shall provide adequate flow from the house to the main. Tracer wire is required on all service laterals, gravity or pressure.

- C. For gravity sewers, manholes with a minimum diameter of forty-eight inches (48") shall be installed at all changes in grade, size, alignment, intersections, and at distances of no greater than four hundred feet (400') unless indicated otherwise on the plans. The use of fittings in the place of manholes is not acceptable.
- D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Molded Tees shall be used for all "tee" connections for new construction. Molded Tees with "knock-on" fittings shall be used for all "tee" connections on existing gravity sewers. and existing gravity sewers.
- F. Install ductile-iron, force-main piping according to AWWA C600. No rock greater than one (1) foot, measured along its longest axis, shall be placed within (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. No ninety degree fittings are allowed.
- G. Install PVC force-main piping according to AWWA M23. No rock greater than one (1) foot, measured along its longest axis, shall be placed within (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. No ninety degree fittings are allowed.
- H. Install Polyethylene force-main piping according to AWWA C906. No rock greater than one (1) foot, measured along its longest axis, shall be placed within (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. No ninety degree fittings are allowed.
- I. Location of Sewers with Respect to Water Mains:
 - 1. Horizontal Separation – Sewer mains shall be laid at least ten feet (10') horizontally from any existing or proposed water line. The distance shall be measured edge-to-edge. In cases where it is not practical to maintain a ten foot (10') separation, the Missouri Department of Natural Resources may allow deviation on a case-by-case basis, if supported by data from the design engineer. This deviation may allow installation of the sewer closer to a water line, provided that the water line is in a separate trench or on an undisturbed earth shelf located on one (1) side of the sewer at an elevation that the bottom of the water line is at least eighteen inches (18") above the top of the sewer.
 - 2. Crossings – Sewer crossing water lines shall be laid to provide a minimum vertical distance of eighteen inches (18") between the outside of the water line and the outside of the sewer. This shall be the case where the water line is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water line joints. When a water line crosses under a sewer, adequate

- structural support shall be provided for the sewer to prevent damage to the water line.
3. Special Conditions – When it is impossible to obtain proper horizontal and vertical separation as stipulated previously, the sewer shall be designed and constructed of slip-on or mechanical joint ductile iron pipe or PVC pressure pipe for a distance of ten feet (10') on each side of the water line and shall be pressure tested to assure watertightness prior to backfilling.
 4. Sewer Manholes – No water pipe shall pass through or come into contact with any part of a sewer manhole.
- J. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.
- K. All gravity sewer lines shall be installed with slopes not less than the minimum slopes shown in the following table:

Sewer Size	Minimum Slope (Feet per 100 Feet)
6 in.	0.60
8 in.	0.40
9 in.	0.33
10 in.	0.28
12 in.	0.22
14 in.	0.17
15 in.	0.15
16 in.	0.14
18 in.	0.12
21 in.	0.10
24 in.	0.08
27 in.	0.067
30 in.	0.058
36 in.	0.046

- L. Cutting Pipe: Cut pipe in a neat manner without damage to pipe. Remove burrs and shape edges and smooth the pipe end by grinding. Repair lining where required and as approved.

3.7 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to installations indicated.
- B. Ductile-Iron Sewer Pipe with Ductile-Iron Fittings: According to AWWA C600. Install PE film, pipe encasement over ductile-iron sewer pipe and ductile-iron fittings if required according to ASTM A 674 or AWWA C105.
- C. PVC Pressure Pipe and Fittings: Join and install according to AWWA M23.
- D. PVC Gravity Sewer Pipe and Fittings: As follows:
 1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
 2. Join profile sewer pipe fittings with gaskets according to ASTM D 2321 and manufacturer's written instructions.
 3. Install according to ASTM D 2321.

E. Polyethylene Pipe and Fittings: Join and install according with ASTM D2321 or ASTM D2774 for pressure systems, AWWA Manual of Practice M55 Chapter 7 and the following:

1. Butt Fusion

The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.

2. Saddle fusion

Saddle fusion shall be done in accordance with ASTM F 2620 or TR-41 or the fitting manufacturer's recommendations and PPI TR-41. Saddle fusion joints shall be made by qualified fusion technicians. Qualification of the fusion technician shall be demonstrated by evidence of fusion training within the past year on the equipment to be utilized on this project. (ASTM F905).

3. Electrofusion

Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290 and PPI TN 34. The process of electrofusion requires an electric source, a transformer, commonly called an electrofusion box that has wire leads, a method to read electronically (by laser) or otherwise input the barcode of the fitting, and a fitting that is compatible with the type of electrofusion box used. The electrofusion box must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence of electrofusion training within the past year on the equipment to be utilized for this project.

4. Mechanical

- a. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters and other devices in conformance with the PPI Handbook of Polyethylene Pipe, Chapter 9 and AWWA Manual of Practice M55, Chapter 6.
- b. Mechanical connections on small pipe under 3" are available to connect HDPE pipe to other HDPE pipe, or a fittings, or to a transition to another material. The use of stab-fit style couplings is allowed, along with the use of metallic couplings of brass and other materials. All mechanical and compression fittings shall be recommended by the manufacturer for potable water use. When a compression type or mechanical type of coupling is used, the use of a rigid tubular insert stiffener inside the end of the pipe is recommended.
- c. Mechanical couplings that wrap around the pipe and act as saddles are made by several manufacturers specifically for HDPE pipe. All such saddles, tapping saddles, couplings, clamps etc. shall be recommended by the manufacturer as being designed for use with HDPE pipe at the pressure class listed in this section.
- d. Unless specified by the fitting manufacturer, a restraint harness or concrete anchor is recommended with mechanical couplings to prevent pullout.
- e. Mechanical coupling shall be made by qualified technicians. Qualification of the field technician shall be demonstrated by evidence of mechanical coupling training within the past year. This training shall be on the equipment and pipe components to be utilized for this project.

5. Joint Recording

The critical parameters of each fusion joint, as required by the manufacturer and these specifications, shall be recorded either manually or by an electronic data logging device. All fusion joint data shall be included in the Fusion Technician's joint report.

- F. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.
- G. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.
- H. Install with top surfaces of components, except piping, flush with finished surface.

3.8 REACTION ANCHORAGE AND BLOCKING

- A. All unlugged bell and spigot or all-bell tees, Y-branches and bends deflecting 11-1/4 degrees or more which are installed in piping subjected to internal hydrostatic heads in excess of 15 feet in exposed, or 30 feet in buried, piping shall be provided with suitable reaction blocking, struts, anchors, clamps, joint harness, or other adequate means for preventing any movement of the pipe caused by unbalanced internal liquid pressure.
- B. Trench installation: Where in trench, the foregoing designated fittings shall be provided with concrete thrust blocking between the fitting and solid, undisturbed ground in each case, except where solid ground blocking support is not available. At the tops of slopes vertical angle bends shall be anchored by means of steel strap or rod anchors securely embedded in or attached to a mass of concrete of sufficient weight to resist the hydraulic thrust at the maximum pressures to which the pipe will be subjected. All concrete blocking and anchors shall be installed in such a manner that all joints between pipe and fittings are accessible for repair.
- C. The bearing area of concrete reaction blocking against the ground or trench bank shall be as shown by the plans or as directed by the Engineer in each case. In the event that adequate support against undisturbed ground cannot be obtained, metal harness anchorages consisting of steel rods or bolts across the joint and securely anchored to pipe and fitting or other adequate anchorage facilities approved by the Engineer shall be installed to provide the necessary support. Should the lack of a solid vertical excavation face be due to careless or otherwise improper trench excavation, the entire cost of furnishing and installing metal harness anchorages in excess of the contract value of the concrete blocking replaced by such anchorages shall be borne by the Contractor.
- D. For other locations: Reaction blocking, struts, anchorages, or other supports for fittings installed in fills or other unstable ground, above grade, or exposed within structures, shall be provided as required by the plans or as directed by the Engineer.
- E. Protection of metal surfaces: All steel clamps, rods, bolts and other metal accessories used in reaction anchorages or joint harness subject to submergence or contact with earth or other fill material and not encased in concrete shall be adequately protected from corrosion with not less than two coats of Koppers "Bitumastic No. 50", or approved equal, heavy coal tar coating material, applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied. Metal surfaces exposed above grade or within structures shall be painted with two coats (in addition to a primer coat) of a paint approved by the Engineer.

3.9 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Form continuous concrete channels and benches between inlets and outlet. Manhole bottoms shall be formed to provide smooth continuous flow. Non shrink spout shall be used to form a smooth transition between downstream invert and channel of manhole.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Slope of frame and covers shall match slope of pavements both longitudinally and cross slope per frame and cover adjustment detail in construction plans.
- D. Set tops 3 inches (76 mm) above finished surface elsewhere, unless otherwise indicated.
- E. Install precast concrete manhole sections with gaskets according to ASTM C 891.
- F. Construct cast-in-place manholes as indicated.
- G. Backfill around manhole per specifications. No rock greater than one (1) foot, measured along its longest axis, shall be placed within (2) feet of the manhole.

3.10 REPAIR OF EXISTING MANHOLES

- A. Internal Repairs: Polyurethane Grout, repair water infiltration into manholes using polyurethane grout, SealGuard II or approved equal. Repair per manufacturer's instructions.
- B. External Repairs, Non-Shrink Grout, use to make minor repairs to manholes from outside the manhole only. Not to be used to repair water infiltration into the manhole from inside the manhole. Conspec 100 or approved equal.

3.11 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.12 BLACKWATER VALVE INSTALLATION

- A. Install horizontal units in piping where indicated.
- B. Install combination units in piping and in structures where indicated.

3.13 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 6 inches deep. Set with tops 1 inch above surrounding grade.

- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.14 AIR RELEASE FACILITIES

- A. Air release valves shall be A.R.I. model D-025 combination air valve for sewage.
- B. Air release facilities shall be located at the high points of all pressure sewer systems and shall be properly sized to prevent buildup of air or gases that will impede flow of the wastewater.
- C. Air release valves must be automatic and designed to prevent wastewater solids and grease from reaching the valve operating mechanism.
- D. Provisions for cleaning the valve by back flushing should be provided.

3.15 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.
- B. Use Inserta-Tees® (or approved equal) to make branch connections into existing piping, NPS 4 to NPS 20. Install Inserta-Tee® and encase entire connection with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
- C. Make branch connections from side into existing piping, NPS 21 or larger, by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - 1. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
 - 2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
- D. Protect existing piping to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.16 CLOSING ABANDONED SANITARY SEWERAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 6-inch- thick non-shrink grout plug.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Structures: Excavate around structure as required and use one procedure below:
 - 1. Remove structure and close open ends of remaining piping.

2. Remove top of structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
3. Backfill to grade according to Division 2 Section "Earthwork."

3.17 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
 1. Place plug in end of incomplete piping at end of day and when work stops.
 2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
 1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 95 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Re-inspect and repeat procedure until results are satisfactory.

3.18 FIELD TESTING

- A. General:
 1. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 2. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- B. 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.

C. Hydrostatic Pressure Test:

1. Test connections shall be made and the pipe filled with water. Unless otherwise specified, a pressure of 1.50 times the normal operating pressure (for the lowest point on the pipe line) but not less than the greater of 1.25 times the normal operating pressure or 150 pounds per square inch (psi). In no case shall the test pressure be allowed to exceed the design pressure for the pipe, appurtenances, or thrust restraints.
2. After air removal, water shall be pumped in to bring the pipe to the specified pressure. The hydrostatic test shall be of at least a 2-hour duration. Test pressure shall not vary by more than 5 psi for the duration of the test. 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:

$$L = ND(P)^{1/2}/7,400, \quad \text{(Equation 1, AWWA C605-94)}$$

Where

- L - Allowable leakage, in gallons per hour
- N - Number of joints in the length of pipeline tested
- D - Nominal pipe diameter, inches
- P - Average test pressure, psi (gauge)

The allowable leakage must not exceed the volumes specified below for 50 joints of the particular diameter of pipe being tested:

**Allowable Leakage per 50 joints of Pipe* - gph
(AWWA C-600)**

Avg. Test Pressure (psi)	Nominal Pipe Diameter (in)										
	1.5	2	3	4	6	8	10	12	14	16	18
300	0.18	0.23	0.35	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11
275	0.17	0.22	0.34	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02
250	0.16	0.21	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92
225	0.15	0.20	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82
200	0.14	0.19	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72
175	0.13	0.18	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61
150	0.12	0.17	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49

3. All exposed pipe, fittings, valves, 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, 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:
 - a. Outfall line.
 - b. Drain lines.
 - c. Sanitary sewer lines.
3. Furnish all facilities required including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator to avoid over-pressurization, 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:

1)	Size (diameter)	4-1/2 inches
2)	Pressure Range	0-15 P.S.I.
3)	Figure Intervals	1 P.S.I. Increments
4)	Minor Subdivisions	0.05 P.S.I.
5)	Pressure Tube	Bourdon Tube or diaphragm
6)	Accuracy	+ 0.25% of maximum scale reading
7)	Dial	White coated aluminum with black lettering, 270° Arc and mirror edge
8)	Pipe Connection	Low male 1/2" 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.
4. Test each reach of sewer pipe between manholes after completion of the installation of pipe and appurtenances and the backfill of sewer trench.
5. 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.

(Continues on next page)

**Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for $Q = 0.0015$
(ASTM F 1417, TABLE 1)**

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:3
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:5	115:2	129:4
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:5	124:3	142:2	160:1
33	31:10	72	25.852L	43:05	64:38	86:10	107:4	129:1	150:4	172:2	193:5
36	34:00	66	30.768L	51:17	76:55	102:3	128:1	153:5	179:2	205:0	230:4

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 one half 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 for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in the following table:

**Minimum Test Times for Various Manhole Diameters in Seconds
(ASTM C 1244, TABLE 1)**

Depth (ft)	Manhole Diameter, in.								
	30	33	36	42	48	54	60	66	72
Time, in seconds									
8	60	60	60	60	60	60	60	60	60
10	60	60	60	60	60	60	60	60	60
12	60	60	60	60	60	60	60	60	60
14	60	60	60	60	60	60	60	60	60
16	60	60	60	60	60	60	60	60	67
18	60	60	60	60	60	60	60	65	73
20	60	60	60	60	60	60	65	72	81
22	60	60	60	60	60	64	72	79	89
24	60	60	60	60	60	64	78	87	97
26	60	60	60	60	64	75	85	94	105
28	60	60	60	60	69	81	91	101	113
30	60	60	60	63	74	87	98	108	121

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. Re-testing 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.
4. The mandrel diameter shall be based on 95% of the actual inside pipe diameter.

G. Alignment Tests: Sewer alignment shall be checked by using a laser beam or lamping.

END OF SECTION 33 33 00

SECTION 46 21 83 – SEPTAGE RECEIVING BAR SCREEN

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies a nonmechanical stainless steel bar screening receiving station including trash exit and folding trash chute for the removal of trash from wastewater.

1.2 SUBMITTALS

- A. Product Data: Dimensional drawings and submittal specifications.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A manufacturer experienced with machine and fabrication of bar screens.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle bar screening equipment and accessories per manufacturer recommendations.

1.5 WARRANTY

- A. Equipment warranty shall be manufacturers standard, extended to 12 months from startup, not to exceed 18 months from shipment. Manufacturers warranty shall not relieve the Contractor from furnishing a complete system warranty as specified in the General Conditions.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Mini Screen 400; or equal.

2.2 Septic Receiving Station Screen

- A. Screening System:
 - 1. Non-mechanical 3/8 gapped x 1/4" Stainless-steel bar screening system.

2. Screening Area of 16 square feet.
 3. System should allow for gravity off load of a minimum of 500 gpm.
- B. Hopper Assembly:
1. Material: SST
- C. Adjustable Hopper Legs:
1. Material: Aluminum
 2. Hopper legs should be adjustable, capable of raising the hopper assembly to the height of 8".
- D. Trash Exit Chute:
1. 7 foot trash extension.
 2. Trash extension shall be bolt on and foldable.
 3. Trash extensions shall be capable of being mounted on the right or left side of the unit.
- E. Catwalk:
1. Material: Aluminum or SST
 2. OSHA compliant non-slip catwalk to allow for viewing and cleaning of the equipment.
- F. Hopper Inlet:
1. 4" Cam Telescoping Inlet Manifold, with fan spreader and 6" x 4" Truck Cam Adaptor.
 2. Fan spreader should deflect waste down onto the screen making the front screen virtually self-cleaning.
- G. Hopper Outlet:
1. 6" Cam Outlet with 6" Female Cam by NPT.
 2. 6" Schedule 40 Female Adaptor.
- H. Fasteners:
1. Material: Type 316 Stainless-steel
- I. Include 1 set of custom built stainless steel cleaning tools.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer recommendations.

END OF SECTION 46 21 83.